

**Water Quality
Best Management Practices
for
Cow/Calf Operations**



**in
Florida**

June 1999

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Acknowledgements

In 1997 the Florida Cattlemen's Association began a process to develop Water Quality Best Management Practices for Florida Cow/Calf Operations. That process included many hours of study, much debate and discussion, and many meetings, all of which contributed to and are reflected in this BMP Manual. In that regard, this Manual represents the committee's collective best efforts to establish sound, responsible, guiding principals for Cow/Calf operations in the State of Florida.

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Introduction

This manual describes the water quality **best management practices (BMPs)** for beef cow/calf operations in Florida. These practices are designed to protect our water bodies and maintain compliance with the State's water quality standards. These practices are specifically targeted for beef cow/calf operations in Florida and the activities that normally occur in conjunction with beef cattle production.

(This manual is a guideline for statewide use. Rules and regulations may vary around the state so be aware and use local guidelines if necessary.)

In Florida, there are over 5 million acres of **improved pasture** and 7 million acres of total pasture and rangeland. Because of the large acreage, pasture runoff may affect the quality of our lakes and streams. This manual contains a Water and Management Practices Quality Risk Assessment to help you identify potential concerns. Also, this manual provides current guidelines for appropriate practices that will help improve the quality of water discharged from your grazing lands. Once a practice has been selected, further information can be obtained from the Natural Resources Conservation Service Technical Guides, Section IV. The manual also describes methods to conduct other activities associated with ranching in a manner which conforms to State of Florida water quality standards.

This manual does not address other resource issues such as protection of wetlands or water conservation. Implementation of some of the practices described in this manual may require permits from a water management district. Appendix D provides a list of contact people for other questions you may have about water quality management practices. To assist you in using this manual, words in **red** are defined in the Glossary.

Although many of the relationships between cow/calf operations and water quality impacts have been quantified, many others have not. Consequently, as significant new information becomes available, this manual will be regularly updated. Please fill out the registration card (last page) and return it to the Florida Cattlemen's Association so that we may mail updates.



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Water Quality Concerns

Cow/calf operations in Florida are generally low-intensity agriculture with relatively low levels of **pollutants** discharged off-site. However, certain siting and management practices may contribute to a violation of State water quality standards. Under these situations, cattle ranches may contribute elevated levels of phosphorus, nitrogen, sediment, bacteria, and oxygen-demanding organic material. For example, nitrogen and phosphorus may be contributed to a receiving **water body** from over-fertilized pastures or problem or significant amounts of manure deposited directly in a waterway can cause violations. Sediment movement from pastures denuded of vegetation or **erosion of canal banks** may cause sedimentation or noncompliance with State water quality standards for **turbidity**. Where cattle tend to congregate, animal waste can be a source of bacteria and organic material which causes decreases in oxygen levels in the water as it decays.

The potential for discharges from cow/calf operations to cause water quality violations varies greatly, depending on soil type, slope, drainage features, stocking rate, nutrient management, pest management, or activities in wetlands. **In general, areas where cattle tend to congregate or have access to water bodies may have the greatest potential to contribute to water pollution.** Whereas, **low density grazing of native range** has the lowest potential to contribute to pollution. This manual will attempt to identify potential sources of water pollution and related **best management practices (BMPs)** which minimize water quality concerns.

After implementation of these BMPs it may be necessary to add more stringent guidelines for site specific areas that continue to exceed state water quality standards. The guidelines should be developed by the ranches and affected parties located in the watershed that has the violation.



Water quality concern site when located near ditches, canals, streams or wetlands

Water Quality Standards

Water quality standards for surface waters and groundwater in the State of Florida are contained in numerous chapters of the Florida Administrative Code (Chapters 62-3, 62-4, 62-242, 62-300, 62-302, 62-520, 62-522, and 62-550, F.A.C.). Surface water quality standards apply within the landward extent of “waters of the state”, which does not include all water bodies. The complete definition of “waters” is found in Section 403.031 of the Florida Statutes. A portion of which states:

“Waters” 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...”

Generally, this means that surface water quality standards apply to water features that run THROUGH your property (streams, **canals**) and so are not entirely owned by you. Likewise, water quality standards apply to lakes that are bounded by more than one owner. However, water quality standards generally do not apply to isolated wetlands or small lakes entirely within your property boundaries. Surface water quality standards do not usually apply to man-made cattle watering ponds, although groundwater quality standards may apply. Ditches which originate within your property may not have to meet water quality criteria within the ditch, but they will have to meet water quality standards at the point at which they discharge to “waters of the state”. Since this is a complicated issue, it’s best to consult an expert for a determination of where water quality standards must be met.

The Environmental Protection Agency (EPA) and the state Department of Environmental Protection (DEP) are currently developing “Total Maximum Daily Loads” or TMDL’s, as required by the Clean Water Act. A TMDL is defined as the maximum amount of a pollutant that a water body can assimilate while remaining in compliance with State water quality standards. Once the maximum pollutant load has been calculated, both point sources (such as wastewater treatment plants) and **nonpoint sources** (such as runoff from agricultural operations or urban areas) may be required to reduce pollutant discharges. **Implementation of the practices described in this manual provides a good argument that you have made reasonable efforts to reduce pollutants from your ranch by the maximum practicable amount.**

Water Quality Conservation Plan

Development of a conservation plan, for your ranch or farm, to guide the implementation of Best Management Practices that addresses water quality concerns will result in the maximum benefit. A written management plan can be used to document all planned and completed activities which could affect water quality. This can be extremely useful in discussions with regulatory agencies. In addition, having a well thought out, written plan can help managers and owners schedule and accomplish their objectives.

A conservation plan is simply a record of the decisions of the owner or manager of the ranch. Well-written conservation plans should address all of the activities on the ranch. These activities should be considered on their effect on the soil, water, air, plant, animal and human resources. Activities that have a potential negative effect on these resources should be carefully considered to identify alternatives that will meet the landowner's goals for production, landscape appearance and quality of life.

Assistance in developing a plan can be obtained through the local Soil and Water Conservation District (SWCD), the USDA-Natural Resources Conservation Service (NRCS), the Cooperative Extension Service, and private consultants. Conservation planning assistance through these entities is a voluntary process. SWCD, NRCS and Extension personnel will provide the owner/manager with alternatives to address the resource concerns. However, the decisions included in the conservation plan are the responsibility of the owner or manager.

Keys to Pollution Prevention

Over the years, cattlemen's associations have published recommendations for water pollution control. These recommendations are summarized in the following common sense suggestions for avoiding pollution problems:



Develop a ranch conservation plan.

A ranch conservation plan developed with help through the NRCS can help guide management decisions for improved water quality.



Maintain adequate vegetative cover.

Vegetative cover helps to filter pollutants from runoff, reduces runoff velocity and controls soil erosion. Management practices which help to maintain vegetative cover usually involve distributing cattle so they don't overgraze portions of the grazing resources, and allow for recovery of the vegetation following a grazing period.

- **Use grazing systems (such as prescribed or rotation grazing) to minimize the impact of grazing**
- **Adjust the stocking rate in sensitive watersheds**



Carefully plan your watering and feeding sites.

Most nonpoint source pollution problems occur in the vicinity of watering, supplemental feeding or loafing areas where animals tend to congregate most often. Such concentrations can have an impact on vegetation and on the condition of the soil so that erosion is more likely and water percolation is diminished.

- **Place supplemental feeding and mineral stations a reasonable distance away (approx. 100') from stormwater drainageways, streams, drainage canals, lakes, wetlands, wells and sinkholes**
- **Develop alternative water sources to attract animals away from streams, drainage canals, and lakes as much as possible**

- Plan your shading facilities to keep cattle away from streams, drainage canals, and lakes as much as possible. Leaving or planting small, scattered clusters of trees in upland areas of pastures can serve as shade structures

- When feasible, move feeding stations, alternative water supplies or shade structures periodically to prevent areas of concentrated waste accumulation and denuded vegetation



Carefully plan your temporary holding areas

Concentrated animal areas such as **cowpens** and other temporary holding areas have the potential to produce large pollutant loads.

- Locate new **cowpens** more than 200 feet away from a canal, stormwater drainageway, stream or lake or include a berm to prevent runoff into the water body.

- For existing concentrated animal areas that are located near a water body, use filter strips, grassed waterways, berms or waste management systems to minimize the transport of pollutants to water bodies.



Use structural techniques to abate pollution.

Sometimes it may be impossible to locate supplemental feeding or shade facilities outside of sensitive water quality areas. In such cases, other techniques can be used to help keep sediment, nutrients, and organic matter out of the water.

- When feasible, re-establish natural flow patterns, plug drainage canals and divert water through internal marshes, cypress ponds or other natural wetlands that can assimilate nutrients. The plugging of canals and/or some diversion of natural surface flows may require permits under Chap 373, F.S. Contact your WMD prior to making structural changes.

- Use practices such as grassed waterways, filter strips, sediment traps, swales, retention and detention ponds



Minimize off-site discharge, when possible

Pollutants are carried off-site by water. By reducing the amount of water leaving your property, you can reduce the off-site water quality impacts.

- **Carefully control seepage irrigation to minimize tailwater**

Artificial drainage is often required to make pastures usable. However, increased drainage tends to increase nutrient losses. By preventing overdrainage, you can reduce the movement of pollutants off-site.

- Use **water control structures**, such as a **flashboard riser on culverts**, to **retard water flow**

- **Heavy vegetative cover in ditches should be mechanically removed instead of using herbicides due to high nutrient releases when the vegetation decomposes**

- **When cleaning ditches, pile vegetation and sediment away from the ditch so nutrients don't wash back into the water**

- **When cleaning ditches, use turbidity screens in the water at discharge points so turbid water does not leave your property**

- **Plug unnecessary drainage canals**

- **Utilize filter marshes or vegetation in wet areas to clean water before movement off-site**

- **Utilize man-made ponds in upland areas to reduce cattle use of natural wetland systems**



Use source control

You can minimize pollutants which leave your property by carefully controlling imported materials which you use and apply on your ranch. Pollutants can come from fertilizers, sludge application, pesticides, chemicals and fuels. If these materials are properly stored, applied and disposed of, then there's less chance that they'll be carried off-site in runoff.

- **Use a nutrient management plan**

- **Use soil and plant nutrient tests to determine fertilization rates when appropriate**

•Follow University of Florida Institute of Food and Agricultural Sciences (IFAS) fertilizer recommendations

•Apply sludge at agronomic rates, consistent with your nutrient management plan and DEP Agricultural Use Plan

•Don't apply fertilizer, organic fertilizer, or sludge directly to water bodies, drainage ditches or prior to forecasted heavy rainfall

•Use a pesticide management plan

•Follow directions on the pesticide label

•Prevent accidental spills and dispose of empty containers properly

•In the event of a spill have a spill response plan

•Grass clippings from “sod mowing” should be stored away from wetlands and ditches

Florida's Farm•A•Syst Program has useful confidential worksheets to help you identify potential sources of pollution due to storage and handling of pesticides, petroleum products and fertilizers. Although the program is designed to help reduce contamination of your drinking well, it can provide useful information to prevent groundwater and surface water pollution. Once you've identified vulnerable areas, fact sheets provide suggestions for reducing pollution sources.

• Use Farm•A•Syst to help identify potential sources of pollution

• Store materials (pesticides, chemicals, fuels, and fertilizers) carefully



Minimize the potential for man-induced erosion

Cows aren't the only ones contributing to soil **erosion**. Human activities, such as land clearing, culvert installation, road building, ditch and canal maintenance, pasture renovation activities and certain other short-term crops (watermelons, sod) can expose soil to erosive factors that can increase pollutant loading.

• When land is cleared, quickly plant a vegetative cover

• Leave grass buffer strips during land clearing along drain areas

- **During construction, follow DEP’s erosion and sedimentation control practices (Florida Land Development Manual)**
- **Minimize the number of vehicle crossings through streams and canals. If stream crossing cannot be avoided, locate the crossing in the area of least impact considering habitat, soil types, slopes, streambed characteristics, and bank stability.**
- **Use stabilized culverts or hard surface crossings. Hard surface crossings can be concrete or an economical way is to use geotextile fabric with rock on top.**
- **Don’t mow canal banks too closely, leave some vegetative cover**



Employee Training

Employees whose job duties include activities which relate to Best Management Practices should be properly trained to perform those activities prior to performing those activities. The employee should be informed of pertinent information relating to job duties as needed. Applicable personnel at all levels of responsibility should be informed annually of the general components and goals of the BMPs. Training sessions should be documented in the Employee Training Log.

- **Inform employees about BMPs**
- **Review the Conservation Plan with employees, so it is clear what your goals and priorities are**
- **Re-train annually and when changes are made**
- **Train employees to document and retain records of activities**

Water Quality Risk Assessment

The following checklist will help you assess the potential for water quality problems in surface and groundwater on or adjacent to your ranch. By answering the questions in the checklist, you can identify sources of potential problems, rank yourself overall, and prioritize areas where you should take action. The checklist is a confidential, self-test. **We suggest that you go through the checklist before you read the rest of the manual.**

After completing the Risk Assessment, if you identified high risks in the following categories, refer to the associated water quality improvement practice in the manual:

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Water Quality Risk Assessment

SCORE

Rate the following conditions in your pastures from 1 (low) to 5 (high):

I. Soil Erosion

A. Is there **rill erosion**, due to water runoff, along the major canals, ditches or stream banks?

- 1 <20% of banks have rill erosion
 - 2 <40% of banks have rill erosion
 - 3 <60% of banks have rill erosion
 - 4 <80% of banks have rill erosion
 - 5 almost all banks have rill erosion
-

B. Is there soil erosion or denuded areas, due to cattle access, along the major canals, ditches or stream banks?

- 1 <20% of banks have erosion or denuded areas
 - 2 <40% of banks have erosion or denuded areas
 - 3 <60% of banks have erosion or denuded areas
 - 4 <80% of banks have erosion or denuded areas
 - 5 almost all banks have erosion or denuded areas
-

C. Is there soil erosion around the culverts or other water control structures in the canals or ditches?

- 1 <20% of culverts have visible erosion around them
 - 2 <40% of culverts have visible erosion around them
 - 3 <60% of culverts have visible erosion around them
 - 4 <80% of culverts have visible erosion around them
 - 5 almost all culverts have visible erosion around them
-

D. Is there soil erosion from roads that runs into nearby wetlands, canals, lakes or streams?

- 1 Never
 - 2 Only following very large storms (> 2 inches of rain)
 - 3 Usually some erosion following minor storms (> 1 inch of rain)
 - 4 Usually some erosion (plume of sediment) every time it rains
 - 5 Observable delta of sediment into nearby water bodies
-

E. Have you ever had a road or culvert “blow out” due to high water levels?

- 1 Never
 - 2 Once every 5 years
 - 3 Once every 3 years
 - 4 About once each year
 - 5 A few culverts each year
-

F. Have you observed turbid water leaving your property following a storm event?

- 1 Never
 - 2 Only following very large storms (> 2 inches of rain)
 - 3 Usually some turbidity following minor storms (> 1 inch of rain)
 - 4 Usually some turbidity every time it rains
 - 5 Water is always a little turbid, even when it doesn't rain
-

G. Have you observed a sand bar at the confluence of your drainage ditches/canals and a downstream lake or stream?

- 1 No
 - 2 There's a small sandbar(s) that I can see at really low water
 - 3 There's a small sandbar (s) that I can usually see
 - 4 There's a large sandbar that causes some flow diversion
 - 5 There's a large sandbar that I have to clean out regularly
-

Soil Erosion (Average of all Erosion Scores) _____

If your score averages 2 or less in any category, keep up the good work in that category. If your score averages greater than 2 in any category, you may have a problem which could lead to a violation of water quality standards and should be investigated further.

II. Nutrients

A. Soil and Forage Analysis

- 1 Soil analysis is used for pH
 - 2 Soil and/or forage analysis is used as an indicator of plant nutritional needs
 - 5 No testing is done nor are IFAS recommendations used to determine plant needs
-

B. Nitrogen fertilization rates are based on:

- 1 Plant needs or IFAS recommendations
 - 3 Plant needs, but sometimes extra is applied to guarantee forage quality and quantity
 - 5 Previous application schedule is used
-

C. Phosphorus fertilization rates are based on:

- 1 Plant needs or IFAS recommendations
 - 3 Plant needs, but sometimes extra is applied to guarantee forage quality and quantity
 - 5 Previous application schedule is used
-

D. Manure Management

- 1 Livestock waste is spread evenly in the pasture by grazing cattle
 - 2 Livestock waste is spread mostly evenly in the pasture by grazing cattle
 - 4 Livestock waste is spread poorly in the pasture by grazing cattle
 - 5 Livestock waste is concentrated in small areas of the pasture such as around supplemental feeding sites and shade structures near water bodies and ditches
-

E. Overall nutrient management

- 1 Nutrients contributed from organic matter, legumes, manure and sludge are always considered when determining fertilization rates needed to meet plant needs
- 3 Nutrients contributed from organic matter, legumes, manure and sludge are sometimes considered when determining fertilization rates needed to meet plant needs
- 5 Nutrients contributed from organic matter, legumes, manure and sludge are not considered when determining fertilization rates needed to meet plant needs

Nutrients (Average of all Nutrient Scores) _____

If your score averages 2 or less in any category, keep up the good work in that category.
If your score averages greater than 2 in any category, you may have a problem which could lead to a violation of water quality standards and should be investigated further.

