UNIVERSITY OF FLORIDA
IFAS EXTENSION

Water Management Best Management Practices for PhosphorusControl on Organic Soils: Retention of Drainage On-Farm [1]

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This fact sheet is part of a BMP series which was written specifically to address the concern for phosphorus control in the Everglades Agricultural Area. The information contained in the series may be applied to any agricultural area composed primarily of organic soils or Histosols. However *please be aware that this information may not be applicable to any other soil types*.

BACKGROUND

Retention of drainage on-farm could reduce phosphorus losses from 15-60%. This Best Mangagement Practice requires a farm to have the capacity to store additional storm drainage water on-site both during and after rainfall events without adverse impacts on crop production.

On-farm storage of water can be accomplished in three ways. The first technique is simply to let water tables throughout the farm rise by reducing pumping times. The second technique involves a higher management variation of the first technique where water is only allowed to rise in isolated blocks within the farm. The third storage technique is to build a separate storage reservoir on the farm. Each technique will be discussed in greater detail in this document with pros, cons, and specific design considerations being presented.

TEMPORARILY RAISING WATER TABLES IN THE FIELDS

Temporarily raising water tables in the fields after storms has the advantage of being easily implemented by changing pump schedules. Its main disadvantage is increased soil wetness. If crops such as vegetables that are sensitive to wet soil conditions are involved, very limited additional wetness is acceptable. This Best Management Practice, therefore, is of limited benefit for vegetable operations. However, more water-tolerant crops such as sugarcane should be able to use this BMP effectively. If vegetables are being grown within the confines of the sugarcane farm, hydraulic isolation of the vegetable blocks is necessary to fully implement the BMP. To determine the amount of in-field storage and related drainage required for a given storm, it is necessary to estimate the soil wetness that would be expected from that storm. The water table and soil moisture accountability procedure, described in this guide (see Temporal Water Table Control), must then be followed. It is important to remember that the water table fluctuation control is concerned mainly with downward fluctuations. Upward movement, therefore, was permissible to a greater degree. Using this water management analysis procedure will also allow you to precalculate an estimate of the actual retention capabilities of the farm.

Until sufficient experience is gained, the use of the moisture accounting and pump control algorithms will seem fairly complicated and confusing. However,

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2.

once confidence is gained, this should become a routine part of farm operation, providing you with a valuable understanding and control of the water management system. Such an understanding could likely lead to other benefits for the farm. To get started, however, we suggest that a farm-specific program be developed with the support of private or governmental water management experts.

STORING WATER IN ISOLATED FARM BLOCKS

Storing water in isolated farm blocks can be useful in cases where different crops are being grown behind a pump station, or when the movement of water between blocks is desirable. The use of sugarcane lands to store drainage water from vegetable areas within or outside the farm is a good example of crop block storage. However, because of the potential importance of this Best Management Practice, vegetable storage in sugarcane will be discussed separately (see Retention of Vegetable Field Drainage Water in Sugarcane of Fallow Lands) This section will focus instead on block storage techniques for the sugarcane farming operations.

Fallow sugarcane lands and rice fields are prominent storage locations for excess rainfall, and in this regard can be very useful. However, storage in fallow/rice lands is limited by the available acreage (seasonal and usually only about 20% of the farm acreage) and the need to hydraulically isolate (dike) this area. Hydraulically isolating blocks will necessitate the use of additional pumps and dikes. These typically have been of a temporary nature. Permanent diking and ditching systems, however, once installed, can simplify future operations and improve overall farm water management. The diking referred to in this instance can simply be the normal road access dikes and ditch spoil separations. No large scale diking would be required.

Research and farmers' experiences during flood periods have demonstrated there is a high potential tolerance of sugarcane for prolonged root inundation, both partial and complete. This ability to withstand root submergence for extended periods of time depends upon plant variety and maturity, as well as on soil type and degree of soil/water aeration (Deren, et al, 1991). Storing water in fields cropped to sugarcane has solid potential as a BMP, but additional research concerning the interactions of soil type and water level with cultivar and length of inundation are required before full-scale implementation.

The water conveyance system on a sugarcane farm must be modified so that drainage water can be moved from one block of land to another within the farm drainage system. This system will require setting up gated culverts and pumps on isolated feeder channels so that water can be raised in a given block of land by draining it from another block within the farm. Low level diking will be needed if land flooding is anticipated. It may be advantageous to have the feeder ditches arranged to allow water to be pumped from one side of a block to other in order to maintain a flow across the block. Water kept in motion is better aerated and thereby is believed by some growers to reduce the negative impact of root zone inundation. However, no scientific data are available to verify this claim. Therefore, we do not know yet whether flow from one block to another on a rotational basis would be better than recycling water within blocks. In any event, we advise starting out on a small scale to gain experience before expanding to a farm-wide system.

