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NONPOINT SOURCE BEST MANAGEMENT PRACTICES PROGRAM FOR THE EVERGLADES AGRICULTURAL AREA

by

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SUMMARY:

The South Florida Water Management District is implementing a comprehensive program of restoration to Florida's Everglades ecosystem. The cornerstone of the restoration effort is a program of agricultural best management practices (BMP) developed and implemented to reduce non-point source total phosphorus runoff from a 553,000 acre agricultural basin on organic (muck) soils. An overview of the BMP program components, effectiveness measurement, and results are reported.

KEYWORDS: Best Management Practices, Everglades, Nonpoint Source,Regulation,Phosphorus

NONPOINT SOURCE BEST MANAGEMENT PRACTICES PROGRAM FOR THE EVERGLADES AGRICULTURAL AREA

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ABSTRACT

The Florida Everglades has experienced changes to native vegetative communities over the past several decades. These changes are believed to be due to the alteration of natural water flows, changes in water quality, and invasion of exotic vegetative species. The scientific community generally agrees that the changes are being caused by a combination of hydrology alterations from a government designed and built drainage system, urban and agricultural development, and the establishment and rapid expansion of exotic vegetation. The South Florida Water Management District is implementing a comprehensive program of restoration to Florida's Everglades ecosystem. The cornerstone of the restoration effort is to improve the water quality from the largest tributary to the Everglades, a 553,000 acre agricultural area of primarily sugarcane and vegetables, through a program of agricultural best management practices (BMPs). The BMP program was developed as a regulatory permitting initiative. The regulatory program required the implementation of BMPs to reduce total phosphorus from the basin by an average annual 25 percent beginning in 1996. Monitoring has shown that the landowners have implemented best management practices and have reduced total phosphorus by an annual average of 47 percent.

INTRODUCTION

The South Florida Water Management District (SFWMD) is one of five regional water resource management agencies in Florida. Defined by surface hydrologic boundaries, the SFWMD covers about 18,000 square miles within 16 counties, roughly from Orlando through Key West. This area includes the state's most populous coastal area of Palm Beach through Miami, the 718,400 acre Everglades Agricultural Area (EAA), and the Everglades which are delineated as water conservation areas (WCAs) and Everglades National Park (ENP) (Figure 1). The SFWMD is charged with managing water resources within its boundaries for flood protection, water supply, and water quality for urban areas, agriculture, and the environment.

The Everglades is an internationally recognized ecosystem which once sprawled across four million acres of southern Florida. In the past 100 years, man's efforts to develop Florida have resulted in the Everglades being radically altered. Almost half the original wetlands have been lost -- with approximately two million original Everglades acres remaining today. These expanses are largely contained in three Water Conservation areas located in western Palm Beach, Broward and Dade counties, and Everglades National Park at the southern end of the peninsula. Within the remaining Everglades, some areas are in near-pristine condition while others are visibly suffering. Problems which have affected the Everglades include changes in water quantity, timing, distribution; changes in tributary water quality; invasion of non-native plants such as melaleuca (*Melaleuca quinquenervia*); and other consequences resulting from man's encroachment (SFWMD, 1992a).

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In 1987, the state enacted the Surface Water Improvement and Management, or SWIM Act (Florida 1987). The SWIM Act required Florida's water management districts to develop plans which contain strategies to either protect undisturbed "natural" water bodies or restore impacted areas. The Everglades SWIM plan was the fourth plan developed by the SFWMD. In 1991, the Florida legislature passed the Everglades Protection Act (Florida, 1991) which further defined the requirements of the Everglades SWIM Plan. The Everglades Protection Act was revised and "strengthened" during the 1994 Florida legislative session. The resulting act, renamed the Everglades Forever Act (EFA), replaced the Everglades SWIM Plan and mandated a comprehensive Everglades Restoration Program (Florida, 1994).

The Everglades Restoration Program undertaken by the SFWMD is based upon a comprehensive approach to restoration and protection by proposing strategies for improving water quantity, timing, and distribution deliveries (hydroperiod), improving water quality in tributary water, and long-term removal and management of exotic species. The Everglades program is arguably the most publicly discussed and debated effort the SFWMD has undertaken in recent years. One of the most visible points surrounding the Everglades restoration initiative, is to what extent are the Everglades' impacts due to changes in hydroperiod versus changes in water quality. Although this discussion continues, the SFWMD has proceeded with efforts intended to begin improving tributary hydroperiod and water quality. One such undertaking is the Everglades Regulatory Program (Whalen, 1992).

The regulatory program is the cornerstone of the overall Everglades restoration initiative since it addresses issues at the source rather than downstream. The EAA program targets a 25 percent reduction in phosphorus leaving the EAA basin. This phosphorus reduction is to be achieved through the implementation and long-term maintenance of on-site "best management practices" (BMPs) by landowners.

PROGRAM DESCRIPTION

Overview

The largest tributary to the Everglades is the Everglades Agricultural Area or EAA (**Figure 1**). The EAA is 718,400 acres of highly productive agricultural land comprised of rich organic (muck) soils located between Lake Okeechobee to the north and the Everglades to the south. Draining the EAA began as a federal government project during the early 1900's in an effort to promote agricultural development and urban settlement of the sparsely populated south Florida peninsula. Today, 553,000 acres within the EAA are tributary to the northern Everglades (drainage from the remaining 165,400 acres discharges north into Lake Okeechobee). The EAA is comprised of approximately 505,000 acres of agricultural production: 82% sugar cane, 9% vegetables, 6% sod, 2% livestock, 1% rice and other crops. The remaining 48,000 acres are urban areas, roadways, canals and levees, and other land uses.