III. Pasture Management

A. Stocking rates

- 1 Stocking rates are below the conservation plan recommended levels and forage is adequate
- 2 Stocking rates are at the conservation plan recommended levels and forage is adequate
- 3 Stocking rates are above the conservation plan recommended levels only during the growing season and forage is adequate
- 4 Stocking rates are above the conservation plan recommended levels for all of the year and forage is short

B. Grazing system

- 1 Native Rangeland - large pastures and **low density grazing**
- 1 Pastures are subdivided and rotational grazing is practiced
- 6 Some pastures are subdivided and rotational grazing is practiced
- 5 Rotational grazing is not practiced

C. Livestock distribution

- 1 Livestock are highly encouraged to move about the pasture by placement of water sources, shade and supplemental feed
- 2 Livestock are moderately encouraged to move about the pasture by placement of water sources, shade or supplemental feed
- 4 Livestock are somewhat encouraged to move about the pasture by placement of water sources, shade or supplemental feed
- 5 Livestock are not encouraged to move about the pasture

D. Livestock Access to Water bodies

(water bodies include streams, lakes, sloughs or drainage canals, but generally do not include isolated wetlands, lateral ditches or cattle watering ponds)

- 1 Livestock do not have access to water bodies
- 2 Livestock only have limited access to water bodies at specific points for crossing and watering, with appropriate soil erosion control measures
- 2 Livestock have unlimited access to water bodies on native rangeland but at **low density grazing**

- 3 Livestock have unlimited access to water bodies but on a rotational grazing scheme
 - 5 Livestock have unlimited access to water bodies at **high density grazing**
-

E. Denuded Areas

- 1 There are no areas of the pasture that are denuded of vegetation
 - 2 The only areas denuded of vegetation are around shade structures, alternative water sources or supplemental feed areas that are more than 100' away from water bodies
 - 3 There are a few areas denuded of vegetation for less than 30 days that are greater than 50' from water bodies
 - 4 There are a few areas constantly denuded of vegetation that are greater than 50' from water bodies
 - 5 There are constantly denuded areas within 50' of water bodies
-

F. Sediment and nutrient traps

- 1 There's a buffer strip 50' or more wide of good vegetation along all water bodies
 - 2 There's a buffer strip 25' wide along all water bodies
 - 3 There's a buffer strip 10' wide along all water bodies
 - 4 There's a buffer strip 5' wide along all water bodies
 - 5 There's no buffer strip along water bodies
-

Pasture Management (Average of Pasture Management Scores)

If your score averages 2 or less in any category, keep up the good work in that category. If your score averages greater than 2 in any category, you may have a problem which could lead to a violation of water quality standards and should be investigated further.

IV. Concentrated Animal Runoff

- A. If you periodically keep cattle in concentrated areas, such as cowpens, do you
- 1 Prevent all of the runoff from the concentrated area from reaching canals or streams
 - 2 Route all of the runoff through vegetated filter strips before it gets to canals or streams
 - 3 Collect some of the runoff in ponds or vegetated filter strips before it gets to canals or streams
 - 5 Allow uncontrolled runoff from the concentrated area directly to canals or streams

- B. Are your cowpens located within 200' of a canal or stream?

- 1 None of them are located within 200' of a canal or stream.
- 3 Some of them are located within 200' of a canal or stream.
- 5 All of them are located within 200' of a canal or stream.

Concentrated Animal Runoff (Average of all scores)

If your score averages 2 or less in any category, keep up the good work in that category. If your score averages greater than 2 in any category, you may have a problem which could lead to a violation of water quality standards and should be investigated further.

Ground Water Risk Assessment

SCORE

Rate the following conditions in your ranch from 1 (low) to 5 (high):

I. Potential Contamination

A. Is there pesticide and fertilizer handling and mixing areas near water wells?

- 1 >200' from a well
- 2 within 200' to 150' from a well
- 3 within 150' to 100' from a well
- 5 less than 100' from a well

B. Is there fueling and fuel storage areas near water wells?

- 1 >200' from a well
- 3 150' to 200' from a well
- 5 less than 150' from a well

C. Is there cowpens near water wells?

- 1 >200' from a well
- 2 200' to 50' from a well
- 3 50' to 25' from a well
- 4 25' to 5 feet from a well
- 5 within 5' or within the pens

D. Are anti-siphon devices attached to the well system?

- 1 All discharge points have backflow preventers
- 2 All discharge points to water troughs and potential siphoning points have backflow preventers
- 5 no backflow preventers are on the system

E. Do wells have the ability to be closed?

- 1 All wells have been properly capped, sealed or have control valves and the valves are above ground level
- 1 Wells have been properly capped, sealed or have control valves but at ground or below ground level

- 1 Only some of the above ground wells have the ability to be closed
- 5 No wells above or below ground have been closed.

Ground Water Potential Contamination

(Average of all scores)

If your score averages 2 or less in any category, keep up the good work in that category. If your score averages greater than 2 in any category, you may have a problem which could lead to a violation of water quality standards and should be investigated further.

Water Quality Best Management Practices

NRCS Conservation Practices

Natural Resource Conservation Service (NRCS) practices which may address potential water quality risks are summarized below. These practices are combined into a Conservation Plan for your ranch. For a more detailed description of each practice, refer to the NRCS Technical Guides, Section IV or contact your local District Conservationist (Appendix D).

Brush Management (NRCS Practice #314)

Brush management is managing and manipulating stands of woody vegetation on rangeland and pastureland by mechanical, chemical, or biological means or by prescribed burning. Thus, reducing excess brush to restore natural plant community balance and manipulating brush stands through selective and patterned treatments to meet specific needs of the land and objectives of the land user. This practice is used to improve or restore a quality plant cover to reduce sediment and improve water quality and increase quality and production yields of desirable plants for livestock and wildlife.

Brush management objectives and procedures may be different for various kinds of land and for different management objectives.

Mechanical brush management (mowing or roller chopping) within isolated, herbaceous wetlands for the sole purpose of restoring the natural plant community is allowable provided that:

- (a) the wetland is not utilized by species listed by the State or Federal government as endangered or threatened;
- (b) the activity is conducted in the dry season and preferably where there is no standing water;
- (c) a six inch vegetation height remains after mowing;
- (d) at least 10 percent of wetland remains undisturbed; and
- (e) the wetland is given a recovery period of at least three years between mechanical brush management events.

Mechanical brush control operations should be timed so as to prevent exposure of bare soil for undue periods of time to reduce erosion and subsequent movement of soil. They also should be conducted during the dry season, whenever feasible. If chemical methods are applied, the operator should be advised to follow all label instructions and adhere to all state and local regulations. Chemical methods should be conducted during the dry season, whenever possible.

To reduce the possibility of pollution and to increase effectiveness of the herbicide, chemical control methods should not be used during periods of unstable weather where there is a possibility of rain within 2 to 5 hours after application of the chemical. Aerial sprays should not be applied when wind velocity exceeds 10 miles per hour or when temperature is below 65° F or above 90° F.

Brush control enhances the watershed with quality and quantities of water by reducing evapo-transpiration, allowing grasses to increase so they can impede and filter overland flow, and increase their root density to hold soil.

Critical Area Planting (NRCS Practice #342)

This practice includes establishing permanent and temporary seedings, sod, and vegetative ground covers. Plantings are done to stabilize soil and reduce sediment runoff to downstream areas. It's most applicable on highly erodible or severely eroded areas, dams, dikes, ditches, levees, cuts, fills and denuded or gullied areas.

Fencing (NRCS Practice #382)

Fences may be installed to allow for rotation, deferment, and resting of grazing lands. To reduce erosion and avoid water quality degradation through improved distribution of grazing animals and wildlife, strategic location of your fences needs to be considered before installation.

Fence locations should allow livestock access to water and working pens. If this results in undesirable fence placement, then installation of alternative water sources should be investigated.

Areas of difficult terrain or areas which receive periodic standing surface water such as swamps and marshes should be avoided if possible. The locations and construction of all fences and its materials should comply with local, state and federal laws. The landowner should obtain all required permits prior to construction or any land clearing activity that may be regulated.

Regular inspection of fences should be part of the on-going management program. Inspection of fences after storm events is needed to maintain the intended use of the fence.

Filter Strips (NRCS Practice #393)

Filter strips are an area of vegetation that removes sediment, organic matter and other pollutants from runoff and wastewater. Filter strips can be used as part of a waste management system, provided there is: 1) adequate soil drainage to ensure satisfactory performance, 2) provisions to prevent continuous or daily discharge of liquid waste, and 3) provision to mow and remove vegetation to maintain the effectiveness of the filter area. Controlled grazing and burning may be satisfactory.

The plans and specifications for filter strips should be site specific, however, filter strips which are used to filter runoff from concentrated livestock areas, such as **feedlots**, barnyards or **cowpens**, should follow these guidelines:

- A. A settling basin, vegetated barrier or low velocity channel should be provided between the waste source and filter strip when more than one hundred 1,000 pound or two hundred 500 pound animal units are continuously confined more than 45 days in a non-vegetated pen. Confinement of this number of animals for the entire duration may require permitting under the Confined Animal Feeding Operation (CAFO) rules from the EPA, Florida DEP or the local Water Management District.
- B. If a constructed settling basin is needed, contact the local NRCS office for assistance.
- C. A low velocity channel should be a minimum of 75 feet long. It should be designed for a flow depth of 0.5 feet or less to pass the peak flow resulting from a 2-year, 24-hour rainfall at a velocity of 0.5 ft per second or less. Provisions should be made for removing settled solids from the channel as necessary to maintain proper function.
- D. A filter strip may be a relatively uniform grass area or grass waterway. Minimum dimensions should be based on the peak outflow from the concentrated waste area or settling facility based on a 2-year, 24-hour rainfall.
- E. Grass area filter strips should be generally on the contour and sufficiently wide to pass the peak flow at a depth of 0.5 ft. or less. Flow length should be sufficient to provide at least 15 minutes of flow-through time.
- F. Grass channel filter strips should be designed to carry the peak flow at a depth of 0.5 ft. or less. Flow length should be sufficient to provide at least 30 minutes of flow-through time. Grass species and shape of channel should be such that grass stems will remain upright during design flow.
- G. Runoff from upland areas should be diverted around corrals and cowpens. Consult with the local NRCS and Water Management District for design and permitting requirements.

Refer to the NRCS Practice #393 (Filter Strip) for specific methods of seedbed preparation; adapted plants; planting dates and rates of seeding or sprigging; need for mulching, use of a stabilizing crop, or mechanical means of stabilizing; and fertilizer, soil amendment, and weed control requirements. Specify requirements for maintenance.



Grassed Filter Strip Between Pasture and Wetlands

Grade Stabilization Structures (NRCS Practice #410)

A grade stabilization structure is used to control the grade and head cutting in natural or artificial channels. This practice reduces erosion and prevents the formation or advance of gullies. The structures include earth embankments, full flow open structures, side-inlet drainage structures, seepage control, trash guards and antivortex devices.

Grassed Waterways (NRCS Practice #412)

A grassed waterway is a natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of surface water runoff. Grassed waterways provide for the disposal of excess surface water without causing erosion or flooding and improve water quality.

A well established grassed waterway will reduce **surface water runoff** and increase infiltration and percolation to groundwater, trap sediment and reduce nutrients and pesticides leaving the site.

The design of grassed waterways should follow these guidelines:

- A. The vegetation should be well established before large runoff flows are permitted in the channel.
- B. Proper grazing or haying management practices should be used to maintain the integrity of the grassed waterway.
- C. Grassed waterways should be installed only where field conditions facilitate stable systems.

- D. Grassed waterway channels should be protected from sediment deposition. If sediment delivery cannot be controlled before it reaches the waterway, consider the installation of vegetative filter strips to intercept the sediment.



Grassed Waterway to Reduce Sediment Movement

Livestock Shade Structures (NRCS Practice #473)

A Livestock Shade Structure is a portable, metal, PVC or pipe frame structure with a mesh fabric roof. Shade structures protect livestock from excessive heat and reduce pollution of surface waters. Shade structures are a quick and economic solution when alternatives, such as tree planting or construction of isolated ponds are not feasible. The shade structures should be moved periodically to prevent destruction of vegetation in the immediate area. It is advisable to locate shade structures away from water bodies and other sensitive areas.

Nutrient Management (NRCS Practice # 590)

The purpose of this practice is to manage plant nutrients for optimum forage yields while minimizing the movement of nutrients to surface and ground water. Nutrient management considers the amount, source, form, placement, and timing of applications of nutrients. All sources of plant nutrients, such as organic and chemical fertilizer added and nutrient reserves within the soil are considered under this practice.

Nutrient budget

A nutrient budget should be developed that considers all nutrient sources (soil residual, crop residues, organic and chemical fertilizer, and irrigation water) versus the required amounts of nutrients. Use the Nutrient Budget Worksheet (Appendix B) to determine if additional plant nutrients need to be applied. Utilize forage analysis, soil testing or IFAS recommendations to determine what nutrients are needed.

University of Florida, IFAS fertilizer recommendations for forage crops should be followed (see Fact Sheet SL-129, UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops). For bahiagrass pastures, Florida’s most common pasture forage, neither soil testing nor phosphorus and potassium fertilization is recommended for south Florida (see IFAS Circular #916, Fertilization of Established Bahiagrass Pasture in Florida).

On bahiagrass pastures nitrogen is applied in relation to intensity of use, but generally 50 to 60 pounds of nitrogen/acre should be applied in late winter. This time correlates with a period of low to moderate rainfall and nitrogen fertilizer is least likely to be washed into surface waters. It is also the time ranches are most in need of forage. Other perennial grasses may need nitrogen in late winter and at other times through the year based on IFAS recommendations.

The IFAS fertilizer recommendation of Bahiagrass pastures in North Florida are presented in the following table:

<u>Nitrogen</u>	<u>Nitrogen, lb acre⁻¹</u>	<u>P₂O₅ and K₂O Recommendations</u>
Low	0 -70	Do not apply P or K fertilizer. Use only for grazed pasture. Do not use for hay.
Medium	70 - 140	Apply 25 lb acre ⁻¹ , of P ₂ O ₅ if soil P test is low, none if test is medium or high. Apply 50 lb acre ⁻¹ , of K ₂ O if soil K test is low, none if test is medium or high.
High	140 - 180	Apply according to soil test-based recommendations

[†] lb acre⁻¹ * 1.12 = kg ha⁻¹

The nutrient content of non-farm organic fertilizer (e.g. municipal sewage sludge) can be obtained from the sludge hauler or treatment plant. Applications should conform to standards developed by the State of Florida and the Environmental Protection Agency.

Timing of Nutrient Application

To avoid nutrient losses through runoff, apply fertilizers during times with the least potential for leaching or surface runoff. Refer to the water budget (provided by NRCS) for your county to determine the times when the lowest potential for nutrient losses from rainfall occur. Time nutrient applications so that they coincide as closely as possible with periods of plant growth and nutrient uptake.

Optimize Nutrient Uptake

Maintain proper soil pH for optimum utilization of applied nutrients, while preventing toxic effects from other accumulated elements, such as copper. The pH recommendations are published in Univ. of Florida, IFAS Fact Sheet #SL-129.

Preventing Nutrient movement off-site

Include erosion control practices to minimize soil loss and runoff that can carry dissolved and soil-borne nutrients to surface waters. Filter strips along streams are very effective in reducing the levels of suspended solids and nutrients.

Try to prevent spreading fertilizers in ditches as this is a means of movement off-site.

Also, plan fertilizer loading sites away from ditches and canals where spills can contaminate the water.

Pest Management (NRCS Practice #595)

This practice manages the types and amounts of pesticides applied in or on the soil or on plant foliage to minimize the impacts to surface and ground water. Pesticide application events should be strategically designed to target designated pest species and governed by the amount necessary to protect forage and livestock grown. Where feasible, pesticide application may be eliminated completely if adequate biological controls are available.

Pesticide selection

Pesticide recommendations change frequently. Registrations may be canceled or added at any time. Recommended rates or products that were valid at the start of the growing season may change. Check with your local Extension agent for the most recent recommendations, or access the computer based Florida Agriculture Information Retrieval System (FAIRS). Base pesticide selection on characteristics such as solubility, toxicity, degradation, and adsorption, considering site specific characteristics such as soil, geology, depth to water table, proximity to surface water, topography and climate, so that the potential for pollution of surface and groundwater is minimized. Also consider the effect of pesticide application on any beneficial organism that may be present. Using pesticides that have the least effect on beneficial organisms may allow longer periods between treatment, or eliminate completely the need for re-treating.

Pesticide application

If applying restricted use pesticides, be fully trained and licensed according to the state law (Chapter 5E-9.024) or hire someone who is appropriately certified.

Read and follow all label directions and Material Safety Data Sheets (MSDS).

Reduce the potential for ground and surface water contamination by reducing the amounts of application equipment rinsate as much as possible. Rinsing the sprayer is necessary only when changing from one pesticide to another pesticide in order to avoid crop injury, when moving to a new application site and the pesticide last used in the sprayer is not registered for the new site, or when cleaning the sprayer for storage. **Do not dump rinsate on the ground or discharge to surface waters or septic systems!** Rinsate should be sprayed on fields where the pesticide was originally applied, as long as the maximum application rate for that pesticide is not exceeded. Another option is to store the rinsate and use it to dilute the same pesticide for the next application.

Avoid mixing pesticides and loading or rinsing sprayers immediately adjacent to wells, since spills in these areas can easily contaminate water supplies. Run a long hose (100-200 feet) away and preferably downhill from the supply well to the mixing and sprayer loading-rinsing area. Install anti-siphon devices on all hoses used to fill sprayer tanks.

By using erosion control practices that minimize soil loss and runoff, the movement of adsorbed pesticides to surface waters is also minimized.