PROCEDURE FOR BEGINNING A BLOCK STORAGE SYSTEM

The procedural operation of a block storage system would be to first operate the farm as described in in this guide (see Minimizing Water Table Fluctuations). Once excess rainfall occurs, this excess water could be pumped into the first farm block until its allowable water saturation time is reached (see Minimizing Water Table Fluctuations--Table 2). This block, then, could be appropriately drained into a second block until its water saturation time limit has been reached. This process continues until the excess water is evapotranspired from the system or until there are no more available blocks. At that time, the excess drainage water will need to be pumped from the farm. However, it may be likely that by then one of the earlier blocks will have regained storage capacity so that additional excess rainfall could go to it. Figures 1 and 2 show an example of a farm layout which utilizes a block storage technique.

ON-FARM STORAGE RESERVOIRS

On-farm storage reservoirs which store excess rainfall on-site for later use for irrigation could reduce phosphorus losses from 10-60%. Such reservoirs would require about 5-10% of the farmer's land be removed from production. The reservoirs would then be constructed of either muck or marl dikes (preferred for reduced seepage losses). These would require a pump station and release gates for water control. Their sizing would be based on the desired water retention, height of dike, and water level control requirements of the farm. For example, a sugarcane farm would require smaller reservoirs on a per-acre basis than a vegetable farm.

On-farm storage reservoirs offer the simplest managerial scheme of any of the previous retention systems because their operational procedure is simply to pump all excess water into the reservoir until its capacity is exceeded, at which time water is released off the farm. Conversely, irrigation is drawn from the reservoir until its storage capacity is depleted and water is brought into the farm. The reservoir has the additional advantage of removing some of the phosphorus from the water during storage.

There are, however, several disadvantages to retention ponds:

* The acreage required for the reservoir is permanently removed from crop production. Depending on the degree of retention desired and dike heights, this acreage could amount to as much as 10 percent of existing crop land.

* Seepage from the storage reservoir may create additional operational costs due to increased pumping.

* The reservoir's additional water surface area will extend the consumptive use of water on the farm.

* Cost of construction and loss of farm productivity make this system very expensive.

For some farms the operational advantages could outweigh these disadvantages.