The central drainage system for this region consists of five major canals and seven large pump stations and water control structures operated by the SFWMD (**Figure 2**). Structures S-352, S-2, and S-3 discharge excess stormwater runoff from the EAA north to Lake Okeechobee while S-5A, S-6, S-7, and S-8 discharges are directed south into the Everglades. The collective capacity of these pump stations is over 13 trillion gallons per day or greater than 20,000 cubic feet per second. Farm-level water management is controlled by privately owned and operated pumps and water control structures which are authorized to connect to the SFWMD primary canals. The over 300 private water control structures range from culverts to 200,000 gallons per minute pump stations (**Figure 2**) These private structures are the primary water management mechanism (irrigation and drainage) for 218 separate hydraulic basins (**Figure 3**).

During 1991 and 1992 the SFWMD developed the EAA Regulatory Program as directed by the Everglades Protection Act. The regulatory program was developed through a series of public workshops and round-table discussions. The year-long effort resulted in Chapter 40E-63, Florida Administrative Code (F.A.C.) which describes the intent, requirements, and compliance of the EAA Regulatory Program (SFWMD, 1992b).

The 40E-63 BMP program is unique in that its goal is to achieve a 25 percent reduction in phosphorus for the entire EAA basin -- not for each individual farm. The SFWMD will determine if a 25 percent overall reduction has occurred by comparing phosphorus discharges for future 12-month periods with a base 10-year period of record from 1978 through 1988. The first annual compliance period was May 1, 1995 through April 30, 1996 (SFWMD 1992b).

Chapter 40E-63 required each permit application to contain (a) a BMP plan and (b) a water quality monitoring plan. The minimum requirements and review process for these plans are discussed below. On July 9, 1992, the SFWMD Governing Board approved the final Chapter 40E-63 permit application. These permits represent 100% of the EAA regulated area.

Best Management Practices

As part of each permit application, the landowner was required to submit a proposed plan of on-site BMPs -- operational programs or physical enhancements designed to reduce phosphorus leaving their property.

The SFWMD was faced with the tasks of (a) establishing a base level of BMPs for each farm basin and (b) ensuring consistency with BMP plans between different landowners. To accomplish both of these tasks a system of BMP "equivalents" was developed. The intent was to assign "points" to BMPs within three basic categories: fertilizer techniques, water management, and sediment control (**Table 1**). Some BMP research has been conducted within the EAA region (SFWMD 1991); however no specific phosphorus reduction levels have been quantified for individual BMPs. The BMP list and points assigned to each BMP were based upon best professional judgment of SFWMD staff and input and recommendations from the EAA farmers. Given that no absolute quantitative information on the effectiveness of individual specific BMP exists, the level of equivalent points assigned to an individual BMP are obviously debatable. However to date, no alternative has been proposed.

Twenty-five BMP "equivalents" or "points" was set as the minimum target BMP level. Utilizing the BMP "equivalents" approach allowed flexibility of each landowner to develop a BMP plan which was best suited for site specific geographic and crop conditions. **Table 2** presents a comparison of BMP "equivalent" plans for four actual farms. Although, each farm had different crops, soil depths, and drainage capacities, equal BMP plans were developed and accepted.

Water Quality Monitoring

The 40E-63 water quality monitoring is being conducted at two levels: (1) EAA basin-level by the SFWMD and (2) farm-level monitoring of private water control structures within the EAA conducted by the landowners.

The primary means to determine the BMP program success is through analysis of water quality monitoring conducted at the EAA basin-level by the SFWMD. Total phosphorus and flow measurements have been conducted at structures S-352, S-2, S-3, S-5A, S-6, S-7, and S-8

(Figure 2) for over 20 years. Primary compliance for all permits collectively is determined by the annual phosphorus levels measured at these pump stations.

The secondary method of compliance determination is through farm-level water quality monitoring. Permit applications were required to contain a water quality monitoring plan. The farm-level monitoring plans consist of daily flow measurements, collection and composite of farm discharge water samples (up to a maximum of 21 days) and analysis for total phosphorus. Water quality samples are required to be collected by automatic samplers.

FARM-LEVEL BMP PROGRAM IMPLEMENTATION

Farm-level compliance is a secondary level of the overall regulatory program focus. Farm-level compliance is conducted by inspections and submittals for BMPs and water quality monitoring.

BMP implementation is monitored by two methods: (a) BMP annual reports and (b) BMP field inspections.

BMP Annual Reports

The annual reports are submitted by the grower. Prior to the report submittal, the SFWMD provides a simple checklist outlining the BMP plan developed for each individual farm basin. The SFWMD stresses to the growers that these "reports" should contain straight forward BMP implementation descriptions. The reports are not intended to be voluminous with copies of fertilizer receipts, work orders, pump logs, but rather a summary of all BMP installation and operation activities.

BMP Field Verification

BMP field inspections are conducted on approximately an eighteen month basis. The eighteen month rotation allows BMP observations to be rotated between South Florida's wet (May -October) and dry seasons (November - April).

The BMP field inspection verifies the BMP implementation information submitted as part of the permit application and BMP annual reports. The verifications involve a combination of visual field observations, a review of office records, and examination of submitted hydrologic data. During the office review the inspector focuses on records that document soil test results, fertilizer recommendations and applications, BMP training of farm personnel, pump logs and any other material that supports BMP implementation and on-going maintenance. While in the field, inspectors note any visual observations that the selected BMPs have been implemented. Observations may include spoil on canal banks indicating canal cleaning was performed, fertilizer banding or land leveling equipment operating, maintenance of vegetation on ditch banks to reduce sedimentation, and any other observable evidence that supports BMP implementation.