Field applications of pesticides should be minimized just prior to periods of anticipated heavy or sustained rainfall to prevent surface water contamination or accelerated leaching to groundwater and ineffective control of target organisms.

Whenever possible, use integrated pest management (IPM) practices, including cultural, mechanical, biological and chemical methods.

Consider the effects of the seasonal water budget on potential pesticide loss to surface or groundwater by using the Pesticide Evaluation Worksheet in Appendix C.

Select an application method that reduces the potential for runoff or leaching. Foliar application and banding may be appropriate, depending on the specific situation.

Ponds (NRCS Practice #378)

Ponds can be constructed by excavation or embankment to provide water for livestock. Side slopes of excavated ponds should not be steeper than one horizontal to one vertical, and a watering ramp with a slope of three horizontals to one vertical should be included. The depth to the water table should be considered in pond design. Consult water management districts for legal site and size and avoid construction in or close to wetlands.

Prescribed Burning (NRCS Practice #338)

Burning is a natural phenomenon on the flatwoods, marshes and sloughs which make up the major rangeland resource sites of Florida. Controlled use of fire in Florida is a valuable management tool. It is a natural component in forming the plant communities in the state. Prescribed burning suppresses many undesirable plant species to maintain the natural balance of plants.

Prescribed burning enhances the palatability and nutritional value of edible plants for wildlife and livestock. By reducing overpopulated brush and woody components in the plant community, increased quantity of wildlife/livestock food is produced. Furthermore, when prescribed burning is used to recycle accumulated litter and excessive brush in a beneficial way, the threat of wildfire is reduced. (Adapted from "Prescribed Burning" a fact sheet from the USDA Soil Conservation Service, 1990.)

Rangeland plant communities that are dependent upon periodic fires will quickly shift into transitional plant communities dominated by woody species when burning is suppressed. When burning is suppressed this shift will often reduce the useable area for wildlife and livestock. Shading by woody plants reduces the amount of grasses and other herbaceous plants. In addition, increased soil moisture losses due to the increased woody overstory limits water needed for production of forage for livestock and wildlife. Reduced grass leads to less soil holding capacity, more water use and less nutrient retention.

Always begin with a **prescribed burning plan!** When developing the plan, determine the objectives to be met by burning and secure maps of the area. Map out fire lanes, highways, and populated areas. Consider the burn objectives, direction and smoke dispersion when deciding what conditions must be met for a successful burn. All burn plans should meet the requirements established by the Florida Division of Forestry (DOF). Always call your local DOF office the day you plan to burn to check the weather conditions and obtain a burn authorization permit.

Conditions to consider include wind speed, direction and predictability, fuel load, humidity, temperature, soil moisture, and kind of soil. Avoid burning muck soils unless the soil moisture level is high enough to assure that the soil will not ignite. When burning areas that are erodible be sure to leave buffer strips so that runoff in a storm event will be captured on-site.

For each prescribed burn the producer or someone experienced (i.e., qualified) with applying the practice should serve as fire boss. The Florida Division of Forestry offers prescribed burning courses to educate ranchers and land managers in the basic techniques and regulations of burning.

Burned areas should have a deferment from grazing for 30 to 90 days during the growing season (March-September) following a burn. This period is essential in promoting the health and vigor of the native range plants. A 30-day deferment beginning in March or April is generally recommended following a winter burn. A deferment during this period will protect the tender new growth of the more desirable bluestem and indiagrasses.

For more information contact the local USDA- Natural Resources Conservation Service office.



Prescribed Burning Improves Range Habitat

Prescribed Grazing (NRCS practice #528A)

Prescribed grazing is the controlled harvest of vegetation by grazing or browsing animals. This practice can be used to maintain a stable and desired plant community, and improve or maintain the health and vigor of selected plants. It also provides water quality benefits and can reduce soil erosion.

The duration, intensity, frequency and season of grazing in or near surface waters should be managed:

- based on plant health requirements and the expected productivity of key forage species to meet the management unit (pasture or paddock) objectives.
- to maintain enough vegetative cover to prevent accelerated soil erosion due to wind or water, and to maintain soil moisture.
- to have positive impacts on vegetative and water quality
- to enhance nutrient cycling through improved manure distribution and increased rate of decomposition
- to insure optimum water infiltration
- to maintain or improve **riparian** and upland area vegetation
- to protect stream banks from erosion
- to manage for deposition of fecal material away from water bodies
- to promote ecological and economically stable plant communities throughout the management unit which meet landowner objectives
- to have adequate upland grazing areas available to support riparian and wetland grazing sites

To accomplish these management objectives, supplemental feed may be necessary to meet the desired nutritional levels for animals of concern. The location of supplemental feed, salt and minerals should be considered to reduce negative impacts to soil, water, air, plant and animal resources. It is advisable to locate mineral and supplement feeders away from water bodies. Also locate alternative water sources in uplands to reduce frequency of use in water bodies.

Use of natural or artificial shelter or shade, such as Livestock Shade Structures, should be included as part of a prescribed grazing practice when conditions are needed.

Prescribed grazing schedules should be designed to account for seasonal and annual variations in the growth and amount of forage available due to temperatures, precipitation, day length and/or hydrology.

Range Seeding (NRCS Practice #550)

Range seeding promotes the re-establishment of adapted plants on rangeland. It's performed to prevent excessive soil loss and produce more forage on rangeland, native pasture, or grazeable woodland. Range seeding is recommended on longleaf pine-turkey oak hills, North and South Florida flatwoods, cabbage palm flatwoods and upland hardwood hammocks. It is not recommended for freshwater marshes, ponds, sloughs and swamps.

Sediment Basins (NRCS Practice #350)

Sediment basins preserve the capacity of reservoirs, ditches, canals and other waterways and reduce pollution by trapping sediment from construction sites or agricultural areas. This practice applies where physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures to keep soil and other material in place or where a sediment basin offers the most practical solution to the problem.

Troughs or Tanks (NRCS Practice #614)

A trough or tank, along with the necessary devices for water control and over-flow disposal, can be installed to provide drinking water for livestock. They provide an alternative to stream, springs, ponds or wetlands. Livestock watering facilities at selected locations protect vegetative cover and promote erosion control, through proper distribution of grazing and better grassland management. Troughs or tanks should be installed where there is a need for new or improved watering places to permit the desired level of grassland management, to reduce health hazards for livestock, and to reduce livestock use in streams.



Water Tank in an Uplands Site for an Alternative Watering Location

Waste Management Systems (NRCS Practice #312)

A waste management system consists of a series of components designed to manage liquid and solid waste from a concentrated animal area. Runoff and seepage are collected and recycled to prevent discharge of pollutants. Physical components include debris basins, dikes, diversions, fencing, filter strips, grassed waterways, pond sealing, pumps, **water control structures**, and waste storage facilities. Management components to provide treatment and recycling include irrigation management, nutrient management and waste utilization.

Waste Storage Ponds (NRCS Practice #425)

A waste storage pond is an impoundment made by excavation or earthfill for temporary storage of animal or other agricultural waste. By storing liquid and solid waste, the pond prevents nutrient runoff.

Waste Utilization (NRCS Practice #633)

Waste utilization promotes the use of waste from farms, dairy operations, municipal treatment plants and agricultural processing plants in an environmentally acceptable manner. This practice may be applied as part of a conservation management system on soils and vegetation suitable for use as a plant nutrient additive and to protect water quality.

Waste application should be accomplished in a manner (timing and rate) such that the runoff from the application area will not occur due to the application method used. Application of wastes should comply with the Nutrient Management practice and should be based on the most limiting nutrient or heavy metal.

Application of “residuals”, which is sludge from domestic wastewater treatment facilities or septage management facilities must follow the requirements of Chapter 62-640, Florida Administrative Code. This rule requires that the treatment facility submit an Agricultural Use Plan to the Department of Environmental Protection. The Agricultural Use Plan will include site use restrictions (setback distances, crop harvesting, grazing and public access limitations) depending on the levels of metals and pathogens in the “residuals”. The setback distance is generally 200 feet from water bodies (excluding wholly owned water bodies and canals or ditches used for irrigation or drainage which don’t discharge off-site). The residual application rate is limited to agronomic rates, about 200 lbs. of nitrogen per active growing season for improved pasture. The actual setback distances, application rates and other components of the Agricultural Use Plan will vary for each ranch, depending on site-specific conditions. If treatment facilities are using your property for residual application, make sure you have a copy of the Agricultural Use Plan and that you understand it.

NATIVE RANGE GRAZING

Native range includes natural grasslands, savannas, shrublands, woodlands, wetlands and associated riparian areas which support a vegetative cover of native grasses, grasslike plants, forbs, shrubs or other natural species. Normally livestock are grazed at **low densities** (i.e., one animal unit to every 6-40 acres depending on the condition and type of range site).

Non-point source pollution from rangeland livestock depends on the stocking rate, length of grazing period, the season of use, manure deposition sites and location. Normally, pastures and rangelands have not presented water quality problems caused by cattle excrement. Potential problems occur in cases where animals congregate for feeding, water and resting, in proximity to surface waters.

There is little scientific evidence that excrement from beef cattle on rangelands significantly impacts water quality. When significant nutrient contamination does occur, especially phosphorus, it is more likely explained by soil erosion and sediment processes within the watershed, rather than directly tied to livestock themselves.

Rangeland water quality can be managed by encouraging spatial distribution of cattle through mineral, upland water developments or fences for rotational grazing management. Subdividing large pastures to exert more control over the frequency and timing of grazing can also be used to improve grazing distribution.

Finally, and foremost, poor grazing management will lead to nutrient losses and invasion of undesirable species. Good planning and management on pastures and rangeland can be used effectively to prevent the occurrence of pollution problems.

DEP Construction Practices (Florida Land Development Manual)

The implementation of some practices may inadvertently effect the quality of water discharged off-site. In particular, construction or land clearing may cause sediment movement and **turbidity** problems. Erosion and sediment control should be considered when constructing Access Roads, Dams, Dikes, Field Ditches or other surface drainage structures. Likewise, activities which include land clearing, such as firebreaks or brush management should be conducted in a manner that minimizes movement of sediment in drainage water.

During construction activities such as placing culverts or pumps, measures should be taken to prevent the movement of sediment into adjacent water bodies. Such measures include placement of strawbales, silt fences, **turbidity barriers**, brush barriers or the construction of a temporary diversion dike which diverts sediment-laden water to a sediment trapping facility (pond or undisturbed area stabilized by existing vegetation).

Road banks and disturbed areas should be vegetated as soon as possible following construction, preferably within 14 days. Select grasses or legumes which are suitable for your soil and geographic area and prepare the seedbed appropriately. Seeded areas adjacent to the construction should be checked periodically to insure that a vigorous stand of vegetation is maintained, and reseeded if necessary. As an alternative to seeding, bermudagrass plugs or sprigs may be used.

Sodding may be appropriate for areas where immediate vegetative cover is required, or on sloped areas which may be difficult to seed. In waterways where concentrated, erosive flow will occur, properly pegged sod is preferable to seed because there is no lag time between installation and the time when the channel slopes are protected by vegetation. Ground preparation is as important with sod as with seed. Sod can be placed as solid plantings, spot sodding (alternate blocks of sod and bare soil) or in strips.

If vegetation other than turf is preferred, trees, shrubs, vines or ground covers may be used. These plants are used on steep slopes where seeding or mowing is not feasible or where woody plants are desirable for soil conservation or wildlife habitat. Disturbed soil between trees and shrubs should be mulched or planted with permanent vegetation to prevent erosion.

If the use of vegetation is precluded and protection against erosion is needed, use mulch, riprap or other nonvegetative materials. If an area cannot be seeded immediately for some reason, mulches should be applied, then the area seeded as soon as feasible. Mulches include organic materials such as straw, wood chips, or shredded bark. This prevents erosion by protecting the soil surface from raindrop impact, reducing the velocity of overland flow and fostering the growth of vegetation.

For more information on erosion and sediment control practices during construction, refer to Chapter 6 of the Florida Land Development Manual (1988). The most useful sections are on straw bale barriers (1.05), silt fences (1.06), brush barriers (1.07), temporary sediment traps (1.25), temporary sediment basins (1.26), **riprap** (1.37), temporary seeding

(1.65), permanent seeding (1.66), sodding (1.67), bermudagrass establishment (1.68), mulching (1.75), and trees, shrubs, vines and ground covers (1.80).



Turbidity Barrier in Place to Reduce Sediment-Laden Water from Escaping the Work Area

Associated Land Use Concerns

Fire Lines (Silviculture BMPs, 1993)

Fire line construction is an integral component of both fire suppression and prescribed burning. However, fire lines can result in excessive erosion and water quality degradation. Lines plowed in wetlands can also result in excessive drainage and possibly conversion of wetlands to non-wetland systems. Extra precautions are necessary when constructing fire lines near surface waters and near or within wetlands.

- Plow fire lines only where necessary, making use of existing barriers such as roads, water bodies, etc.
- Where possible, use alternatives to plowed lines such as harrowing, foam lines or wet lines.
- Do not plow lines through sensitive areas such as wetlands, marshes, prairies and savannas unless absolutely necessary. Avoid these areas or use alternative fire line construction methods.
- Maintain minimum plow depth at all times.
- When crossing water bodies with plowing equipment, raise the plow to prevent connecting the line directly to the water body.
- Do not construct fire lines which act as drainage systems, particularly those that might connect or chain isolated wetlands.
- Use water bars, turnouts and/or vegetation to stabilize fire lines when erosion and sedimentation might otherwise result.
- Orient fire lines along the contour whenever possible to prevent erosion and gullyng.

The following practices, when constructed or performed may have water quality impacts, such as movement of sediment into adjacent water bodies or wetlands. Since these activities involve construction, drainage alterations or activities in wetlands, **you should contact the water management district to determine if permits are needed.**

Construction of Access Roads (Silviculture BMPs)

Access roads are a potential source of long-term erosion and sedimentation problems, because of the “bare soil” nature of the road surface and periodic maintenance of the road surface and associated ditches. The following best management practices are adapted from the Silviculture Best Management Practices manual (1993):

Road Planning

Carefully plan the location and desired drainage features *before* construction, using soil survey maps, topographic maps and aerial photographs.

Minimize stream and wetland crossings.

Road Construction

Avoid construction during wet conditions. If possible, complete construction several months before heavy usage. This will reduce surface scour and decrease sediment transport.

Balance cuts and fills to maximize use of local material and to maximize roadbed stability.

To reduce both road costs and disturbed surface area, minimize the road width consistent with the anticipated type and amount of traffic.

For fill road construction, keep road shoulders at a gentle slope to minimize erosion and accelerate revegetation.

Stabilize road banks and critical road segments using mulch, seed and fertilizer, or other methods to keep the road from washing and to keep sediment out of streams.

Road Drainage

Drain road systems using culverts, cross ditches, turnouts, etc. to enhance long-term stability, reduce maintenance and protect water quality.

Where, applicable, use practices such as turnouts or ditch plugs, to reduce the volume and velocity of flow.

When practical, all road drainage practices that divert ditch flow or road surface runoff should direct such flow onto vegetated areas where it can be adequately dispersed.

Access roads should not be located within 50 feet of wetlands or watercourses. Do not direct ditch flow or road runoff into streams, lakes or other water bodies due to the possible erosion and turbidity problems.

Use cross-drain culverts on roads where there is a need to direct ditch flow from one side of a road to the other, underneath the road surface. Base the size of the culvert on the road ditch size. **(This practice may require permits.)**

An alternative to culverts may be the use of low water crossings using filter fabric, rock or concrete to stabilize the base. Size of crossing will vary with the intended use.

Use water turnouts to periodically turn ditch flow out and away from the road, and onto an adjacent vegetated area for dispersal of road runoff and sediment. Vegetated areas used for water turnouts should be adequate in size and have sufficient ground cover to assimilate discharges.

Road Maintenance

All drainage structures should be periodically checked and maintained, especially following excessive rain events. If signs of sediment and/or turbid discharges are present, take immediate corrective actions for any problem.

Ditches and culverts should be kept free of major obstructions and ditches should be allowed to revegetate as much as is practicable.

Stabilize critical segments of roads with seeding or mulching to accelerate revegetation and protect nearby watercourses.

Installation of Culverts

Since culverts are installed in a drainage system (canal or ditch), there's an inherent risk of sediment transport during construction. To minimize movement of sediment in the water body, use DEP Construction Practices during installation. Make sure that floating **turbidity barriers** are properly installed downstream, prior to excavating or filling associated with the culvert installation. Complete the installation quickly and work in the dry season, if possible.

Once the culvert is installed, stabilize exposed slopes with sod, geotextiles or other ground covers within 14 days. Vegetate exposed areas with grass seed or sod within 14 days.

Silviculture

Silvicultural activities should follow the Silviculture Best Management Practices manual (1993), distributed by the Department of Agriculture and Consumer Services.

Intermittent Row Cropping

Intermittent row crops, such as watermelons, are periodically grown to renovate pastures or supplement income. To reduce the potential for water quality violations, select pastures with adequate, existing drainage features to keep alterations to the drainage system to a minimum. Amend your nutrient management plan to include the row crop. Leave a 50 foot vegetative buffer around the edge of the pasture and wetlands within the pasture to promote sedimentation. **(Permitting may be required if new ditching or altering of existing ditches is needed).**

Other Water Quality BMPs

Animal Mortality

All wastes, including dead animal carcasses, contain microorganisms. Some of these organisms may be pathogenic (disease causing) either to animals of the same species or to different species. Proper management of animal mortalities will prevent the movement of these organisms to surface or ground water and will, therefore, reduce the risk of transmitting disease.

Proper management of mortalities will also protect surface waters from unwanted organic loads which can lower dissolved oxygen levels and kill fish. In addition, odor and nutrient enrichment problems can be prevented.