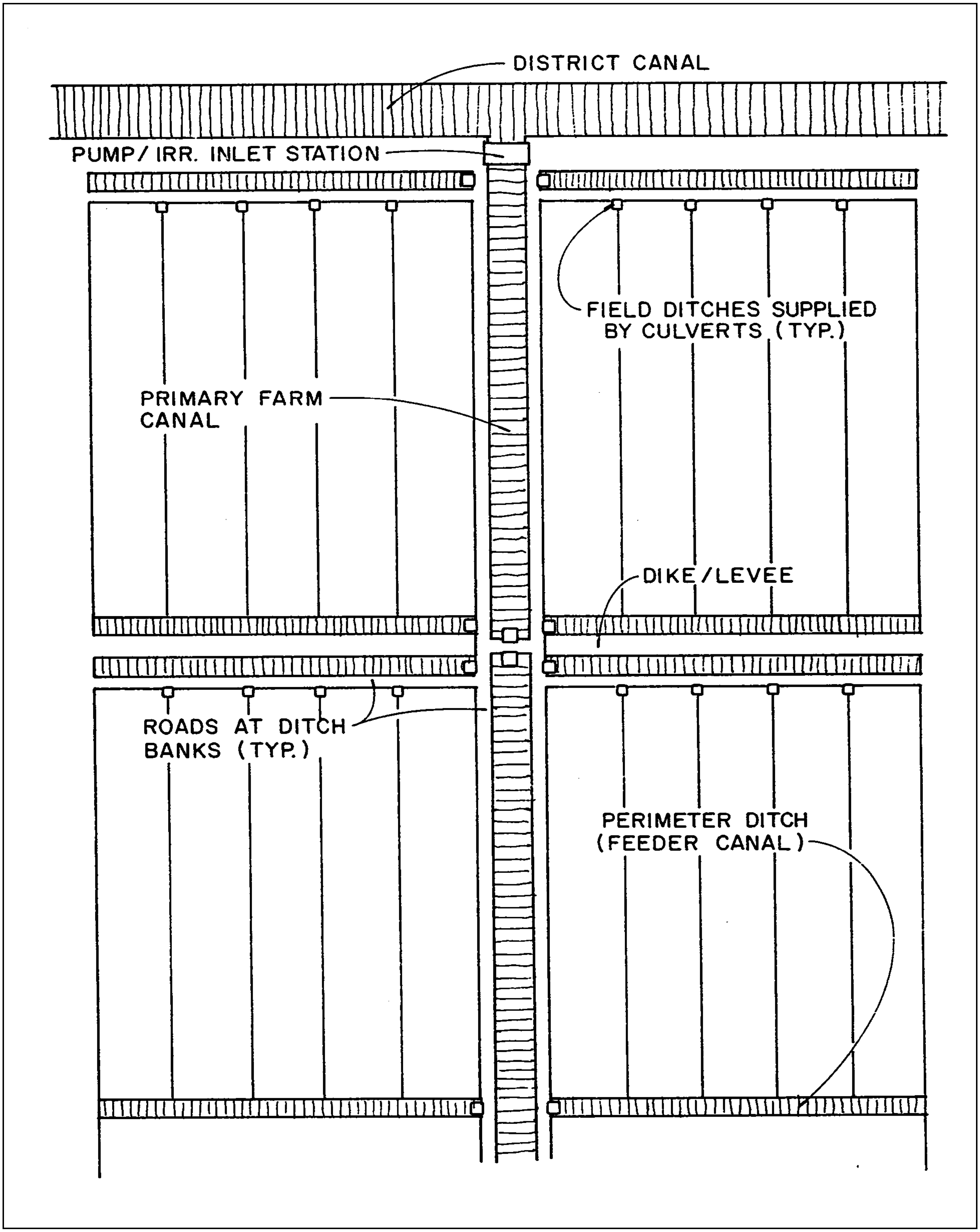

Figure 1. Plan view of one possible block storage system.

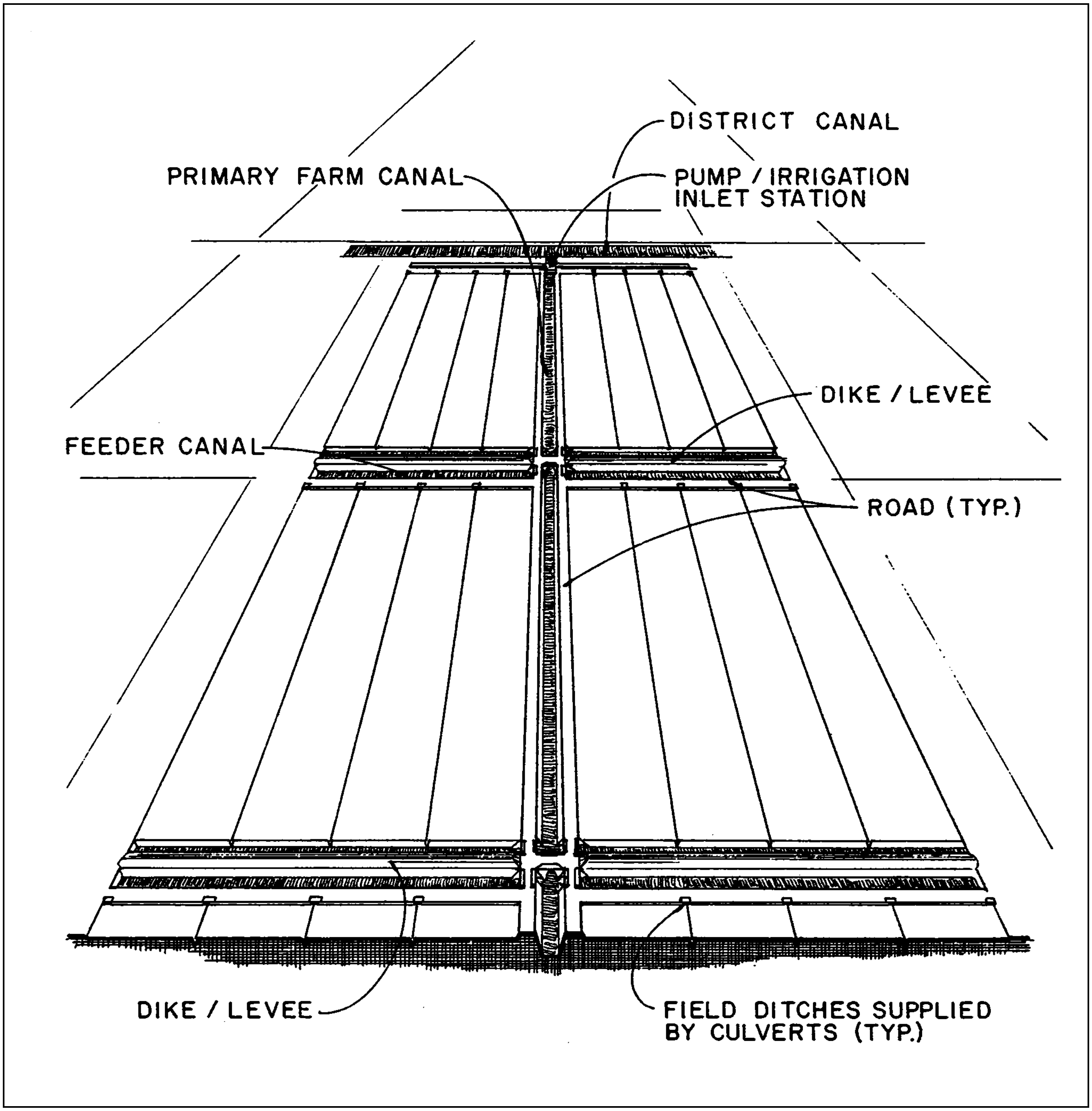

Figure 2. Aerial view of a possible block storage system.