A review of farm basin hydrologic data is conducted to provide feedback to the grower on their detention BMP. During the BMP development, each grower selected a level of on-farm detention that they believed could be met on an overall annual basis. The intent of this BMP is to decrease the off-site discharges (thus decreasing phosphorus loads). On-farm detention has been achieved by various and sometimes quite different methods from one farm to another. Some farm managers identified specific water table control elevations to provide guides as to when to initiate pumping and when to stop pumping to prevent over drainage. Other growers concentrated on internal farm hydraulic management through coordinated cropping practices and internal water routing by portable pumps and increased infrastructures such as culverts with risers. Still other growers are implementing a combination of these efforts. Regardless of the approach, the effectiveness of this BMP is monitored by examination of the daily rainfall and discharge flow data submitted for each farm basin. Examples of these evaluations are presented in **Figures 4 and 5. Figure 4** shows a farm which had selected 1½ inches of on-farm rainfall detention as its goal. However, the majority of time, it appears that pumping was initiated prior to the target 1½ inches of rainfall. In contrast, **Figure 5** shows that on an overall basis, off-site pumping was typically not initiated before the cumulative 1½ inches rainfall target was met.

Site verifications allow SFWMD staff to work with the permittees by discussing BMP strategies and communicating areas of concern. The BMP verifications conducted thus far indicate that the growers have implemented their respective BMP plans and are taking a proactive approach to reviewing and improving their plans where possible.

Water Quality Field Audits

Rule 40E-63 requires each permittee to conduct total phosphorus field sampling under an approved Comprehensive Quality Assurance (QA) Plan. QA Plans are subject to approval by the Florida Department of Environmental Protection and are to insure that correct and consistent laboratory and field sampling procedures are followed. The SFWMD conducts field sampling QA audits as a check of adherence to the approved QA sampling methodology and to ensure consistency between different water quality monitored sites. The field sampling QA audits are based on a standardized audit checklist developed through a review of the various QA plans in use under this program. The checklist was developed specifically for conducting QA field audits and considers that total phosphorus is the only parameter being sampled. The audits review water quality sample collection methods, record keeping and sample quality control procedures.

The checklist for each audit conducted summarizes the audit and indicates the audit result as "pass" or will specifies areas needing improvement. If areas needing improvement are identified, the following procedures occur:

1) Notify the sampler and permittee of the areas.
2) Reschedule a follow-up audit.
3) If the follow-up audit still indicates areas needing improvement, then the sampler is disallowed from further participation in the 40E-63 BMP program until the areas needing improvement are resolved.

As part of the field QA audit, a split sample is collected to test for differences in reported concentration values analyzed by different laboratories and to assure accurate total phosphorus analysis.

A non-parametric statistical analysis is conducted on all split samples. **Figure 6** presents the results of comparing the Percent Relative Difference (PRD) between the landowner analyzed total phosphorus concentration with the SFWMD laboratory value. The PRD is plotted against the permittee reported phosphorus concentration value. The mean, ± 1, ± 2, and ± 3 standard deviations are overlain on the entire population. Any split sample with a calculated PRD greater than ± 3 standard deviations is scheduled for a follow-up spilt sample for verification. If the follow-up PRD is still greater than ± 3 standard deviations, then the following procedures occur:

1) Examine field sampling technique with QA Audit(s),

2) Discuss differences with the lab(s),

3) Examine data pattern for lab(s) for all permitted sites,

4) Invoke second follow-up splits. and

5) If still rejected, disallow lab use for permit program until laboratory satisfies the SFWMD of resolution of differences.

As identified on **Figure 6** by (◆) only three split samples out of 175 have resulted in a PRD of ±3 standard deviations

BMP PROGRAM DATA EVALUATION

Basin-Level

As stated earlier, the 40E-63 BMP program goal is the 25 percent reduction of total phosphorus discharged from the EAA. Since the 25 percent reduction goal is for the EAA basin as a whole, an across-the-board 25 percent reduction for each individual farm basin is not a primary concern. The 25 percent annual phosphorus load reduction determination is made by comparing current 12-month EAA phosphorus discharges at S-352, S-2, S-3, S-5A, S-6, S-7, and S-8 (**Figure 2**) with a 10-year base data period (October 1, 1978 to September 30, 1988). The average annual total phosphorus load from the 10 year base period is approximately 205 metric tons.

However, before this comparison can be made, the average annual target phosphorus load must be adjusted for hydrologic variations of the current year. Because rainfall and stream flow are subject to large temporal and spatial variation in south Florida, the compliance evaluation adjusts EAA basin TP load for hydrologic variability. Otherwise, the hydrologic variability could be large enough to obscure the effectiveness of BMPs to reduce phosphorus loadings.

The adjustment for hydrologic variability includes two components.

(1) A model to estimate future phosphorus loads. The model estimates a future phosphorus load of the EAA basin by substituting future hydrologic conditions for the conditions that occurred during a base-period (water years 1978-1988). The estimation is based on hydrologic data collected from any future time period of May 1-April 30. The estimation incorporates a calculation for the required 25% phosphorus load reduction. May 1 - April 30 corresponds generally with the change from dry to wet rainfall periods.

(2) Accommodation for possible statistical error in the model by specifying a required level of statistical confidence in the prediction of the long-term average phosphorus load. The 90th percentile confidence level was selected as reasonable.

The models used to adjust for hydrologic variability and determine 25 percent phosphorus reduction are presented in **Figure 7**.