Mortality management will vary around the state but some alternatives are rendering, burning, burial or moving the carcass to an upland site away from other animals and water sources.

SPECIFIC BEST MANAGEMENT PRACTICES FOR AGRICHEMICAL AND FARM EQUIPMENT MAINTENANCE

(As adopted in the BMPs for Agrichemical and Farm Equipment Maintenance Manual [May 1998])

BMPs for Pesticides

Pesticides are designed to kill or alter the behavior of pests. When, where and how they can be used safely and effectively is a matter of considerable public interest. If they are not used wisely, pesticides may pose risks to pesticide applicators and exposed farmworkers, and may pose long term environmental problems.

Pesticide spills can be especially problematic. Even pesticides designed for rapid breakdown in the environment can persist for years if present in high concentrations. The results can be contamination of drinking water; fish kills and other impacts to nontarget organisms; and administrative fines and legal remedies. It is important that pesticide users protect themselves from all of these hazards. This section will discuss several ways to prevent problems with pesticides. It will address pesticide selection, storage, safe practices for mixing and loading, and waste disposal.

The most obvious method to reduce the risk from pesticides is to use them only when necessary. Determine which pesticides are the most useful and least environmentally harmful for a given situation. Apply them properly and effectively to minimize costs and the effects on public health and the environment while maximizing crop production. Give particular attention to the vulnerability of your farm to ground or surface water contamination from leaching or runoff.

Always follow the directions on the label. These directions have been developed after extensive research and field studies on the chemistry, biological effects, and environmental fate of the pesticide. The label is the single most important document in the use of a pesticide.

Following label directions is required by state and federal pesticide laws!

To determine which pesticides are most appropriate for use on your farm, and when and how to use them, you should consult the appropriate pesticide selection guides produced by the University of Florida Institute of Food and Agricultural Sciences (IFAS) and talk with your county extension agent, your agrichemical dealer, or an independent crop consultant.

Integrated Pest Management (IPM)

IPM is a philosophy of managing pests that aims to reduce farm expenses, conserve energy, and protect the environment.

IPM is a broad, interdisciplinary approach using a variety of methods to systematically control pests which adversely affect people and agriculture.



IPM does not, as many believe, mean that no pesticides are used.

Rather, it means that pesticides are only one weapon against pests and that they should be used judiciously, and only when necessary.

The goals of an IPM program are:

- (1) Improved control of pests, through a broad spectrum of practices that work together to keep pest populations below economically significant thresholds.
- (2) More efficient pesticide management, through less frequent and more selective use of pesticides.
- (3) More economical crop protection, from reduced chemical costs and more efficient protection.
- (4) Reduction of potential hazards to farmers, workers, consumers, and the environment, through reduced pesticide exposure.

IPM accomplishes these goals using resistant plant varieties, cultural practices, parasites and predators, other biological controls such as *Bacillus thuringiensis* (BT), and other methods including chemical pesticides as appropriate.

The basic steps for an IPM program are:

- (1) Identify key pests and beneficial organisms and the factors affecting their populations.
- (2) Select preventative cultural practices to minimize pests and enhance biological controls. These practices may include soil preparation, crop rotation, resistant varieties, changed planting dates, modified irrigation methods, cover crops, augmenting beneficials, etc.
- (3) Use trained “scouts” to monitor pest populations to determine if or when an emergency control tactic might be needed.
- (4) Predict economic losses and risks so that the cost of various treatments can be compared to the potential losses to be incurred.
- (5) Decide the best course and carry out corrective actions.
- (6) Continue to monitor pest populations to evaluate results of the decision and the effectiveness of corrective actions. Use this information when making similar decisions in the future.

See your county extension agent or independent crop consultant for help in setting up an IPM program for your farm.

Pesticide Equipment Calibration and Loading

Keep application equipment properly calibrated and in good repair. Correct measurement will keep you in compliance with the label, reduce risks to applicators, farm workers, and the environment, and save you money. **Calibrate using clean water and do not calibrate equipment near wells, sinkholes, or surface water bodies.** Measure pesticides and diluents accurately to avoid improper dosing, preparation of excess or insufficient mixture, or preparing a tankload of mixture at the wrong strength.

Proper application of pesticides will help a farm reduce costs and increase profits. Improper application can result in wasted chemicals, marginal pest control, excessive carry-over, or crop damage. As a result, inaccurate application is usually very expensive.

Most pesticides are applied with hydraulic sprayers. Tractor-mounted, pull type, pickup-mounted and self-propelled sprayers are available from numerous manufactures to do all types of spraying. Spray pressures range from near 0 to over 300 pounds per square inch (PSI), and application rates can vary from less than 1 to over 100 gallons per acre (GPA).

Be aware of the proper application methods, chemical effects on equipment, equipment calibration and correct cleaning methods. **Sprayers should be calibrated when new or when nozzles are replaced,** and recalibrated after a few hours of use, as new nozzles may wear and flow rate may increase rapidly. For example, wettable powders may erode nozzle tips, causing an increase in application rates after spraying as little as 50 acres. **Recalibrate equipment periodically to compensate for wear in pumps, nozzles, and metering systems.**

The amount of chemical solution applied per acre depends upon the forward speed, system pressure, size of nozzle, and spacing of nozzles on the boom. A change in any one of these will change the rate of application. Consult the operator's manual for detailed information on a particular sprayer.

Calibration should be performed by measuring the amount of pesticide applied to a part of an acre and calculate how much would be applied to an entire acre. Be sure to check the flow rates of all nozzles on the sprayer so they are similar.

Several different calibration methods can be found in the University of Florida/IFAS Circular SM38, *Spray Equipment and Calibration*.

Pesticide Record Keeping

The Florida pesticide law requires certified applicators to keep records of all restricted use pesticides (RUP). The federal worker protection standard (WPS) requires employers to inform

employees of all pesticides applied to forests, groves, fields, nurseries and greenhouses. To meet your legal responsibility and to document your production methods you need to maintain accurate pesticide records.

Florida law requires that you record the following items to comply with the restricted use pesticide record keeping requirement:

Brand or product name EPA Registration Number Total amount applied Location of application site Size of area treated Crop/variety/target site	Month/day/year/time of application Name and license number of applicator (If applicator is not licensed, record his name and his/her supervisor's name and license number) Method of application Name of person authorizing the application, if the licensed applicator does not own or lease the property
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Florida regulations require that information on RUPs be recorded within two working days of the application and maintained for two years from the application date. The WPS requires information on all pesticides to be recorded and posted when a pesticide is about to be applied or has recently been applied. WPS requires that records be made available for 30 days after an expired restricted entry interval (REI).

Required records must be made available upon request to FDACS representatives, USDA authorized representatives, and licensed health care professionals.

Pesticide Storage

Design and build pesticide storage structures to keep pesticides secure and isolated from the surrounding environment.

Store pesticides in a roofed concrete or metal structure with a lockable door. Locate this building at least 50 feet from other structures (to allow fire department access). Keep pesticides in a separate facility, or at least in a locked area separate from areas used to store other materials, especially fertilizers, feed, and seed. **Do not store pesticides**



Figure 1. Pesticide storage room with corrosion-resistant shelving.

near burning materials, hot work (welding, grinding), or in shop areas. Do not allow smoking in pesticide storage areas.

Store personal protective equipment (PPE) where it is easily accessible in the event of an emergency, but not in the pesticide storage area (since that may make it unavailable in time of emergency). Check the label and the Material Safety Data Sheets (MSDS) for the safety equipment requirements. **Keep a written pesticide inventory and the MSDS file for the chemicals used in the operation on site.** Do not store this information in the pesticide storage room itself.

Depending on the products stored and the quantity, you may need to register the facility with the Department of Community Affairs and your local emergency response agency. Check with your dealer about Community Right-to-Know laws for the materials that you purchase. **An emergency response plan should be in place and familiar to farm personnel before an emergency occurs**, such as a lightning strike, fire, or hurricane. Individuals conducting emergency pesticide cleanups should be properly trained under the requirements of the Occupational Safety and Health Administration (OSHA). For reporting chemical spills, see the Reference section.

Do not store large quantities of pesticides for long periods of time. **Adopt the “first in - first out” principle, using the oldest products first to ensure that the product shelf life does not expire.**

Store pesticides in their original containers. Do not put pesticides in containers that might cause children and others to mistake them for food or drink. Keep the containers securely closed and inspect them regularly for splits, tears, breaks, or leaks. **Arrange pesticide containers so that labels are clearly visible and make sure labels are legible.** All pesticide containers should be labeled. Refasten all loose labeling. Use non-water-soluble glue or sturdy transparent packaging tape to refasten loose labels. Do not refasten labels with rubber bands (these quickly rot and easily break) or non-transparent tapes such as duct tape or masking tape (these may obscure important product caution statements or label directions for product usage). If a label is damaged, immediately request a replacement from the pesticide dealer or formulator. As a temporary supplement to disfigured or badly damaged labels, fasten a baggage tag to the container handle. On the tag write the product name, formulation, concentration of active ingredient(s) and the date of purchase. If there is any question about the contents of the container, set it aside for disposal.

Dry bags should be raised on plastic pallets to ensure that they do not get wet. Do not store liquid materials above dry materials. Store flammable pesticides separately from non-flammable pesticides.

Segregate herbicides, insecticides and fungicides to prevent cross-contamination and minimize the potential for misapplication. Cross-contaminated pesticides often cannot be applied in

accordance with the labels of each of the products. This may make it necessary to dispose of the cross-contaminated materials as wastes and could require the services of a consultant and hazardous waste contractor.

Use shelving made of plastic or reinforced metal. Keep metal shelving painted (unless stainless steel) to avoid corrosion. Never use wood shelving because it may absorb spilled pesticide materials.

Construct floors of seamless metal or concrete sealed with a chemical-resistant paint. For concrete, use a water-cement ratio no higher than 0.45:1 by weight, and leave a rough finish to provide adhesion for the sealant. **Equip the floor with a continuous curb to retain spilled materials.** While a properly sealed sump may be included to help recover spilled materials, do not include a drain. Provide sloped ramps at the entrance to allow handcarts to safely move material in and out of the storage area.

When designing the facility, keep in mind that temperature extremes during storage may reduce safety and affect pesticide efficacy. Provide automatic exhaust fans and an emergency wash area. The emergency wash area should be located outside the storage building. Explosion proof lighting and fans may be required by local fire and electrical codes. It is recommended that the light/fan switch be located outside the building so that both are on before entering and until people have left the building.

The BMPs discussed often address the ideal situation of newly constructed permanent facilities. However, the user is encouraged to apply the principles and ideas put forth to existing facilities, and to portable or temporary facilities that may be used on leased land where permanent structures are not practical.

Plans and specifications for pesticide storage buildings are available from several sources, including the Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture, the Midwest Plan Service, and the UF-IFAS Publications Office. These publications also contain recommended management practices for pesticide storage facilities. See the reference section at the end of this publication for information on how to obtain these materials.

Locating Mixing and Loading Activities

Use extreme caution when handling concentrated chemicals. Spills could result in an expensive hazardous waste cleanup. It is important to understand how mixing and loading operations can pollute vulnerable ground and surface water supplies if conducted improperly and at the wrong site. **Locate operations well away from ground water wells and areas where runoff may carry spilled pesticides into surface water bodies.** If such areas cannot be avoided, protect wells by properly casing and capping them and use berms to keep spills out of surface waters.

Areas around public water supply wells should receive special consideration and may be designated as wellhead protection areas. Before mixing or loading pesticides in such areas, consult with state and local government officials to determine if special restrictions apply.

For your own safety, always use all PPE required by the label.

Described below are several BMPs that can help to prevent contamination at mixing and loading sites. These include field mixing, nurse tanks, portable mixing centers, and permanent mixing and loading structures.

Field Mixing and Nurse Tanks

Conducting all mixing and loading operations at random locations in the field away from wells or surface water bodies is an inexpensive way to reduce environmental contamination.

Mixing chemicals at random sites in the field lessens the chance of a buildup of spilled materials in any one place. This will reduce the chance of adversely affecting the natural organisms which biologically degrade pesticides. If concentrated pesticide is spilled at the field mixing site, the soil should be dug up and collected immediately. It can then be diluted with clean soil or fertilizer and applied at the labeled rate (unless prohibited by the label).



Figure 2. Nurse tank with pump, chemical inductor tank and emergency fresh water tank.

If it is not practical to conduct field mixing operations away from wells, every effort should be made to properly case and cap wells, or retrofit open uncased wells to protect the ground water from spills and runoff. Check with your local Soil and Water Conservation District (SWCD) or Water Management District (WMD) to see if cost-share grants are available for these activities.

Nurse tanks are tanks of clean water transported to the field to fill the sprayer. Nurse tanks make it possible to move the mixing and loading operation away from permanent sites (which are often near wells or surface water) to random locations in the field.

Never introduce pesticides into a nurse tank. Instead, inject pesticides into the transfer line or add them to the spray rig during filling. The pesticides may be introduced by conventional pouring, or pumped by a closed system, depending on label requirements and the type of

container. **Always use a check valve at the nurse tank to prevent backflow into the nurse tank.**

Regardless of the water source, **an air gap should be maintained whenever practical between the water source and the chemical to provide positive backflow protection.** Where allowed by the label, anti-foaming agents should be used. Always leave adequate headspace (usually 10%) when filling the tank. **Never leave a tank unattended while filling.**



Figure 3. Portable fabric mix/load pad.

In some areas of Florida, water is drawn directly from canals or ditches in the field. **In such situations, use a barrier such as a berm or some type of portable containment system to prevent spills from contaminating surface water. Use at least two forms of backflow protection to stop pesticides from siphoning back into the canal.** These could be an air gap at the fill point and a foot valve on the pump, or for a closed system, a double check valve and vacuum breaker.

Portable Mixing Centers

Another option for preventing contamination of mixing and loading sites is to use a portable mixing center. Some are little more than a very durable version of a child's wading pool, while others are made of interlocking steel sections with a custom fitted liner and built in sump. One variation is a self-contained mix/load trailer with a nurse tank at one end and a mix/load area at the other, where the mixture is pumped directly into the sprayer. Another uses portable containment facilities with nurse tanks to set up a temporary mixing/loading site in a remote field, or on leased land where no permanent structure is practical.

Portable mixing centers usually have no roof, but should be protected from rain. Since the pad may contain pesticide residues, the accumulated rainwater might have to be applied as a pesticide or disposed as a hazardous



Figure 4. Portable closed mix/load system.
Courtesy of Empty-Clean. Cordele, GA.

waste. A heavy rain could cause the pad to overflow, washing pesticides into the environment. **Clean portables thoroughly immediately after a spill, because the liner material could be damaged by the pesticide formulation.** Also, a sudden thunderstorm could result in a considerable amount of contaminated rainwater to be dealt with, or even a spill. Where practical, portable pads for mixing and loading should be used away from wells or surface water. **Never leave a tank unattended while filling.**

Permanently Located Mixing and Loading Facilities

To minimize the risk of pesticides accumulating in the environment from repetitive spills, you may wish to **construct a permanent mix/load facility** with an impermeable surface (such as sealed concrete) so that spills can be collected and managed.



Figure 5. Typical CMC for agricultural use.

A permanently located mixing and loading facility, or chemical mixing center (CMC), is designed to provide a place where spill-prone activities can be performed over an impermeable surface that can be easily cleaned and permits the recovery of spilled materials. Where feasible, the mixing and loading facility should be located in close proximity to the pesticide storage building to reduce the potential for accidents and spillage when transferring pesticides to the mixing site. Do not build new facilities on potentially contaminated sites, since subsequent cleanup efforts may require the operation to be relocated.

In its most basic form, a CMC consists of a concrete pad treated with a pesticide-resistant sealant and sloped to a liquid-tight sump where all of the spilled liquids can be recovered. **When considering a permanent CMC, it is important to assess the level of training and supervision required by the staff that will be using the center, so that it is operated in a safe and responsible manner.** Even the best designed facility will not prevent environmental contamination if it is not properly managed.

It is crucial that a CMC facility be properly designed and constructed. Mistakes can be costly and can result in unintended environmental contamination. Several publications are available to explain design, construction and operational guidelines for permanent mix/load

facilities. It is strongly recommended that these publications be consulted before designing any facility. These publications are listed in the reference section.

It is very important that wherever feasible, a CMC be located away from wells or surface water bodies. It should also be built above the flood plain. **The first principle of CMC management is that any material that collects on the pad must be applied as a pesticide or disposed as a (potentially hazardous) waste.** Because any water, including rain, that collects on the pad must be used as a pesticide or disposed as a (potentially hazardous) waste, **an open building must have a roof with a substantial overhang (minimum 30 degrees from vertical, 45 degrees recommended) on all sides to protect against windblown rainfall.**

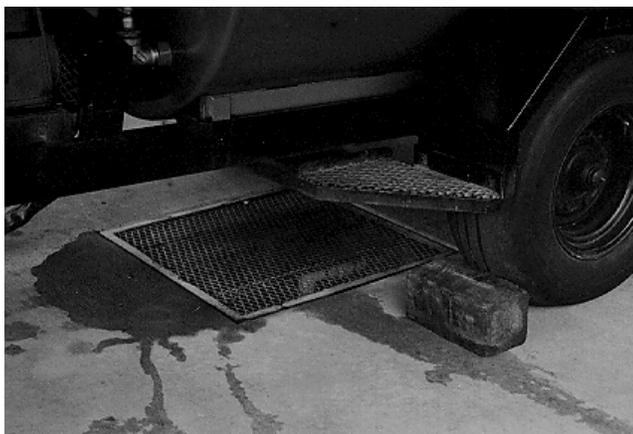


Figure 6. Spills flow into sump, not onto the ground.
Courtesy of John's Island West.

In constructing a concrete mix/load pad, it is critical that the concrete have a water-cement ratio no higher than 0.45:1 by weight. This is needed to minimize cracking and to ensure that the concrete does not fail in tension near the sealant-concrete interface. Superplasticizers and/or fly ash may be added to increase workability of the mix, but additional water must not be added. The concrete should receive a light broom finish to provide adhesion for the sealant. See *Designing Facilities for Pesticide and Fertilizer Containment* (reference the publications list) for full details of concrete specifications.

Materials other than concrete, such as steel or durable synthetics, may also be used in some cases. These materials are also used for portable CMCs where a permanent facility is not practicable.

The CMC sump should be small and easily accessible for cleaning. There must be a way to pump liquid in the sump to the sprayer or to storage tanks. **Immediate application in accordance with the label instructions is usually the preferred method of handling both spills and rinsate.** If rinsate storage tanks are used, there should be at least one tank for each group of compatible pesticide types. This allows rinsate to be saved and used as make-up water for the next time that type of material is applied.

Clean up all spills immediately. For small liquid spills (e.g. when backpack sprayers are being loaded), absorbents such as montmorillonite clays (cat litter) or sand may be used. These can be applied as a top dressing in accordance with the label instructions, or disposed as a (possibly hazardous) waste. Solid materials, of course, can be swept up and reused.

Pump the sump dry and clean it by the end of each day. Liquids and sediments should be removed from the sump and the pad any time pesticide materials are changed to an incompatible product (an incompatible product is one that cannot be legally applied to the same crop). Liquids and sediments can then be applied as a pesticide at less than the label rate, instead of requiring disposal as a (possibly hazardous) waste.

Pesticide Application Equipment Washwater

Washwater from pesticide application equipment must be managed properly since it will contain pesticide residues. Wash the **outside** of the equipment at random spots in the field using water from a nurse tank. **Clean the tires and particularly dirty areas of the equipment exterior prior to bringing it into the pad area.** These practices prevent unwanted dirt from getting on the mix/load pad and sump or from being recycled into the sprayer. **Avoid conducting such washing in the vicinity of wells or surface water bodies.** For intensive centralized or urban operations, it may be necessary to discharge the washwater to a DEP permitted treatment facility.

The inside of the application equipment should be washed on the mix/load pad. This rinsate may be applied as a pesticide (preferred) or stored for use as make-up water for the next compatible application. Otherwise it must be treated as a (potentially hazardous) waste. **After washing the equipment and before an incompatible product is handled, the sump should be cleaned of any liquid and sediment.**

Pesticide Container Management

Rinse pesticide containers as soon as they are empty. Pressure rinse or triple rinse containers and add the rinse water to the sprayer. Shake or tap non-rinseable containers such as bags or boxes so that all dust and material falls into the application equipment. **Always wear the proper personal protective equipment (PPE) when conducting these rinse operations.**

After cleaning, puncture the pesticide containers to prevent re-use (except glass and refillable mini-bulk containers). Keep the rinsed containers in a clean area, out of the weather, for disposal or recycling. Storing the containers in large plastic bags is one popular option to protect the containers from collecting rainwater. **Recycle rinsed containers in counties where an applicable program is available,** or take them to a landfill for disposal. Check with your local landfill before taking containers for disposal, as not all landfills will accept them. For information about pesticide container recycling programs in your area, contact the Pesticide Information Office at the University of Florida (352-392-4721). If permitted by the label and local ordinances, bags, boxes and group 1 pesticide containers may be burned in an open field by the owner of the crops. Burn each day's accumulation and do not store them overnight for later burning. Group 1 containers are containers of organic or metallo-organic pesticides, except

organic mercury, lead, cadmium, or arsenic compounds.

Pesticide Spill Management

Clean up spills as soon as possible. The sooner you can contain, absorb, and dispose of a spill, the less chance there is that it will cause harm. Always use the appropriate personal protective equipment as indicated on the MSDS and the label. In addition, follow the following four steps:

- **CONTROL actively spilling or leaking materials** by setting the container upright, plugging leak(s), or shutting the valve;
- **CONTAIN the spilled material** using barriers and absorbent material;
- **COLLECT spilled material**, absorbents, and leaking containers and place them in a secure and properly labeled container;
- **STORE the containers of spilled material until they can be applied as a pesticide** or appropriately disposed.

Small liquid spills may be cleaned up by using an absorbent such as cat litter, diluting with soil, and then applying the absorbent to the crop as a pesticide in accordance with the label instructions.

Farmers, farm managers, and landowners must comply with all applicable federal, state, and local regulations regarding spill response training for employees, spill reporting requirements, spill containment, and cleanup. **Keep spill cleanup equipment available when handling pesticides or their containers.**

If a spill occurs for a pesticide covered by certain state and federal laws, you may need to report any accidental release if the spill quantity exceeds the “reportable quantity” of active ingredient specified in the law. See the sections on “Spill Reporting Requirements” and “Important Telephone Numbers” at the end of this publication.

For emergency (only) information on hazards or actions to take in the event of a spill call **CHEMTREC**, at **1-800-424-9300**. CHEMTREC is a service of the Chemical Manufacturers Association. For information on whether a spilled chemical requires reporting, call the SARA title III help line at **1-800-535-0202** or the CERCLA / RCRA help line at **1-800-424-9346**.

Pesticide Waste Management Summary

The appropriate practice to be followed depends on the type of pesticide waste. The proper disposal practice for each type of pesticide material is summarized below.

Empty refillable containers (minibulks)	Refer to instructions on the label.
Empty non-refillable containers	Properly clean all containers. Shake out bags. Pressure rinse or triple rinse liquid containers and puncture (except glass). Transport to an approved pesticide container recycling facility. If no recycling facility is available, disposal as solid waste or open burning may be allowed. (Consult label and local authorities.)
Excess formulation (raw product)	Use as a pesticide in accordance with the label, return to the manufacturer in accordance with manufacturer's specifications, follow label instructions for disposal, or contact a hazardous waste contractor to remove and dispose if the EPA or State registrations are no longer valid.
Excess mixture	Use as a pesticide in accordance with label.
Absorbent material used to contain or collect spills or leaks	Use as a pesticide by applying at <i>or below</i> application rate in accordance with label directions for use. If the material must be disposed as a waste, contact the DEP District office for information (see Important Telephone Numbers in the Reference section).
Application equipment washwater	Use tank washwater as a pesticide by applying at <i>or below</i> application rate in accordance with label directions for use, or reuse as a diluent in subsequent applications. Wash outside of equipment at random areas in the field.

BMPs for Fertilizers

If not handled properly, fertilizers can be a significant source of water pollution. If excess nutrients are allowed to enter aquatic systems, they can lead to abnormally heavy algal blooms and stimulate growth of other aquatic plants. This process of eutrophication can result in lower dissolved oxygen levels and subsequent fish kills.

Guidance on the proper application of nutrients in the field is beyond the scope of this document, and the reader is referred to IFAS crop-specific publications for this information. The practices described below are used when storing and loading fertilizer into equipment. These can help prevent contamination of our water resources from spilled nutrients.

Storage

Always store nitrogen based fertilizers separately from solvents, fuels, and pesticides since many fertilizers are oxidants and can accelerate a fire. Ideally, fertilizer should be stored in a concrete building with a metal or other type of flame-resistant roof.

Take care when storing fertilizer to prevent contamination of nearby ground and surface water. Always store fertilizer in an area that is protected from rainfall. Storage of dry bulk materials on a concrete or asphalt pad may be acceptable if the pad is adequately protected from rainfall and from water flowing across the pad. Secondary containment of stationary liquid fertilizer tanks larger than 550 gallons is addressed in DEP rule 62-762, Florida Administrative Code (F.A.C.). Even where not required, the use of secondary containment is a sound practice.

Loading

Load fertilizer into application equipment away from wells or surface water bodies. A concrete or asphalt pad with rainfall protection is ideal, as this permits easy recovery of spilled material. If this is not feasible, loading at random locations in the field can prevent a buildup of nutrients in one location. **Do not load fertilizers on a pesticide CMC because of the potential for cross-contamination.** Fertilizers contaminated with pesticides may cause crop damage or generate hazardous wastes.

Clean up spilled material immediately. Collected material may be applied as fertilizer. At fixed sites, the area can be cleaned by sweeping or vacuuming (or with a shovel or loader, if a large spill), or by washing down the loading area to a containment basin specially designed to permit recovery and reuse of the wash water. Washwater generated should be collected and applied to the crop. **Discharge of this washwater to water bodies, wetlands, storm drains or septic systems is illegal.**

BMPs for Solvents and Degreasers

One of the key principles of pollution prevention is to reduce unnecessary use of potential pollutants. Over time, the routine discharge of even small amounts of solvents can result in serious environmental and liability consequences due to the accumulation of contaminants in soil or ground water. **As little as 25 gallons per month of used solvent disposal can qualify you as a “small quantity generator” of hazardous waste, triggering EPA and DEP reporting requirements.** Whenever practical, replace solvent baths with recirculating aqueous washing units (which resemble heavy duty dishwashers). Soap and water or other aqueous cleaners are often as effective as solvent-based ones. Blowing off equipment with compressed air instead of washing with water is often easier on hydraulic seals and can lead to fewer oil leaks.

Storage

Store solvents and degreasers in lockable metal cabinets in an area away from ignition sources (e.g. welding areas, grinders) and provide adequate ventilation. They are generally toxic and highly flammable. Never store them with pesticides or fertilizers or in areas where smoking is allowed. **Keep basins or cans of solvent covered to reduce volatile organic compound (VOC) emissions and fire hazards. Keep an inventory of the solvents stored and the MSDS sheets** for these materials on the premises, but not in the solvent storage area. Keep any emergency response equipment recommended by the manufacturer of the solvent in a place easily accessible and near the storage area, but not inside the area itself. Follow OSHA signage requirements.

Use

Always wear the appropriate PPE, especially eye protection, when working with solvents. **Never allow solvents to drain onto pavement or soil, or discharge into water bodies, wetlands, storm drains, sewers or septic systems, even in small amounts.** Solvents and degreasers should be used over a collection basin or pad that can collect all used material. Most solvents can be filtered and reused many times. **Store the collected material in marked containers until it can be recycled or legally disposed.**

Disposal

Private firms provide solvent wash basins that drain into recovery drums and a pick-up service to recycle or properly dispose of the drum contents. **Collect used solvents and degreasers, place them into containers marked with the contents and the date, and then have them picked up by a service that will properly recycle or dispose these materials. Never mix used oil or other liquid material with the used solvents.** Use only DEP-approved, licensed contractors. See IFAS publication DSP-2, *Disposal Options for Agricultural Wastes*, for more information.

BMPs for Paint

Paints, stains, or other finishing materials may be either oil-based or latex. **The best method of disposal for empty latex paint cans is to allow the can to fully dry and then dispose it in a landfill.** Often excess latex paints can be mixed together, re-tinted, and used. Charitable housing groups will often accept excess latex paint.

When spraying paints, especially solvent or oil-based ones, **use a high-volume low-pressure (HVLP) spray system.** These systems dramatically increase spray efficiency and reduce overspray, volatile emissions, and material costs.

Oil and solvent based coatings which cannot be used should be disposed as hazardous waste. Most empty cans may be allowed to fully dry and then disposed in a landfill. However, if the paint contained lead, chromium, or contained mercury, the can must be disposed as hazardous waste.



Figure 7. Groups like Habitat for Humanity often use donated paint.

BMPs for Used Oil, Antifreeze, and Lead-Acid Batteries

Collect used oil, oil filters, and antifreeze in separate marked containers and recycle. In Florida, recycling is the only legal option for handling used oil. Oil filters should be drained (puncturing and crushing helps) and taken to the place that recycles your used oil, or to a hazardous waste collection site. Many gas stations or auto lube shops will accept small amounts (including oil filters) from individuals. **Antifreeze must be recycled or disposed as a hazardous waste.** Commercial services are available to collect this material. Do not mix used oil with used antifreeze or sludge from used solvents. See IFAS publication DSP-2, *Disposal Options for Agricultural Wastes*, for more information on this subject.

Lead-acid storage batteries are classified as hazardous wastes unless they are recycled. All lead-acid battery retailers are required by law to accept returned batteries for recycling. Used acid from these batteries contains high levels of lead and must be disposed as hazardous waste, unless the acid is contained within a battery being recycled. Make sure all caps are in place to contain the acid. **Store batteries on an impervious surface and preferably under cover.** Remember, spent lead-acid batteries must be recycled to be exempt from strict hazardous waste regulations.



Figure 8. A safe way to store used oil and filters until they are recycled.

BMPs for Gasoline and Diesel Fuel

Design and manage fuel dispensing areas to prevent soil and water contamination. Place fuel pumps on concrete or asphalt surfaces. Fuel pumps with automatic shut off mechanisms reduce the potential for overflow and spillage during fueling. Do not locate the pumps where a spill or leak would cause fuel to flow onto the ground or into a storm drain or surface water body.

Stationary fuel storage tanks should be in compliance with DEP storage tank regulations (Chapter 62-761, F.A.C. for underground tanks and 62-762, F.A.C. for aboveground tanks). Call the nearest DEP District office for information on these requirements. In general, underground tanks with volumes over 110 gallons and above-ground tanks with volumes over 550 gallons must be registered with DEP and must utilize double-wall construction or be located within a secondary containment system. Local regulations may be more stringent.

While secondary containment is not usually required for smaller tanks, it is still a good practice. Also, roofing and containment for diesel engines is a good idea. (Check with your Water Management District to determine if cost-share funds for these improvements are available.)



Figure 9. Self contained double wall gasoline and diesel fueling station.

Where permitted by local fire code, secondary containment structures should be roofed to keep out rainfall.

Building the containment structure so that it is tall rather than wide will help minimize rainfall accumulation by reducing the exposed surface area. If the structure is not roofed, water that accumulates must be managed properly. The best option is to remove the water with a portable sump pump. This ensures that removal of water will be actively managed. **If the containment structure has a discharge port (not recommended), make certain that it is closed and locked except when uncontaminated rain water is to be drained.** If a discharge port is used, a spring loaded valve is the best method to prevent the port from being inadvertently left open.

The first line of management is to minimize the possibility of a discharge and the need for disposal. For rainfall, if the containment volume is adequate, evaporation of accumulated rainfall will often be sufficient. Critical levels at which discharge is considered should be established for each facility and the levels marked on the containment wall. This will prevent frequent and unnecessary discharge of small volumes.

The water to be discharged must always be checked for contamination. This can be done by looking for an oil sheen, observing any smell of fuel or oil, or through the use of commercially

available test kits. **Never discharge to the environment any water that is contaminated.**

Treat contaminated water on-site using commercially available treatment systems, discharge to a DEP permitted off-site industrial wastewater treatment system, or transport by tanker truck to a treatment facility. Never discharge to a sewer system without written permission from the utility. Never discharge to a septic tank. For more information on disposal options, contact the appropriate DEP District office.

If the water is not contaminated, it can be reused, or discharged to a permitted stormwater treatment system, such as a retention area, grassed swale, or wet detention pond, although this practice is not encouraged. Do not discharge it during or immediately after a rain storm, since the added flow may cause the permitted storage volume of the stormwater system to be exceeded.

BMPs for General Equipment Cleaning

(Does not include pesticide application equipment.)

Clippings and dust removed from machinery should be handled separately from other waste materials and equipment washwater. Many manufacturers now recommend the use of compressed air to blow off equipment. This is less harmful to the equipment's hydraulic seals, eliminates washwater, and produces dry material that is easy to handle.

Wash equipment over a concrete or asphalt pad that allows water to be collected, or to run off onto grass or soil, but not into a surface water body or canal. After the residue dries on the pad, it can be collected and composted or spread in the field. **To keep crop residue and other debris from becoming contaminated with pesticide, do not conduct such operations on a pesticide mixing and loading pad.**

Minimize the use of detergents. Use only biodegradable non-phosphate detergents. The amount of water used to clean equipment can be minimized by using spray nozzles that generate high pressure streams of water at low volumes.

Washwater generated from the general washing of equipment, other than pesticide application equipment, may not have to be collected. **This washwater must not, however, be discharged to surface or ground water either directly or through ditches, storm drains or canals.** **Always check with local authorities to determine whether other requirements may apply.** Equipment washwater can contain soaps, fertilizer residues, solids, and lubricating oil residues. This washwater should not contain solvents and degreasers, since these materials should be used in a separate, contained operation. (See section 3.0 for information on use of solvents and degreasers.)

BMPs for disposal of washwater (from other than pesticide application equipment, and with no degreasers or solvents) depend on several factors, such as volume of washwater generated, nature

of the surrounding area, and the frequency of the operations. **For regular washdown of ordinary field equipment, allow the washwater to flow to a grassed retention area or swale. Do not allow any washwater to flow directly into a surface waters. Any discharge to a surface water body requires a DEP industrial wastewater permit. Discharge to a septic system is not legal.**

Other options are:

- **use a washwater recycling system,**
- **discharge to a treatment system that has been permitted under DEP industrial wastewater rules,**
- **use the washwater for field irrigation.**

If you decide to use a washwater recycling system, care must be taken to operate it properly. **Cleaning of pesticide application equipment using these systems is not recommended.** The introduction of pesticide residues into these systems may result in contamination of the systems and high costs for disposal of contaminated filters and sludges as hazardous wastes.