The first year of compliance determination was May 1, 1995 through April 30, 1996. However, Rule 40E-63 required the phased implementation of BMPs between January 1, 1994 and January 1, 1995. The EAA basin has shown a total phosphorus load reduction over the past three years ranging from 17 to 68 percent with a three year flow-weighted average of 47 percent (**Figure 8**). Flow monitoring conducted at the SFWMD discharge structures indicate that annual flows from the EAA basin have decreased by approximately 10 percent relative to the base period (1979 to 1988). This evaluation, in conjunction with the EAA Basin measured phosphorus trend as presented in **Figure 9**, would indicate that the 47 percent basin reduction is due in large part to BMPs which are reducing phosphorus concentrations.

The EAA growers (collectively) are considered to be "in compliance" if the 25 percent level is met a minimum of one in every three years. If the EAA basin meets the 25 percent reduction, regardless of the individual farm's performance, no additional on-farm BMPs will be required. However, if the 25 percent phosphorus reduction is not met, the unit area discharge loading (pounds per acre) measured from each hydrologic farm basin (**Figure 3**) will be ranked. The basins which produce the highest unit area phosphorus loads may be reassessed for implementation of additional BMPs and a maximum phosphorus level will be set for discharge. However, since the EAA Basin has not been exceeded, the 25 percent reduction target, there are no additional farm-level BMP requirements at this time.

<u>Farm-Level</u>

In an attempt to provide feedback to the growers, annual fow-weighted total phosphorus concentration and load measurements are calculated from the submitted water quality monitoring data and are reported for each farm basin. Please note that the 40E-63 requirements of on-farm water quality monitoring were phased-in depending on permit application submission and issuance. As such the farm-level phosphorus data available at this time represents approximately 45 percent of the acreage within the 40E-63 farm basin boundaries.

Annual average flow-weighted total phosphorus concentrations (parts per billion, ppb) have been calculated from the data reported during Water Year 1995 (WY95) [May 1, 1994 - April 30, 1995]. The annual flow-weighted concentrations, calculated for each hydrologic farm basin, covered a range from 38 parts per billion (ppb) to 942 ppb, with a median value of 152 ppb. **Figure 10** presents a frequency distribution of WY95 concentrations.

Annual average flow-weighted total phosphorus load discharges (pounds per acre, lbs/ac) calculated from the data reported during WY95 covered a range from 0.13 lbs/ac to 13 lbs/ac with a median value of 1.04 lbs/ac. **Figure 11** presents a frequency distribution of WY95 loadings.

Figures 12 and **13** graphically present the spatial distribution of WY95 phosphorus concentrations and phosphorus load discharges by farm basin. Examination of **Figures 12** and **13** do not provide any apparent spatial distribution patterns for the phosphorus concentration and load levels reported. In addition, there does not appear to be any consistent pattern of land use and reported phosphorus levels. However, as future water years are examined, patterns and relationships may become discernible.

FUTURE CHALLENGES

The farm-level data being collected as part of the 40E-63 BMP program may provide valuable insight to determine if relationships exist between total phosphorus concentrations and loads being measured from the 200+ farms/drainage basins within the EAA. In addition to the tabular phosphorus data, spatial information such as soils, land use, BMP groups, rainfall patterns and other applicable variables are stored on GIS coverages. Currently under way is an attempt to determine if any relationships are evident between:

Dependent Variables

- Farm Basin Total Phosphorus Concentration
- Farm Basin Total Phosphorus Loads

Independent Variables

- Land Use
  - Predominately Sugarcane
  - Sugarcane / Vegetable Mix
  - Predominately Vegetable
  - Predominately Sod
  - Predominately Pasture
  - Predominately Urban
  - Predominately Industrial
  - Other applicable combinations
- BMPs
  - Basic Fertilizer
  - Advanced Fertilizer
  - Detention
  - Sediment Control
  - Pasture Management
  - Urban BMPs
- General Soil Types (muck types and sand)
- Rainfall
- Rainfall/Runoff Ratios
- Spatial Location of Permit Areas
- Other applicable variables

Relationships between total phosphorus concentrations & loads and the other variables listed above will be explored by utilizing standard multivariate statistical analysis techniques as well as GIS-based spatial examinations.

CONCLUSIONS

The 40E-63 BMP program is the first of its kind in Florida: nonpoint source regulation for an agricultural area. Achievement of the program's objectives has been an overwhelming success is due to the proactive participation of the EAA landowners. One hundred percent of the area within the regulated boundaries is currently under permit.

BMPs implemented to date have resulted in an annual average 47 percent reduction in total phosphorus discharged from the EAA basin. This accomplishment by the landowners is particularly noteworthy since the 25 percent total phosphorus reduction has been surpassed.

REFERENCES

Florida. 1987. Surface Water Improvement and Management Act. Chapter 373.451 - 373.4596, Florida Statutes.

Florida. 1991. Everglades Protection Act. Chapter 373.4592, Florida Statutes.

Florida. 1994. Everglades Forever Act. Chapter 373.4592, Florida Statutes.

SFWMD. 1991. The Effects of On-Farm Agricultural Practices in the Organic Soils of the EAA on Nitrogen and Phosphorus Transport. University of Florida, Institute of Food and Agricultural Sciences. Final project deliverable submitted to South Florida Water Management District, West Palm Beach, Florida. August 30, 1991. Contract No. 340-M86-0319-A1 through A8.

SFWMD. 1992a. Surface Water Improvement and Management Plan for the Everglades. South Florida Water Management District. West Palm Beach, Florida. March 13, 1992.