Oil/water separators can be used, but must be managed properly to avoid problems. **Do not wash equipment used to apply pesticides on pads with oil/water separators** since the pesticide residues will contaminate the oil that is salvaged. Be aware that the oil collected in these systems may be classified as a hazardous waste (due to high concentrations of heavy metals from engine wear), making disposal expensive. Oil/water separators are generally not necessary unless the water from the system is to be reclaimed for some particular end use, or large volumes of water are generated and the industrial wastewater permit or receiving utility requires such a system.



Figure 10. Wash water recycling system. Courtesy of Collier's Reserve.

Water Well Protection

This practice involves the protection of wells already installed and the prevention of problems in wells that are being planned. For existing wells, it focuses on management activities aimed at reducing the potential for contamination. This includes evaluating and, if necessary, moving or modifying potential sources of pollution. Such sources could include pesticide and fertilizer handling and mixing areas, fueling areas and livestock confinement facilities. This practice also includes checking the water for bacterial contamination and evaluating possible sources, such as septic tank and field lines or livestock activities too near the well head.

Anti-siphon devices should be attached to all system discharge points so that backflow siphoning does not contaminate the well.

Check with local health departments or state water management districts for setback guidelines regarding wells.

When no longer in use, proper sealing of a water well prevents the entry of surface water and migration of associated contaminants to the ground water. Check with your local water management district for guidelines to seal the well.

Wells should be capped when not in use to reduce the potential for contamination. Artesian wells should be capped with control valves so that water flow can be regulated or stopped when water is not needed.

References and Further Reading

A Cattlemen's Guide to Water Pollution Control and 208 Water Quality Planning, National Cattlemen's Association, P.O. Box 3469, Englewood, CO 80155 or 425 13th Street, NW, Suite 1032, Washington, D.C. 20004.

Cattlemen's Information Guide to Water Quality. National Cattlemen's Association, P.O. Box 3469, Englewood, CO 80155 or 425 13th Street, NW, Suite 1032, Washington, D.C. 20004.

Ag Best Management Practices for Protecting Water Quality in Georgia. Georgia Soil and Water Conservation Commission, 117 Savannah Avenue, Statesboro, GA, 30458.

Phosphorus Management in Flatwood (Spodosols) Soils, by A. B. Bottcher, T. K. Tremmel, and K. L. Campbell, in Biogeochemistry in Subtropical Ecosystems, Chapter 17, Lewis Publishers, Boca Raton, FL pp. 405-424. 1999.

Best Management Practices for Agri-chemical Handling and Farm Equipment Maintenance, Florida Dept of Agriculture and Consumer Services, Florida Dept. of Environmental Protection, 1998.

California Rangeland Water Quality Management Plan. California State Water Resources Control Board, July 1995. Contact Division of Water Quality, State Water Resources Control Board, P.O. Box 944213, Sacramento, CA 94244-2130.

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Florida Development Manual: A Guide to Sound Land and Water Management, by Eric Livingston, et al (Chapter 6), Florida Department of Environmental Regulation, 1998.

Natural Resources Conservation Service, Technical Guide, Part IV. Contact nearest United States Department of Agriculture Service Center or the local USDA Natural Resource Conservation Service office located in most Florida counties.

Protecting Water Quality on Alabama's Farms, Alabama Soil and Water Conservation Committee, in cooperation with U.S. Department of Agriculture and Alabama Department of Environmental Management. Contact Alabama Soil and Water Conservation Committee at P.O. Box 304800, Montgomery, AL 36130-4800.

Rangeland Watershed Program Fact Sheets No. 1 through No. 41, Univ. of California at Davis Center for Range and Forested Ecosystems. Website:
<http://agronomy.ucdavis.edu/calrng/htoc.htm>

Silviculture: Best Management Practices Manual, by Florida Department of Agriculture and Consumer Services, Division of Forestry, 1982.

Glossary

Animal Unit (AU) Considered to be one mature cow of approximate 1000 pounds, either dry or with calf up to 6 months of age, or their equivalent, based on a standardized amount of forage consumed.

Animal Unit-Month (AUM) The amount of dry forage required by one animal unit for one month based on a forage allowance of 26 pounds per day.

Best Management Practices or BMPs Schedules of activities, prohibitions, maintenance procedures, and structural or other management practices found to be the most effective, economically viable, and practicable methods to prevent or reduce the discharge of pollutants, given the current level of knowledge. Practices which have a high potential for negatively impacting the economic viability of a farm could not, therefore, be considered BMPs. Where the economic cost of implementing certain BMPs puts an excessive financial burden on the owner, such practices could only be considered BMPs if external funds were available to return an acceptable profitability to the farm. BMPs may change over time as more information is gained.

Canal A totally man-made water body; does not include streams that have been modified by dredging or straightening

Concentrated Livestock Area A high intensity area where animal density is sufficient to cause bare ground conditions.

Confined Feeding Where animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and the animal confinement areas do not sustain crops, vegetation, forage growth, or post-harvest residues in the normal growing season. Animal units in excess of these rates may be subject to federal/state wastewater permitting requirements.

Continuous Grazing The grazing of a specific unit by livestock throughout a year or for that part of the year during which grazing is feasible.

Cowpens or corrals Fenced structure used to temporarily confine cattle for examination, medication, vaccination, administering parasite control, weighing, sorting and/or identification. Confinement is commonly less than 12 hours, but occasionally cattle may be retained for up to one week. Pens are denuded of vegetation if heavily used, but contain vegetation when lightly used.

Detention Basin A basin such as a small pond, lagoon or reservoir where stormwater is detained temporarily, providing flood control and water quality benefits, then discharges the water downstream in such a manner that reduces the peak flow.

Erosion The process by which soil particles are detached and transported by water, wind or gravity to some downslope or downstream deposition point.

Exclosure An area fenced to exclude animals.

Exclusion Range that is closed to grazing by livestock.

High Density Grazing An area, such as improved pasture area, where one animal unit utilizes 2 or less acres per unit per year

Improved Pasture Grazing lands planted primarily to introduced or domesticated native forage species that receive periodic renovation and/or cultural treatments such as tillage, fertilization, mowing, weed control and irrigation. Not in crop rotation.

Intermittent Stream A stream that has a well defined channel but maintains only seasonal flow under typical climatic conditions

Low Density Grazing An area such as native rangeland where each animal unit utilizes more than 6 acres per unit.

Native Range Land on which the existing vegetation, whether growing naturally or through management, is suitable for grazing and browsing of domestic livestock at least part of the year. Rangeland includes any natural grasslands, savannas, shrublands, woodlands and wetlands which support a vegetative cover of native grasses, grasslike plants, forbs, shrubs or other natural species.

Nonpoint Source (NPS) Water pollution which is generated by activities in a broad area and is not traceable to any specific point or identifiable facility.

OFWs Outstanding Florida Waters Water bodies which exhibit unique characteristics in terms of quality and value designated by the State for additional protection from further pollution and degradation

Pollutants Natural or man-made material that have the potential to contaminate air, soils or water.

Rill Erosion An erosion process in which numerous small channels only several inches deep are formed, occurs mainly on recent cuts and fills, canal banks. Rills are smaller than gullies and can be driven across.

Riparian Area Vegetated ecosystems along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body.

Riprap A permanent erosion resistant ground cover or large, loose, angular stone.

Rotational Grazing A grazing scheme where animals are moved from one grazing unit (paddock) in the same group of grazing units to another without regard to specific graze/rest periods or levels of plant defoliation.

Stocking Density The relationship between number of animals and area of land at any instant of time. It may be expressed as animal units per acre.

Stocking Rate The number of animals or animal live weight assigned to a grazing unit on a seasonal basis.

Supplemental Feeding Supplying feed to range animals when available forage is too limited to meet their minimum daily requirement.

Surface Runoff Water that travels downhill over land until entering a defined channel.

Turbidity An optical measurement of the clarity of the water. “Turbid” water appears cloudy and contains suspended sediment or other pollutants that limit light penetration.

Turbidity Barrier A floating geotextile material (usually yellow) which minimizes sediment transport from a disturbed area adjacent to or within a body of water. Also known as a turbidity curtain.

Water body Any river, creek, slough, canal, lake, reservoir, pond, sinkhole or other natural or artificial watercourse which flows within a defined channel or is contained within a discernible shoreline

Water Control Structure Any structure used to regulate surface or subsurface water levels

Watershed A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river or lake at a lower elevation.

Appendices

Appendix A	Employee Training
Appendix B	Nutrient Budget Worksheet
Appendix C	Pesticide Evaluation Worksheet
Appendix D	Where to go for more help (list of names & addresses)
Appendix E	Letters of Endorsement

APPENDIX “A”
Employee Training

EMPLOYEE TRAINING

- Good Housekeeping and Potential Pollutant Material Handling
- Spill Response and Clean Up
- Animal Mortality Management
- Nutrient Management and Spreading
- Proper Pesticide Use
- Petroleum Storage and Handling
- Land Application of Wastes
- Proper Operation and Maintenance of Control Facilities
- Documenting and Retaining Records

EMPLOYEE TRAINING

Date: _____

Topic(s) Discussed:

Employee(s) Present

Responsibility

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Trainer: _____

Signature: _____

TRAINING DISCUSSION POINTS FOR:

GOOD HOUSEKEEPING AND POTENTIAL POLLUTANT MATERIAL HANDLING

- **Stress the importance of ranch and facility appearance**
- **Have a schedule or plan for mowing or grazing grassed waterways and filter strips**
- **Plan for maintenance activities on access roads**
- **Have a schedule or plan to remove salting or feeding sites**
- **Properly maintain cowpen runoff management areas**
- **Properly store potential pollutants**
 - ♦ **Secondary containment for above ground storage tanks**
 - ♦ **Store small containers inside in a protected area.**
- **Discuss proper storage, use and disposal for solvents and degreasers, as well as paints, used oil, anti-freeze and batteries.**
- **Discuss ways to handle potential pollutants to reduce the chance of a spill.**

TRAINING DISCUSSION POINTS FOR:

SPILL RESPONSE AND CLEAN UP

- **Have a spill response and clean up action plan (including any hazardous waste operations and emergency response) for each of the potential pollutant sources**
- **Contain the spill, if safe**
- **Clean it up, if possible, and safe**
- **Reuse or dispose of product properly**
- **Remediate soil, if needed**
- **Example: diesel spill**
 - ♦ **Contain with berms**
 - ♦ **Remove contaminated soil and place on plastic, mix with manure to give nutrients to microorganisms**
 - ♦ **Turn soil until diesel is gone**
- **Notify Local Emergency Planning Committee, appropriate state agency and U. S. Coast Guard National Response Center when a reportable quantity is spilled (25 gal. fuel, for example)**
- **Follow label directions for handling pesticides**
- **Record spill**

TRAINING DISCUSSION POINTS FOR:

ANIMAL MORTALITY MANAGEMENT

- **Movement of dead animal away from water sources and flow ways**
- **Proper disposal methods for your operation**
- **Reduction of third party inquiries due to improper management**

TRAINING DISCUSSION POINTS FOR:

NUTRIENT MANAGEMENT AND SPREADING

- **Proper forage and soil analysis (apply only what the plant needs)**
- **Discuss timing of application**
- **Discuss locations to avoid when spreading**
- **Discuss proper storage, loading and calibration of equipment**

TRAINING DISCUSSION POINTS FOR:

PROPER PESTICIDE USE

- **Discuss pesticide equipment calibration and loading**
- **Discuss proper storage**
- **Discuss record keeping**
- **Discuss locating mixing and loading activities**
- **Discuss field mixing and nurse tanks**
- **Discuss pesticide application equipment wastewater**
- **Discuss pesticide container management**
- **Discuss pesticide spill procedures**
- **Discuss cattle/human withdrawal times for pastures that are treated**

TRAINING DISCUSSION POINTS FOR:

PETROLEUM STORAGE AND HANDLING

- **Discuss need for secondary containment and proper maintenance of facility**
- **Discuss procedure to discharge water from containment facility**
- **Discuss spill reporting plan**

TRAINING DISCUSSION POINTS FOR:

LAND APPLICATION OF WASTES

- **Discuss requirements for “Land Application of Wastewater for Organic Fertilizers”**
- **Discuss requirements for “Manure and Pond Solids Handling and Land Application”**
- **Discuss land application rates of manure, organic fertilizer or wastewater where applicable**
- **Discuss timing of land application**
- **Discuss record keeping if required**
- **Discuss cattle/human withdrawal times**

TRAINING DISCUSSION POINTS FOR:

PROPER OPERATION AND MAINTENANCE OF CONTROL FACILITIES

- **Inform employees about filter strips, grassed waterways waste storage ponds and sediment basins**
- **Discuss the preventive maintenance schedule for all control facilities (dams, dike, terraces, diversions, berms)**
- **Discuss facility inspections**
- **Discuss proper procedures for reporting and repairing any problem with control facilities**
- **Have a rain gauge**
- **Record rainfall**
- **Have a measuring device in retention ponds**
- **Have a wastewater discharge plan**

TRAINING DISCUSSION POINTS FOR:

**DOCUMENTATION AND RETAINING RECORDS OF
ACTIVITIES**

- **Stress importance of record keeping**
- **Have a schedule for retaining records**
- **List activities that should be documented**

For example:

- **Fertilizer rate/location/date**
- **Pesticide spraying**
- **Hazardous waste disposal**
- **Ditch maintenance activities**

APPENDIX “B”

Nutrient Budget Worksheet

(Contact local NRCS office to help with calculations)

Landuser _____

NUTRIENT BUDGET WORKSHEET

Prepared by: _____ County: _____
Field Number(s): _____ Date: _____
Dominant or Planning Soil Type: _____
Tillage Practices: _____
Previous Crop: _____ Yield: _____
Planned Crop: _____ Yield Goal: _____
(5 yr. avg. + 5%)

Soil Test Levels: P _____ ppm K _____ ppm pH _____
Lime requirement _____ T/A

Organic Waste: _____ #N/ton*; _____ #P₂O₅/ton*; _____ K₂O/ton*
Nutrient content (*or lb./1,000 gallons)

	N	P ₂ O ₅	K ₂ O
A. Nutrients Needed for Planned Crop & Yield	_____	_____	_____
B. Organic Waste Contribution Rate to be applied _____ tons/acres, or _____ 1,000 gallons/acre	_____	_____	_____
C. Legume Residue N Credit	_____	<u>N/A</u>	<u>N/A</u>
D. Irrigation Water	_____	_____	_____
E. Nutrient Needs or Surplus E = A - (B+C+D)	_____	_____	_____
Fertilizer Needed (#/acre)	_____	_____	_____

Fertilizer Form _____
Fertilizer Analysis _____
Application rate of bulk fertilizer _____
Application method _____
Time of application _____

APPENDIX “C”
Pesticide Evaluation Worksheet

(contact local IFAS Extension Office to help with calculations)

Cooperative Extension Service
Institute of Food and Agricultural Sciences



Managing Pesticides for Pasture Production and Water Quality Protection¹



A.G. Hornsby, T. M. Buttler, D. L. Colvin, F. A. Johnson, R.A. Dunn, T. A. Kucharek²



WATER QUALITY CONSIDERATIONS IN PASTURE PRODUCTION

Concern about the harmful effects of pesticides on surface water and groundwater quality should motivate pasture producers to select pesticides with the least potential to cause water quality problems. Many pasture producers live in rural areas near where they and other producers grow pastures, therefore, their personal water supply is susceptible to contamination. Unfortunately, information that allows producers to select pesticides less likely to affect water quality has not previously been readily available.

Our purpose is to provide information that can help producers select pesticides that will have a minimum adverse impact on water quality. The procedure considers the soil properties of the application site, the mobility and persistence of pesticides in these soils, and the toxicity of the pesticides in water to humans and aquatic species. A proper selection will decrease chances of adversely affecting surface water and groundwater quality. Certain combinations of soil and pesticide properties (along with weather conditions) can

pose a significant potential hazard to water quality. Our goal is to identify and avoid these circumstances. Information contained in this circular can help pasture producers make better decisions about the pesticides that they use. This document in no way endorses any particular pest control product. All products must be used in accordance with the label.

MATERIALS NEEDED TO USE THIS PROCEDURE

To effectively use this procedure you will need the following source materials:

- 1) A copy of the current IFAS Pest Management Guides or other appropriate information sources that identify pesticides that control specific pests.
- 2) A copy of your county soil survey report to identify the soil types found in your fields.
- 3) A copy of the Soil Science Fact Sheet entitled "[Name of your county]: Soil Ratings for Selecting Pesticides" for your county, available from your



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county Cooperative Extension Office. The basis of these ratings are given in the IFAS Extension Circular 959 entitled "Soil Ratings for Selecting Pesticides for Water Quality Goals," which is also available from your county Cooperative Extension Office.

Note: If your county has not yet been mapped by the Natural Resources Conservation Service (formerly the Soil Conservation Service), you will need to contact the local NRCS office for a site evaluation and determination of soil types and ratings for leaching and runoff of pesticides.

IMPORTANT FACTORS THAT AFFECT PESTICIDE SELECTION

How pesticides behave in the soil is determined by many factors including properties of the pesticides and of the soil at the application site. Some of the factors that should be considered when selecting pesticides with minimal potential for water quality impacts are:

Pesticide Properties

- 1) The organic carbon adsorption coefficient, K_{oc} , describes the relative affinity or attraction of the pesticide to soil materials and therefore its mobility in the soil.
- 2) The biological degradation half-life, $T_{1/2}$, is a measure of persistence of the pesticide in soil.
- 3) The maximum contaminant level (MCL), or the lifetime health advisory level (HAL), or equivalent (HALEQ), is a measure of health risk to humans of pesticide contaminated drinking water.
- 4) Aquatic toxicity, LC_{50} , is a measure of the ability of the pesticide to cause 50% mortality in aquatic test species.

Soil Properties

- 1) Hydraulic permeability is a measure of the soils ability to allow water to percolate through it.
- 2) Organic matter is important for providing binding sites for pesticides, thus reducing their mobility and increasing their opportunity to be degraded by soil microorganisms.

- 3) Slope affects the potential for water to run off the land surface.

Management Practices

- 1) Pesticide application frequencies and rates determine the total amount applied. Lower frequencies and rates reduce the potential for contamination.
- 2) Application methods affect the amount of pesticide subject to transport by water. For example, if applied directly to the soil, there is a greater probability that more of the product will be available for leaching or runoff than if applied to the foliage. If the product is incorporated into the soil, leaching may be the most important loss pathway. Pesticides applied to the foliage may be lost to the atmosphere, decomposed by sunlight, or absorbed by the foliage, thereby reducing the amount available for wash-off and transport to water bodies.
- 3) Irrigation practices can also determine the loss pathways of pesticides. Pesticides often move with water, so the less excess water that is applied, the less potential there is for a pesticide to move past the crop root zone or to run off in surface water. Rainfall or overhead irrigation can wash off significant quantities of pesticides from foliage immediately after application.

INDICES USED TO SELECT PESTICIDES



Table 1 contains two important indices, the pesticide leaching potential (RLPI) and the pesticide runoff potential (RRPI). Both indices are relative. For a given soil, these indices rank the pesticides by their potential to move from the application site by the indicated pathway (leaching or runoff). The indices are based on the organic carbon sorption coefficient and degradation half-life values of each pesticide. Values for these parameters have been taken from scientific literature, technical manuals, and company product literature.

Relative Leaching Potential Index

The Relative Leaching Potential Index (RLPI) defines the relative attenuation (reduction in mass as it moves through the soil) of each pesticide in soil, and therefore its potential to leach to groundwater. Pesticides that are very mobile, for example, those that have K_{oc} values less than 100 in sandy soils, or 50 or less in fine-textured soils should be used with caution. There is some uncertainty in the data used to calculate this index. However, since the values are relative they can still be used. It is important to realize that the smaller the RLPI value of a pesticide, the greater is its potential to leach.

Relative Runoff Potential Index

The Relative Runoff Potential Index (RRPI) defines the relative immobility and availability of each pesticide in soil, and therefore its potential to remain near the soil surface and be subject to loss in the aqueous phase or sediment phase of runoff. There is some uncertainty in the data used to calculate this index. However, since the values are relative they can still be used. The smaller the RRPI value of a pesticide, the greater is its potential to be lost in runoff.

Maximum Contaminant Level, Lifetime Health Advisory Level or Equivalent

Table 1 also contains information on the toxicity of pesticides to humans and aquatic species. This information can be used as a secondary consideration in the pesticide selection procedure.

The Maximum Contaminant Level, MCL, is the highest allowable concentration in drinking water supplied by municipal water systems. It is a Primary Drinking Water Standard based on health considerations and is enforceable by the USEPA. Pesticides that may potentially cause chronic health effects such as cancer, birth effects, miscarriages, nervous system disorders or organ damage are assigned a MCL value by the USEPA. Although the MCL is usually expressed in milligrams per liter (mg/L), in this circular it will be expressed as micrograms per liter ($\mu\text{g/L}$, or ppb). The Lifetime Health Advisory Level, HAL, provides a measure of pesticide toxicity to humans. The HAL as defined as the USEPA is the concentration of a chemical in drinking water that is not

expected to cause any adverse health effects over a lifetime of exposure (70 years), with a margin of safety. If the chemical has not been assigned a MCL or HAL value, a health advisory level equivalent, HALEQ, (denoted by an asterisk) has been calculated using the same formula as the USEPA ($\text{HALEQ} = R_f D \times 7000$) where $R_f D$ is the reference dose determined by the USEPA. For non-carcinogenic pesticides the calculated HALEQ should not differ by more than a factor of 10 from the value forthcoming from the USEPA. The Hal and the HALEQ have units of micrograms per liter ($\mu\text{g/L}$ or ppb). If a pesticide has a MCL value assigned, we use that value rather than the HAL or HALEQ. The smaller the value the greater is the toxicity to humans.

Aquatic Toxicity

The Aquatic Toxicity provides a measure of pesticide toxicity to aquatic species. The values given in Table 1 are the lethal concentrations at which 50% of the test species die (LC_{50}). Unless otherwise noted by a lower case letter following the value, the test species was rainbow trout. The smaller the value the greater is the toxicity to aquatic species.

Data for K_{oc} , RLPI, RRPI, MCL/HAL/HALEQ, and aquatic toxicity are given for the active ingredient (common name) of a product. When using a product that is a mixture of two or more active ingredients use the RLPI, RRPI, MCL/HAL/HALEQ, and Aquatic Toxicity value for the most restrictive active ingredient in the mixture.

Important Note: The information presented in Table 1 **DOES NOT** supersede or replace the information on the pesticide container label or product literature.

PROCEDURE FOR SELECTING PESTICIDES TO REDUCE ADVERSE WATER QUALITY IMPACTS

A "Pesticide Selection Worksheet" is provided as a convenient way to organize the information needed to select pesticides to avoid water pollution by pesticides in a particular production or management unit. Instructions for using the worksheet are provided. The function of the worksheet is to match the soil leach and runoff ratings at the application site with the pesticide RLPI



(leaching) and RRPI (runoff) indices and toxicity values given in Table 1.

This will indicate the relative potential for pesticides to leach or run off from a particular site and consider the toxicity of the pesticides to humans or aquatic life if the pesticides leach into groundwater or if runoff enters surface impoundments or streams. The last two columns are for recording the pasture producer's choices and reasons for selecting particular products.

Our intent is to provide a decision support tool for the pasture producer. The producer is responsible for making the final choice. The completed worksheet can serve as a permanent record of the selection process used and decision made by the producer.

Using the Worksheet

1) **Target Pest:** Correct identification of the pests that need to be controlled is essential! Check with knowledgeable experts and utilize competent diagnostic laboratories so that a proper diagnosis can be made. Misdiagnosis results in the wasteful use of unnecessary pesticides and needless increases in production costs. List confirmed pests in column 1 of the PESTICIDE SELECTION WORKSHEET.



2) **Recommended Pesticides:** Use the current IFAS Pest Management Guides, or other appropriate information sources to identify the pesticides that control the pests of concern. List these pesticides in column 2 of the PESTICIDE SELECTION WORKSHEET.



3) **Pesticide Properties:** For each pesticide listed in column 2 on the PESTICIDE SELECTION WORKSHEET, copy the numeric value for K_{oc} , RLPI, RRPI, MCL/HAL/HALEQ, and Aquatic Toxicity from Table 1 into columns 3, 4, 5, 6, and 7 of the PESTICIDE SELECTION WORKSHEET.



4) **Soil Properties:** Consult the County Soil Survey Report soil map sheets to locate your production fields and to identify the soils that occur in these fields. Use the Soil Science Fact Sheet entitled "[Your County]: Soil Ratings for Selecting

Pesticides" (available from your county Cooperative Extension Office) to determine the leaching and surface runoff rating of the soils in your fields. As you determine the soil leach rating and the soil runoff rating for each soil in each field, list the soil name, soil leach rating, and soil runoff rating in columns 8, 9, and 10, respectively, of the PESTICIDE SELECTION WORKSHEET.



5) **Selection of Pesticides:** Using information that you have compiled on the PESTICIDE SELECTION WORKSHEET, select appropriate pesticides using the **Pesticide Selection Criteria** to match soil and pesticide properties. The selection made can be recorded in column 11 and notes relating to the selection can be recorded in column 12.



Notes:

- 1) If the pesticide product selected is a formulated mixture or a tank mix, each active ingredient must be considered. The most restrictive pesticide in the mixture will determine the choice. Trade names in Table 1 followed by (M) are formulated mixtures.
- 2) Sometimes there may not be a clear choice from among the alternative chemicals available to control a particular pest. In these cases, first order screening using the RLPI or RRPI only can suffice.
- 3) Depth to groundwater and local geohydrology may influence your final selection. Shallow groundwater is more vulnerable to contamination. Deep water tables with intervening impermeable geologic layers are much less vulnerable.



Criteria for Matching Soil Ratings with Pesticide Indices

Pesticides with less potential to adversely affect water quality can be selected by matching the soil ratings and pesticides with the following criteria:

PESTICIDE SELECTION CRITERIA				
IF SOIL RATINGS ARE:		THEN		
LEACH	RUNOFF	SELECT PESTICIDE WITH:		
HIGH	LOW	Larger RLPI value,	<u>AND</u>	Larger MCL/HAL/HALEQ value.
MEDIUM	LOW	Larger RLPI value,	<u>AND</u>	Larger MCL/HAL/HALEQ value.
LOW	LOW	Larger RLPI and RRPI values,	<u>AND</u>	Larger MCL/HAL/HALEQ and Aquatic Toxicity values.
HIGH	MEDIUM	Larger RLPI and RRPI values,	<u>AND</u>	Larger MCL/HAL/HALEQ and Aquatic Toxicity values.
MEDIUM	MEDIUM	Larger RLPI and RRPI values,	<u>AND</u>	Larger MCL/HAL/HALEQ and Aquatic Toxicity values.
LOW	MEDIUM	Larger RRPI value,	<u>AND</u>	Larger Aquatic Toxicity value.
HIGH	HIGH	Larger RLPI and RRPI values,	<u>AND</u>	Larger MCL/HAL/HALEQ and Aquatic Toxicity values.
MEDIUM	HIGH	Larger RRPI and RLPI values,	<u>AND</u>	Larger Aquatic Toxicity and MCL/HAL/HALEQ values.
LOW	HIGH	Larger RRPI value,	<u>AND</u>	Larger Aquatic Toxicity value.

- 4) Distance to surface water bodies may also influence your final selection. Surface waters adjacent to or near the pesticide application site are more vulnerable to contamination than those further away. If surface runoff from the application site usually infiltrates into the soil off site before reaching a surface water body, then the MCL/HAL/HALEQ should be considered as the secondary screening index.

ACKNOWLEDGMENTS

The development of this document was supported by the USDA/ES Water Quality Initiative Project #89EWQI-1-9134 and the Center for Natural Resources, University of Florida, Gainesville, FL.

Table 1. Pastures-Pesticide parameters for selecting pesticides to minimize water quality problems.

Trade name ¹	Common name	Application Type ²		Sorption Coefficient ³		Relative Losses		Toxicity		
		Soil	Foliar	K _{oc} (ml/g)		Leaching RLPI ⁴	Runoff RRPPI ⁵	MCL, HAL or HALEQ ⁶ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)	
Herbicides										
2,4-D amine	2,4-D dimethylamine salt		x	20	E	20	20	70		100
Banvel	dicamba salt		x	2		1	1	200		28
Butoxone	2,4-DB dimethylamine salt		x	20	E	20	20	70	*	4
Butyrac 200	2,4-DB		x	0				0		
Crossbow (M)	2,4-D		x	0				0		
Crossbow (M)	triclopyr ester		x	780		169	27	100		148b
Karmex	diuron	x	x	480		53	23	10		4.9
Remedy	triclopyr ester		x	780		169	27	100		148b
Roundup	glyphosate amine salt		x	24000	E	>2,000	1	700		8.3
Velpar	hexazinone	x	x	54		6	6	200		320
Weedmaster(M)	2,4-D dimethylamine salt		x	20	E	20	20	70		100
Weedmaster(M)	dicamba salt		x	2		1	1	200		28
Insecticides/Miticides										
Ambush	permethrin		x	100000		>2,000	1	350	*	0.0041
Amdro	hydramethylnon	x		730000		>2,000	1	2	*	0.16
Cythion	malathion	x	x	1800		>2,000	555	200		0.2
Dibrom	naled		x	180		1800	>1,000	10	*	0.195
Dipe1	Bacillus thuringiensis		x	nd		nd	nd	nd		95b
Javelin	Bacillus thuringiensis		x	nd		nd	nd	nd		95b

Table 1. Pastures-Pesticide parameters for selecting pesticides to minimize water quality problems.

Trade name ¹	Common name	Application Type ²		Sorption Coefficient ³		Relative Losses		Toxicity		
		Soil	Foliar	K _{oc} (ml/g)		Leaching RLPI ⁴	Runoff RRFI ⁵	MCL, HAL or HALEQ ⁶ (ppb)		Aquatic LC ₅₀ ⁷ (ppm)
Lannate	methomyl		x	72		24	24	200		3.4
Marlate/Methoxtchl or	methoxychlor		x	80000		>2,000	1	400		0.062
Metacide	methyl parathion		x	5100	E	>2,000	39	2		3.7
Orthene	acephate		x	2		6	6	30	*	730
Rotacide	rotenone		x	10000		>2,000	33	30	*	0.031
Sevin	carbaryl		x	300		300	300	700		114
Fungicides										
Apron	metalaxyl	x		50		7	7	400	*	>100
Captan	captan	x		200		800	800	900	*	0.0732
Captec	captan	x		200		800	800	900	*	0.0732
Ridomil	metalaxyl	x		50		7	7	400	*	>100
Thiram	thiram	x		670		446	99	40	*	0.13
Fumigants										
Brom-O-Gas	methyl bromide	INJ		22		4	4	7	*	2.5
Busan 1020	metam sodium	INC,INJ		10	E	14	14	nd		0.079
Telone C-17(M)	1,3-dichloropropene	INJ		32		32	32	0.2		5.5
Telone C-17(M)	chloropicrin	INJ		62		620	620	nd		nd
Telone II	1,3-dichloropropene	INJ		32		32	32	0.2		5.5
Terr-O-Gas(M)	methyl bromide	INJ		22		4	4	7	*	2.5
Terr-O-Gas(M)	chloropicrin	INJ		62		620	620	nd		nd

Table 1. Pastures-Pesticide parameters for selecting pesticides to minimize water quality problems.

Trade name ¹	Common name	Application Type ²		Sorption Coefficient ³		Relative Losses		Toxicity	
		Soil	Foliar	K _{oc} (ml/g)		Leaching RLPI ⁴	Runoff RRPf ⁵	MCL, HAL or HALEQ ⁶ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)
Vapam	metam sodium	INC,INJ		10	E	14	14	nd	0.079
¹ Tradename:		(M) indicates that the product is a mixture of two or more active ingredients.							
² Application Type:		INC: incorporated; INJ: injected; PRE: preemergence; X: applied to soil surface or foliage							
³ Sorption Coefficient:		E: estimated G: educated guess							
⁴ Relative Leaching Potential Index (RLPI):		Smaller number indicates greater leaching hazard.							
⁵ Relative Runoff Potential Index (RRPI):		Smaller number indicates greater runoff hazard.							
⁶ Drinking Water:		Maximum Contaminant Level (MCL), Lifetime Health Advisory Level (HAL); * Lifetime Health Advisory Level Equivalent (HALEQ);							
⁷ Aquatic Toxicity LC ₅₀ :		value is for rainbow trout 48 or 96 hr exposure time, unless otherwise specified. a=channel catfish b=bluegill c=carp j=fat head minnow							
nd: no data available									



PESTICIDE SELECTION WORKSHEET

Landowner/Operator Name: _____ County: _____ Date: _____

Crop: _____ Farm ID: _____ Field ID: _____ Sheet _____ of _____

Target Pest (1)	IFAS Recommended Pesticides (2)	K _{oc} Value (3)	Relative Losses		Toxicity		Soil Type (8)	Soil Leaching Rating (9)	Soil Runoff Rating (10)	Selected Pesticide (11)	Comments (12)
			Leaching RLPI (4)	Runoff RRPI (5)	MCL/HAL HALEQ (6)	Aquatic Toxicity (7)					

If the K_{oc} value is 100 or less or if the RLPI value is 10 or less and the soil leach rating is high, then the pesticide has a high potential for leaching and should be used with extreme caution. Alternative pesticides and reduced rates should be considered if possible. Apply pesticide during periods with low potential for rainfall if possible.

APPENDIX “D”

Where to go for more help

Important Telephone Numbers

EMERGENCY REPORTING

For Ambulance, Fire, or Police,

Dial 911

State Warning Point, 24hrs. Toll-Free **1-800-320-0519**
(Department of Community Affairs, or (850)-413-9911
Division of Emergency Management)

National Response Center 24hrs. Toll-Free **1-800-424-8802**
(Federal law requires that anyone who releases into the environment a reportable quantity of a hazardous substance [including oil when water is or may be affected] or a material identified as a marine pollutant, must **immediately** notify the NRC).

DEP Emergency Response, 24 hrs. Toll-Free **1-800-342-5367**
(Florida Marine Patrol, district offices)

Jacksonville	(904)-448-4320
Orlando	(407)-893-3337
Ft. Lauderdale	(954)-467-5966
Ft. Myers	(941)-332-6975
Tampa	(813)-744-6462
Panama City	(850)-872-7650
Pensacola	(850)-595-8300

Help line numbers

(For chemical hazard information and regulatory questions)

CHEMTREC HOT LINE (Emergency only) 24 hrs	Toll-Free	1-800-424-9300
SARA Title III help line	Toll-Free	1-800-535-0202
CERCLA / RCRA help line	Toll-Free	1-800-424-9346

Non-Emergency Numbers

State Emergency Response Commission (NOT a 24hr #) 1-800-635-7179

(For state spill reporting requirements. This is for follow-up reporting. In an emergency, call the State Warning Point (page 35). If Federal reporting is required, also call the National Response Center.)