SFWMD. 1992b. Rules of the South Florida Water Management District -- Everglades Regulatory Program. Chapter 40E-63, Florida Annotated Code. South Florida Water Management District, West Palm Beach, Florida. New - Jan. 22, 1992; Amended - July 7, 1992.

Whalen, P.J. 1992. The Everglades SWIM Plan. Journal of Soil and Water Conservation 47(3):210-211

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LIST OF FIGURES

LIST OF TABLES

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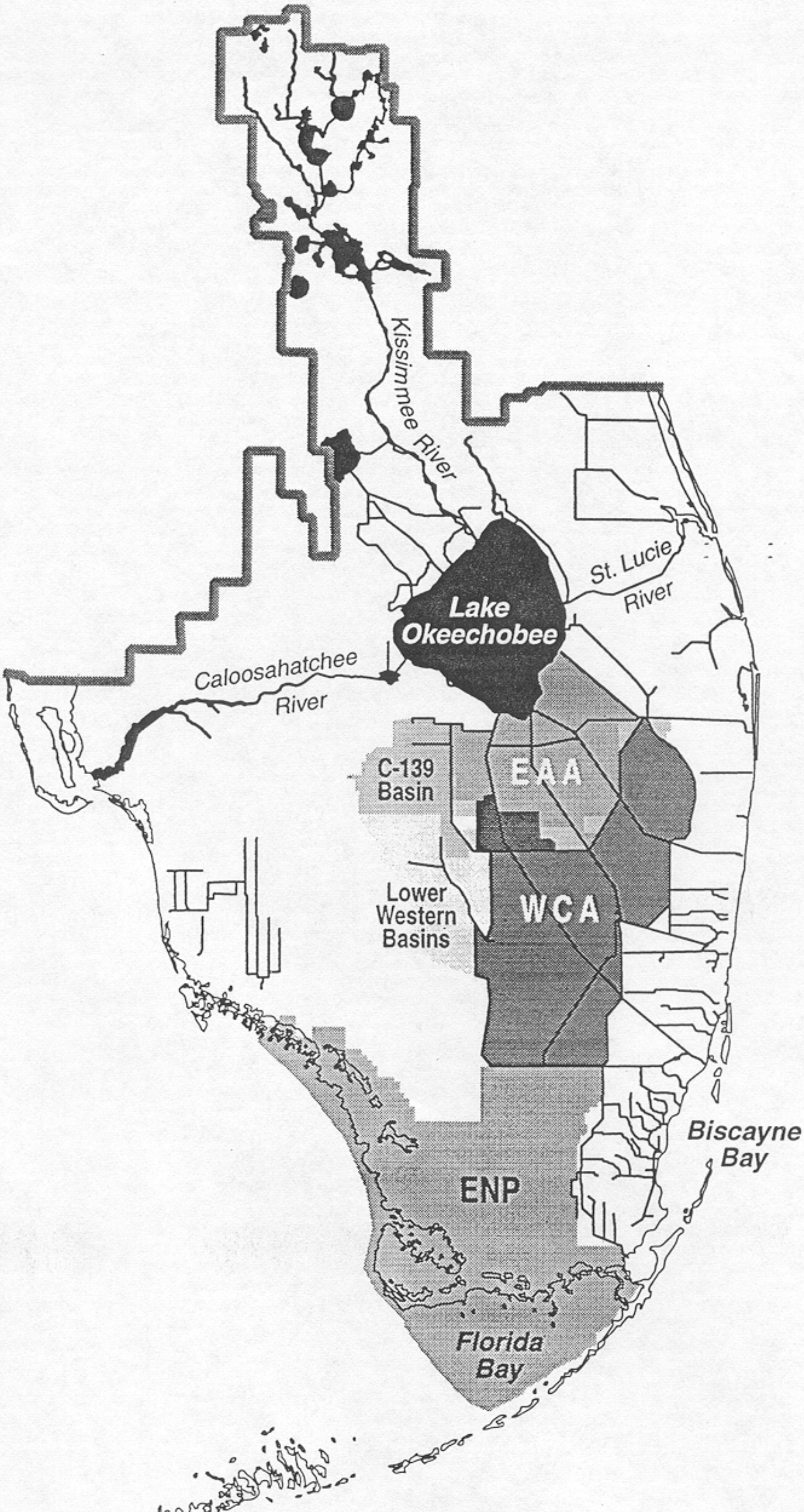

Figure 1. South Florida Water Management District (SFWMD) boundaries and tributary basins to the Everglades.