Florida Department of Agriculture and Consumer Services

Bureau of Pesticides (850)-487-0532
Bureau of Compliance (850)-488-3314
Monitoring

Florida Department of Environmental Protection

FDEP Stormwater/Nonpoint Source
Management Section (Tallahassee) (850)-921-9472

FDEP Hazardous Waste
Management Section (Tallahassee) (850)-488-0300

FDEP District offices:

Northwest (Pensacola) (850)-595-8300

Northeast (Jacksonville) (904)-448-4300

Central (Orlando) (407)-894-7555

Southeast (W. Palm Beach) (561)-681-6800

Southwest (Tampa) (813)-744-6100

South (Ft. Myers) (941)-332-6975

Water Management Districts

Northwest Florida (Tallahassee) (850)-539-5999

Suwannee River (Live Oak) (904)-362-1001 or 1-800-226-1066 Toll-free

St. John's River (Palatka) (904)-329-4500 or 1-800-451-7106 Toll-free

Southwest Florida (Brooksville) (352)-796-7211 or 1-800-423-1476 Toll-free

South Florida (West Palm Beach) (561)-686-8800 or 1-800-432-2045 Toll-free

IFAS County Extension Offices

County	City	Telephone
Alachua	Gainesville	(352)-955-2402
Baker	Macclenny	(904)-259-3520
Bay	Panama City	(850)-784-6105
Bradford	Starke	(904)-966-6299
Brevard	Cocoa	(321)-633-1702
Broward	Davie	(954)-370-3725
Calhoun	Blountstown	(850)-674-8323
Charlotte	Punta Gorda	(941)-639-6255
Citrus	Inverness	(352)-726-2141
Clay	Green Cove Springs	(904)-284-6355
Collier	Naples	(941)-353-4244
Columbia	Lake City	(904)-758-1030
Dade	Homestead	(305)-248-3311
Desoto	Arcadia	(863)-993-4846
Dixie	Cross City	(904)-498-1237
Duval	Jacksonville	(904)-387-8850
Escambia	Pensacola	(850)-477-0953
Flagler	Bunnell	(904)-437-7464
Franklin	Appalachicola	(850)-653-9337
Gadsden	Quincy	(850)-627-6317
Gilchrist	Trenton	(904)-463-3174
Glades	Moore Haven	(863)-946-0244
Gulf	Wewahitchka	(850)-639-3200
Hamilton	Jasper	(904)-792-1276
Hardee	Wauchula	(863)-773-2164
Hendry	LaBelle	(863)-675-5261
Hernando	Brooksville	(352)-754-4433
Highlands	Sebring	(863)-386-6540
Hillsborough	Seffner	(813)-744-5519
Holmes	Bonifay	(850)-547-1108
Indian River	Vero Beach	(561)-770-5030
Jackson	Marianna	(850)-482-9620
Jefferson	Monticello	(850)-997-2986
Lafayette	Mayo	(904)-294-1279
Lake	Tavares	(352)-343-4101
Lee	Ft. Myers	(941)-338-3247
Leon	Tallahassee	(850)-487-3004
Levy	Bronson	(352)-486-2165

Liberty	Bristol	(850)-643-2229
Madison	Madison	(850)-973-4138
Manatee	Palmetto	(813)-722-4524
Marion	Ocala	(352)-620-3440
Martin	Stuart	(561)-288-5654
Monroe	Key West	(305)-292-4501
Nassau	Callahan	(904)-879-1019
Okaloosa	Crestview	(850)-689-5850
Okeechobee	Okeechobee	(863)-763-6469
Orange	Orlando	(407)-836-7570
Osceola	Kissimmee	(407)-846-4181
Palm Beach	West Palm Beach	(561)-233-1712
Pasco	Dade City	(352)-521-4288
Pinellas	Largo	(727)-582-2100
Polk	Bartow	(863)-533-0765
Putnam	East Palatka	(904)-329-0318
Santa Rosa	Milton	(850)-623-3868
Sarasota	Sarasota	(813)-793-2728
Seminole	Sanford	(407)-323-2500
St. Johns	St. Augustine	(904)-824-4564
St. Lucie	Fort Pierce	(561)-462-1660
Sumter	Bushnell	(352)-793-2728
Suwannee	Live Oak	(904)-362-2771
Taylor	Perry	(850)-584-4345
Union	Lake Butler	(904)-496-2321
Volusia	Deland	(904)-822-5778
Wakulla	Crawfordville	(850)-926-3931
Walton	DeFuniak Springs	(850)-892-8172
Washington	Chipley	(850)-638-6180

Florida Soil and Water Conservation District Offices

<p>Alachua SWCD 5709 NW 13 Street, Ste B Gainesville, Florida 32653 Phone: 352-376-7414</p>	<p>Choctawhatchee River SWCD 732 N. 9th Street, Suite C Defuniak Springs, Florida 32433-3804 Phone: 850-892-3712</p>
<p>Baker SWCD Route 3 Box 1074 Macclenny, Florida 32063 Phone: 904-259-2716</p>	<p>Clay SWCD 2463 State Road 16 West Green Cove Springs, Florida 32043 Phone: 904-284-6355 ext 6588</p>
<p>Bay SWCD 6741 Camp Flowers Road Youngstown, Florida 32466 Phone:</p>	<p>Collier SWCD 14700 Immokalee Road Naples, Florida 33964-1468 Phone: 941-455-4100</p>
<p>Blackwater SWCD 6285 Dogwood Drive Milton, Florida 32570 Phone: 850-623-3229</p>	<p>Dixie SWCD Post Office Box 37 Bronson, Florida 32621 Phone: 352-486-2672</p>
<p>Bradford SWCD 226 North Temple Avenue Starke, Florida 32091-1028 Phone: 352-376-7414</p>	<p>Duval SWCD 260 US Highway 301 N #108 Baldwin, Florida 32234 Phone: 904-232-2871</p>
<p>Brevard SWCD 3695 Lake Drive Cocoa, Florida 32926-4251 Phone: 321-633-1702</p>	<p>Escambia SWCD 151 Highway 97 Molino, Florida 32577 Phone: 850-587-5404</p>
<p>Broward SWCD 6191 Orange Drive, Room 6181-P Davie, Florida 33314 Phone: 954-584-1306</p>	<p>Flagler SWCD 111 Yelvington Road East Palatka, Florida 32131-8875 Phone: 904-328-2908</p>
<p>Charlotte SWCD 6900 Florida Street Punta Gorda, Florida 33950 Phone: 941-639-6233</p>	<p>Franklin SWCD 837 Leonard Street Blountstown, Florida 32424 Phone: 850-674-8271</p>
<p>Chipola River SWCD 837 Leonard Street Blountstown, Florida 32424 Phone: 850-674-8271</p>	<p>Gadsden SWCD 2140 W. Jefferson Street Quincy, Florida 32351 Phone: 850-627-6355</p>

<p>Gilchrist SWCD Post Office Box 214 Trenton, Florida 32693 Phone: 352-486-2672</p>	<p>Jefferson SWCD 1250 North Jefferson Street Monticello, Florida 32344 Phone: 850-997-4058</p>
<p>Glades SWCD Post Office Box 445 Moore Haven, Florida 33471 Phone: 863-674-4160</p>	<p>Lafayette SWCD Route 3 Box 14 Mayo, Florida 32066 Phone: 904-294-1735</p>
<p>Hamilton SWCD Post Office Box 1329 Jasper, Florida 32052 Phone: 904-792-1105</p>	<p>Lake SWCD 32235 Merry Road, Suite C Tavares, Florida 32778-4954 Phone: 352-343-2481</p>
<p>Hardee SWCD 505 Civic Center Drive Wauchula, Florida 33873 Phone: 863-773-9644</p>	<p>Lee SWCD 3434 Hancock Bridge Pkwy, Suite 209-B North Fort Myers, Florida 33903 Phone: 941-995-5678</p>
<p>Hendry SWCD Post Office Box 248 Labelle, Florida 33935-0248 Phone: 941-674-4160</p>	<p>Levy SWCD Post Office Box 37 Bronson, Florida 32621 Phone: 352-486-2672</p>
<p>Highlands SWCD 4505 George Boulevard Sebring, Florida 33872-5837 Phone: 863-386-6545</p>	<p>Madison SWCD 1714 East Base Street Madison, Florida 32340 Phone: 850-973-6595</p>
<p>Hillsborough SWCD 1001 E. Baker Street # 403 Plant City, Florida 33566 Phone: 813-759-6450</p>	<p>Manatee River SWCD 1303 17th Street West Palmetto, Florida 34221 Phone: 941-722-6636</p>
<p>Holmes Creek SWCD 103 N. Oklahoma Street Bonifay, Florida 32425 Phone: 850-547-2916</p>	<p>Marion SWCD 2303 NE Jacksonville Road Ocala, Florida 34470 Phone: 352-622-3971</p>
<p>Indian River SWCD 1028 20 Place, Suite A Vero Beach, Florida 32960-5360 Phone: 561-770-5005</p>	<p>Martin SWCD 2401 SE Monterey Road # 343 Stuart, Florida 34996-3302 Phone: 561-221-1303</p>
<p>Jackson SWCD 2741 Pennsylvania Ave, #6 Marianna, Florida 32448-4014 Phone: 850-482-3904</p>	<p>Nassau SWCD Post Office Box 753 Callahan, Florida 32011 Phone: 904-879-3372</p>

<p>Nature Coast SWCD 20 North Main Street, Rm. 202 Brooksville, Florida 34061 Phone: 1-800-728-6374</p>	<p>Putnam SWCD 111 Yelvington Road, Suite 4 East Palatka, Florida 32131-8875 Phone: 904-328-6522</p>
<p>Ochlockonee River SWCD 615 Paul Russell Road Tallahassee, Florida 32301 Phone: 850-877-3724</p>	<p>Santa Fe SWCD Post Office Box 2486 Lake City, Florida 32056 Phone: 904-755-3194</p>
<p>Okeechobee SWCD 452 Highway 98 N Okeechobee, Florida 34972 Phone: 863-763-3619</p>	<p>Sarasota SWCD 7289-A Palmer Boulevard Sarasota, Florida 34231 Phone: 941-316-1100</p>
<p>Orange SWCD 2012 E. Michigan Street Orlando, Florida 32806 Phone: 407-896-0353</p>	<p>Seminole SWCD 3002 South Gate Drive Sanford, Florida 32773 Phone: 407-321-8212</p>
<p>Orange Hill SWCD 1424 West Jackson Street, #D Chipley, Florida 32428 Phone: 850-638-1718</p>	<p>South Dade SWCD 15600 SW 288 Street, Suite 402, Box 7 Homestead, Florida 33033 Phone: 305-242-1218</p>
<p>Osceola SWCD 1895 E. Irlo Bronson Mem. Highway Kissimmee, Florida 34744-3701 Phone: 407-847-4465</p>	<p>St. Johns SWCD 111 Yelvington Road, Suite 4 East Palatka, Florida 32131-8875 Phone: 904-328-6522</p>
<p>Palm Beach SWCD 559 N. Military Trail West Palm Beach, Florida 33415-1311 Phone: 561-233-1720</p>	<p>St. Lucie SWCD 8400 Picos Road, Suite 202 Fort Pierce, Florida 34954-3041 Phone: 561-461-4546</p>
<p>Pasco SWCD 1 Pasco Center 30407 Commerce Drive San Antonio, Florida 33576 Phone: 352-521-4260</p>	<p>Sumter SWCD 32235 Merry Road Tavares, Florida 33513 Phone: 352-343-2481</p>
<p>Peace River SWCD 10 South Desoto Avenue, Room 200 Arcadia, Florida 33821 Phone: 863-494-4040</p>	<p>Suwannee River SWCD 10096 U. S. Highway 129 Live Oak, Florida 32060 Phone: 904-362-2622</p>
<p>Polk SWCD 1700 Highway 17 South Bartow, Florida 33830 Phone: 863-533-7121</p>	<p>Taylor SWCD Post Office Box 300 Perry, Florida 32347 Phone: 850-294-1735</p>

Tupelo SWCD 837 Leonard Street Blountstown, Florida 32424 Phone: 850-674-8271	Wakulla SWCD Post Office Box 40 Crawfordville, Florida 32326 Phone: 850-877-3724
Union SWCD Route 3 Box 1074 Macclenny, Florida 32063 Phone: 904-259-2716	Yellow River SWCD 938 N. Ferndon Boulevard Crestview, Florida 32536 Phone: 850-682-3714
Volusia SWCD 3151 E. State Road 44 Deland, Florida 32724-6409 Phone: 904-943-7893	

REGISTRATION CARD

Water Quality BMPs for Cow/Calf Operations

Update Request

Name: _____

Address: _____

City: _____ ST: _____ Zip: _____

Phone: _____ FAX: _____

Mail to: Florida Cattlemen's Association
P.O. Box 421929
Kissimmee, FL 34742-1929

APPENDIX “E”

Letters of Endorsement



Florida Department of Agriculture & Consumer Services
BOB CRAWFORD, Commissioner

June 15, 1999

Mr. Larry Barthle, President
Mr. Jim Handley, Executive Director
Florida Cattlemen's Association
P.O. Box 421929
Kissimmee, Florida 34742-1929

Dear Larry and Jim:

I want to offer my personal congratulations and support to the Florida Cattlemen's Association for developing the "Water Quality Best Management Practices for Cow/Calf Operations in Florida" document. I am especially proud of the leadership demonstrated by the Association. There was no government mandate or funding; the Cattlemen created this document because it was the right thing to do for the industry and for Florida's natural resources. Although you worked closely with the Florida Department of Agriculture and Consumer Services, the United States Department of Agriculture's Natural Resources Conservation Service, the University of Florida, as well as several state agencies and the water management districts, and we were all there as partners to support your effort, success was ultimately achieved because of your commitment.

The completion of the manual clearly demonstrates the Florida Cattlemen's Association commitment to protect the beef cow/calf agricultural production interests in our State while also protecting the integrity of sensitive water bodies associated with approximately 6 million acres of pastureland. Further, this manual is one more example of the broad based effort by those in agriculture to cooperatively develop and implement Best Management Practices (BMPs) for use by producers.

I encourage the Association's members to embrace and follow the recommendations contained in your BMP manual. Doing so will not only protect our fragile environment, but will also position your industry to refine the practices and avoid new regulations that might otherwise be required as Florida implements the federally mandated Total Maximum Daily Load program under the Clean Water Act. Your initiative in developing this program should also assist the membership in dealing with specific areas of concern, such as the restoration of Lake Okeechobee.

Lastly, I would like to personally commend the Association's Environmental and Private Lands Committee, and Chairman Mike Milicevic, for their hard work and diligence in completing this BMP manual. It is my belief that your model of an industry supported and led BMP development process promotes agriculture's long-standing commitment to good environmental stewardship and will set a positive example for other agricultural sectors to follow in the future. Thanks to all of you for a job well done.

Sincerely,

A handwritten signature in cursive script that reads "Bob Crawford".

BOB CRAWFORD
COMMISSIONER OF AGRICULTURE



Jeb Bush
Governor

Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

David B. Struhs
Secretary

June 16, 1999

Mr. Michael Milecivic
Florida Cattlemen's Association
P. O. Box 421929
Kissimmee, Florida 34742-1929

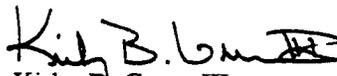
Dear Mr. Milecivic:

Congratulations! You, the Florida Cattlemen's Association, and everyone who has helped develop the "Water Quality Best Management Practices for Cow/Calf Operations Manual" deserve our sincere appreciation for a job well done.

Secretary David Struhs and the water management district executive directors met on June 3, 1999, to review and discuss the manual. We are particularly encouraged that the manual was developed cooperatively by folks representing the Cattlemen, the scientific community and state and federal agencies with an interest in water quality issues.

Please accept this letter on behalf of Secretary Struhs and the water management district executive directors, as our continued support for the Florida Cattlemen's Association's efforts to refine the manual; and our commitment to continue to work with all interested parties to develop educational programs and implement the best management practices.

Sincerely,


Kirby B. Green III
Deputy Secretary

KBG/jgl

cc: Commissioner Crawford



Natural Resources Conservation Service

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

2614 N.W. 43rd St.
Gainesville, Florida
32606-6611

P.O. Box 141510
Gainesville, Florida
32614-1510

(352) 338-9500 (Phone)
(352) 338-9574 (Fax)

June 18, 1999

Mr. Mike Milicevic
750 S.W. C.R. 721
Okeechobee, Florida 34974-8918

Dear Mr. Milicevic:

The USDA – Natural Resources Conservation Service fully supports the development of the "Water Quality Best Management Practices for Florida's Cow-Calf Producers" handbook by the Florida Cattlemen's Association.

Beginning with the Spaniards and continuing through into the 21st century, Florida's cattle industry has a long and colorful history. Throughout this entire period there is ample evidence of the respect and admiration Florida's cattlemen have for our natural resources.

The development of the "Water Quality Best Management Practices for Florida's Cow-Calf Producers" handbook further illustrates the concern Florida cattlemen have for the environment. The creation and utilization of this handbook will help preserve and improve water quality on Florida's ranches. Associated benefits resulting from the use of the handbook, such as improved wildlife habitat, reduced soil erosion and improved forage production, will undoubtedly improve the quality of life for Florida's cattlemen.

The USDA – Natural Resources Conservation Service (NRCS) will continue working with the Florida Cattlemen's Association and its members to implement the Best Management Practices (BMPs). Assistance from the NRCS is available to all landowners in the development of voluntary conservation plans which may be used to document the use of BMPs on individual farms and ranches.

Please feel free to contact the USDA-NRCS for any additional assistance we may provide, and congratulations on a job well done.

Sincerely,


T. Niles Glasgow
State Conservationist