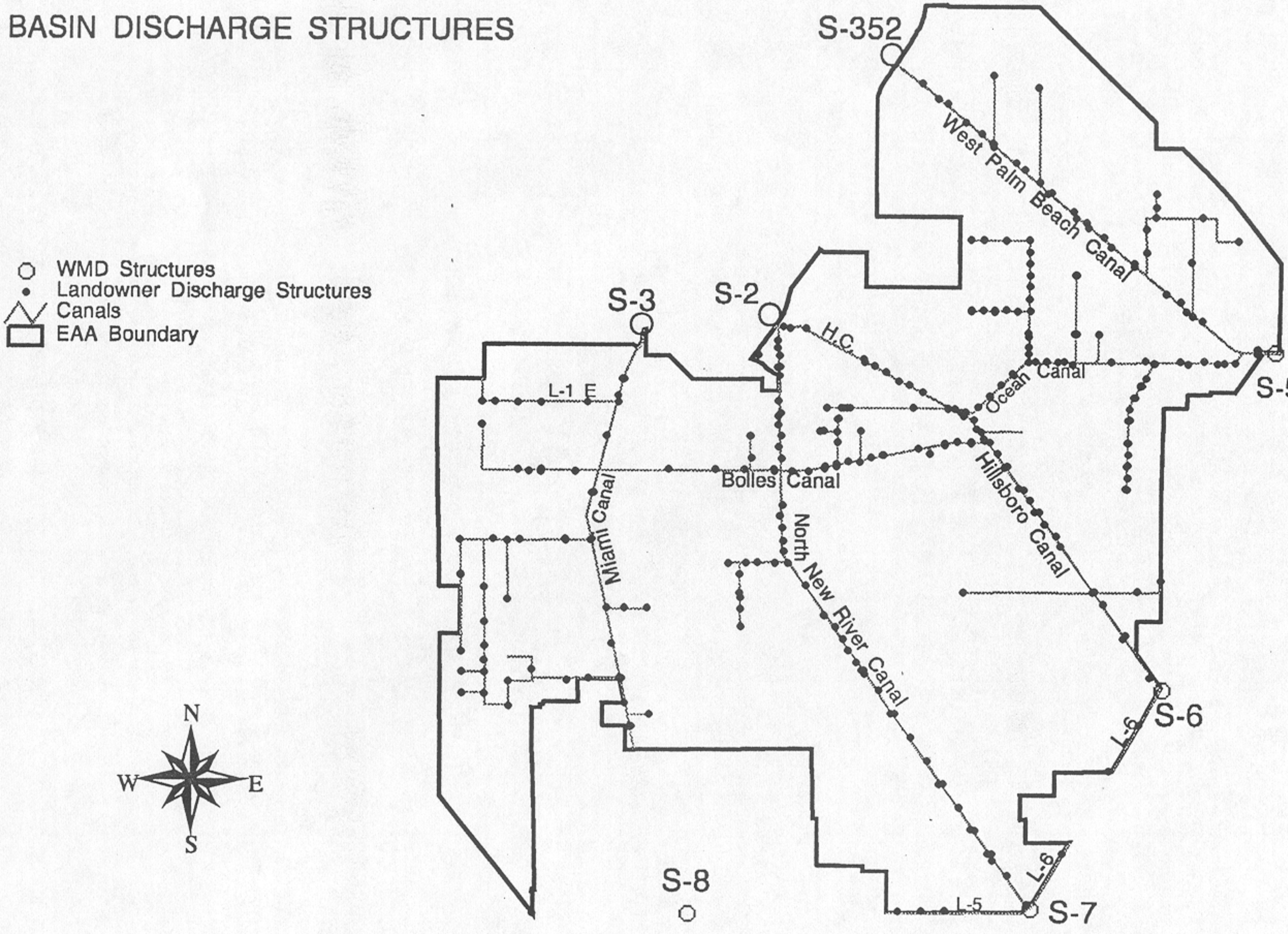

Figure 2. SFWMD pump stations / water control structures and EAA farm water control structures.

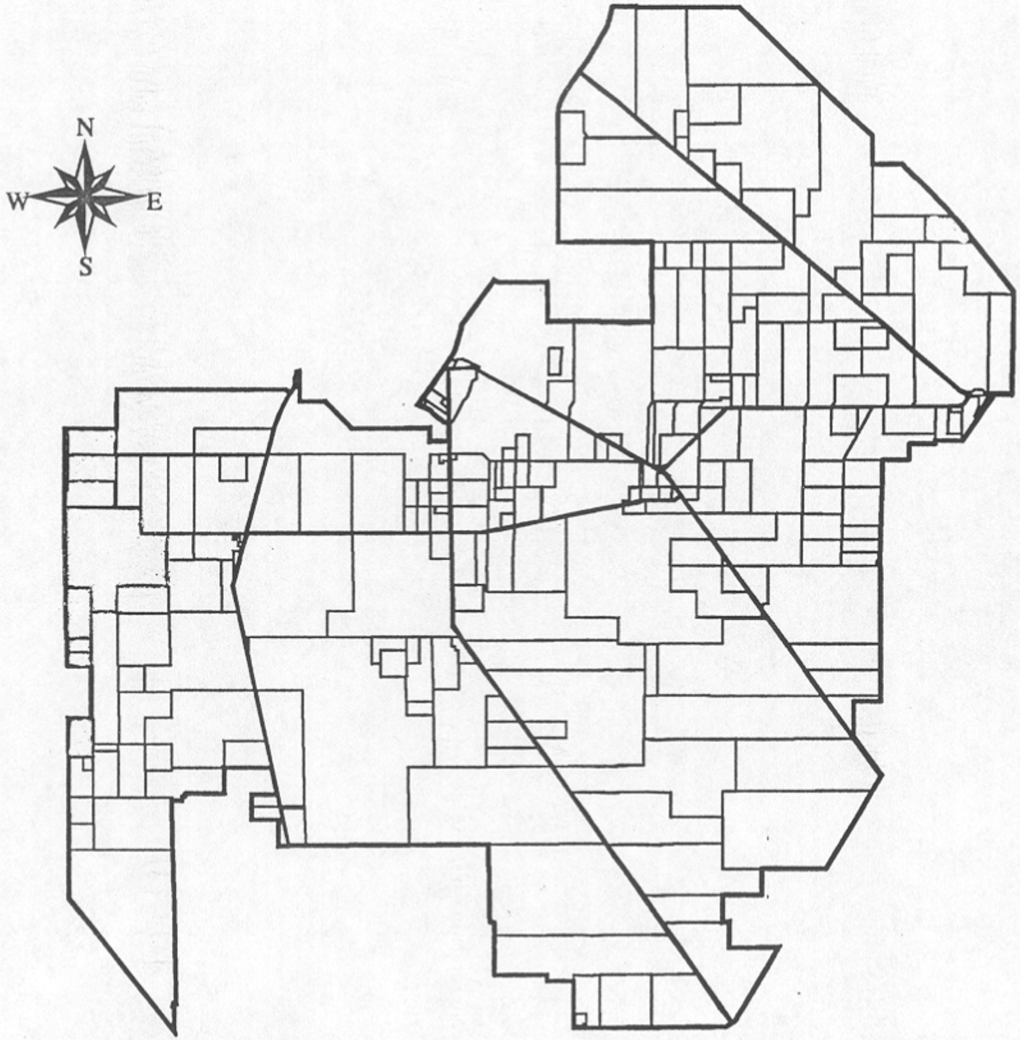

Figure 3. EAA farm hydraulic basins.

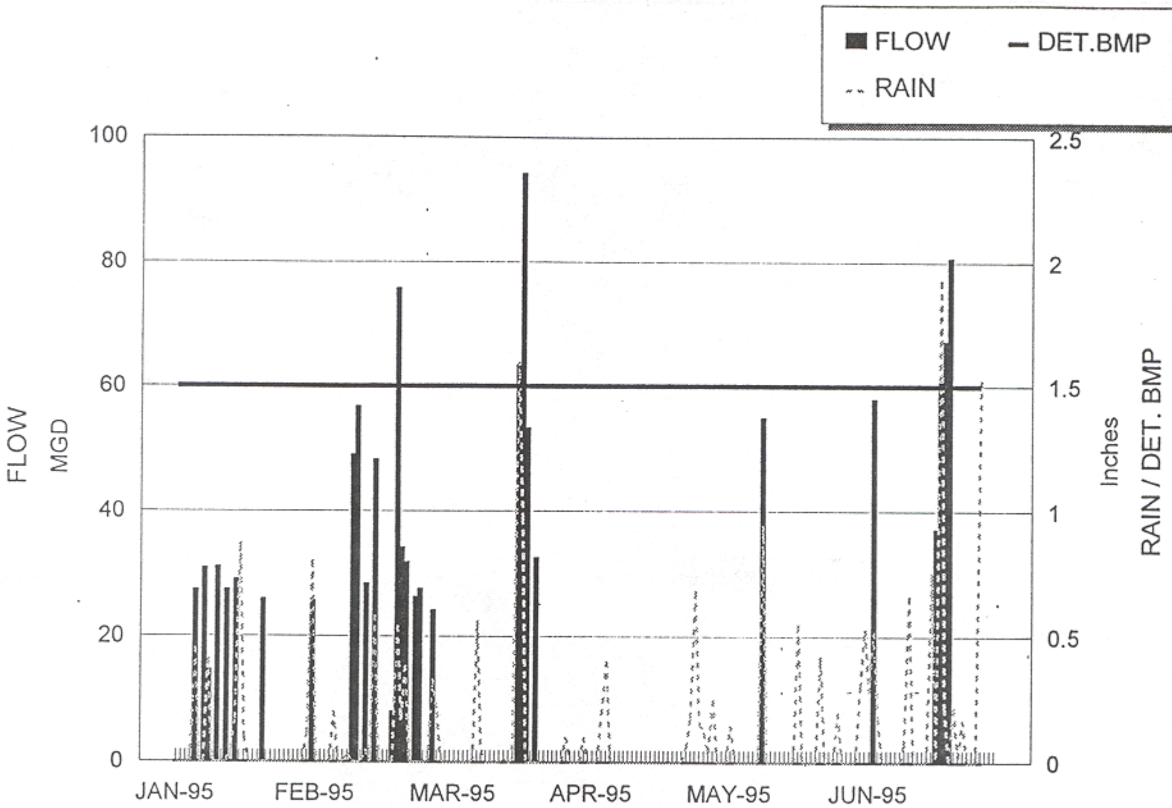

Figure 4. Detention BMP that <u>did not</u> achieve 1½ inch rainfall detention target.

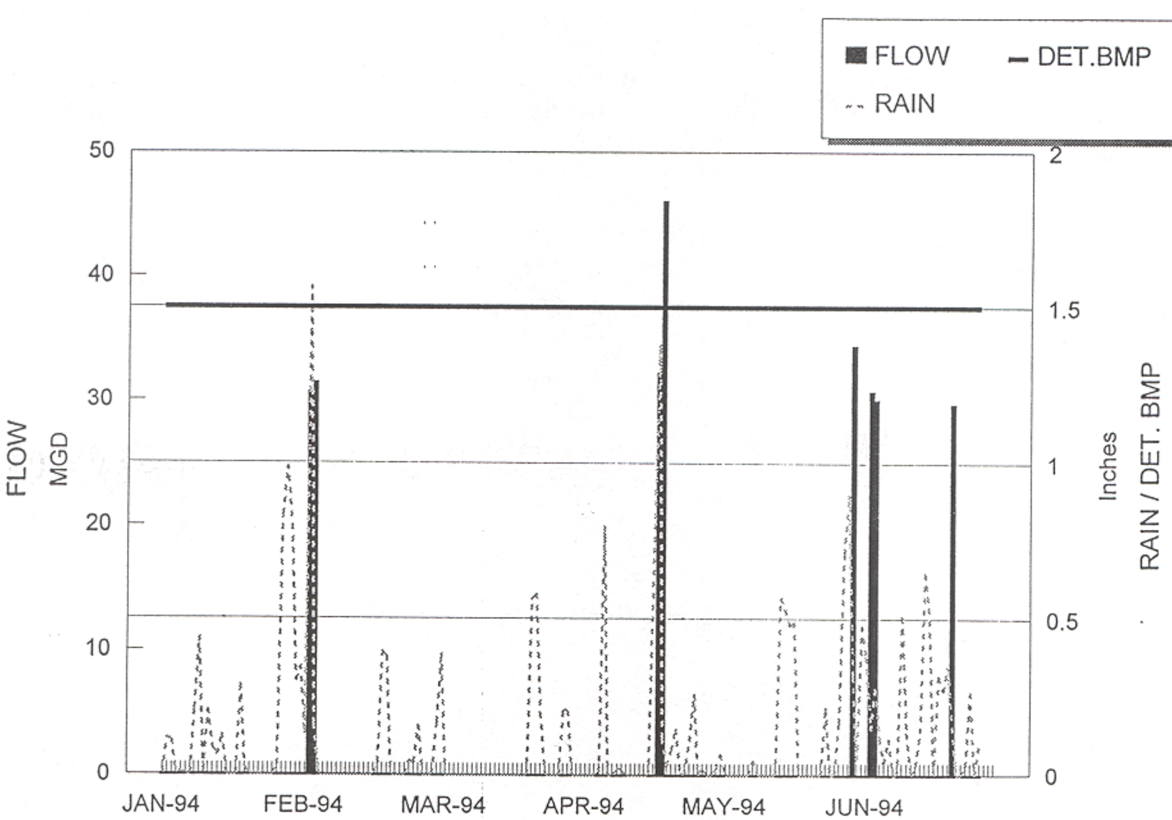

Figure 5. Detention BMP that <u>did</u> achieve 1½ inch rainfall detention target.

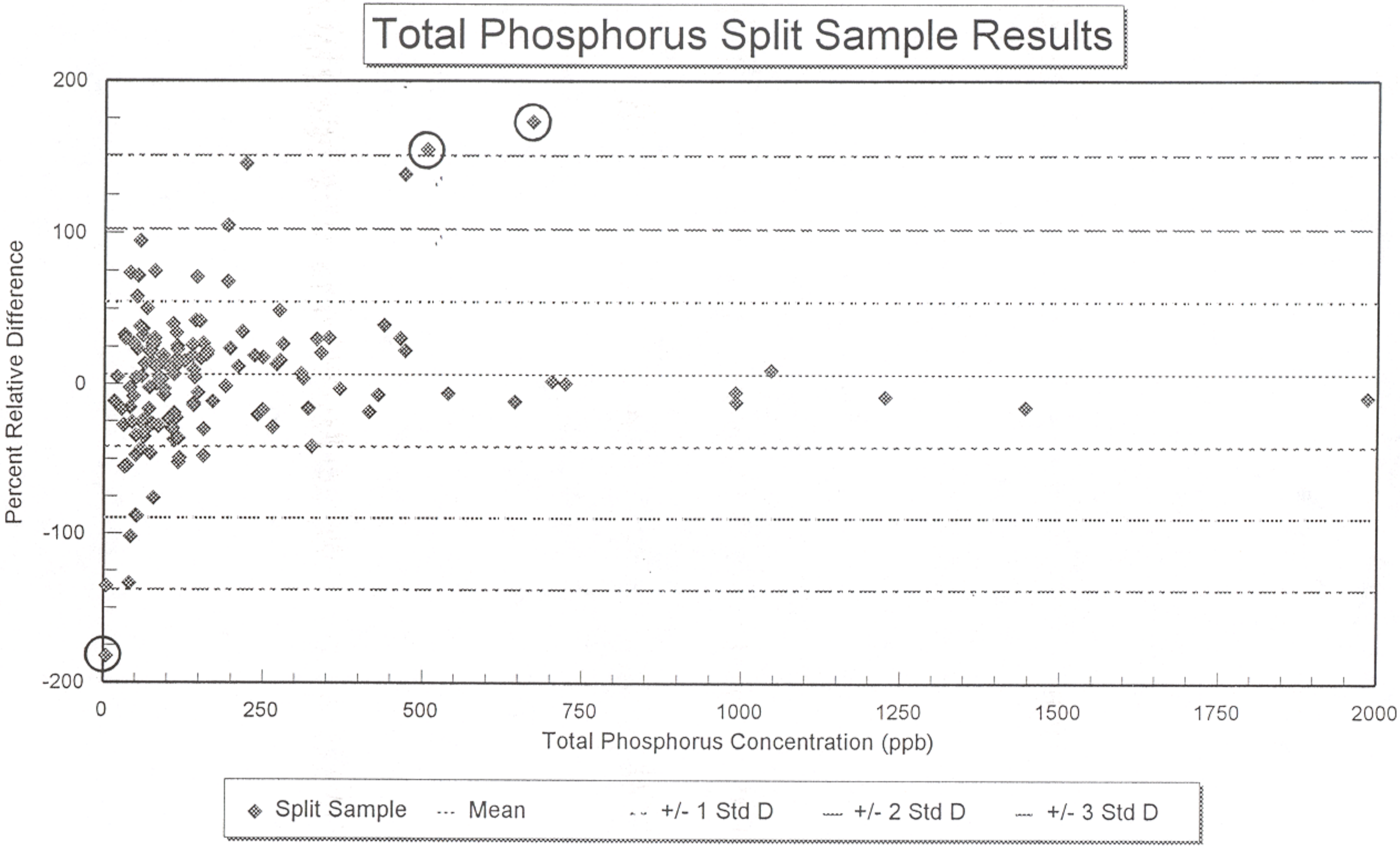

Figure 6. Split Sampling Results of Water Quality Monitoring Field Audit.

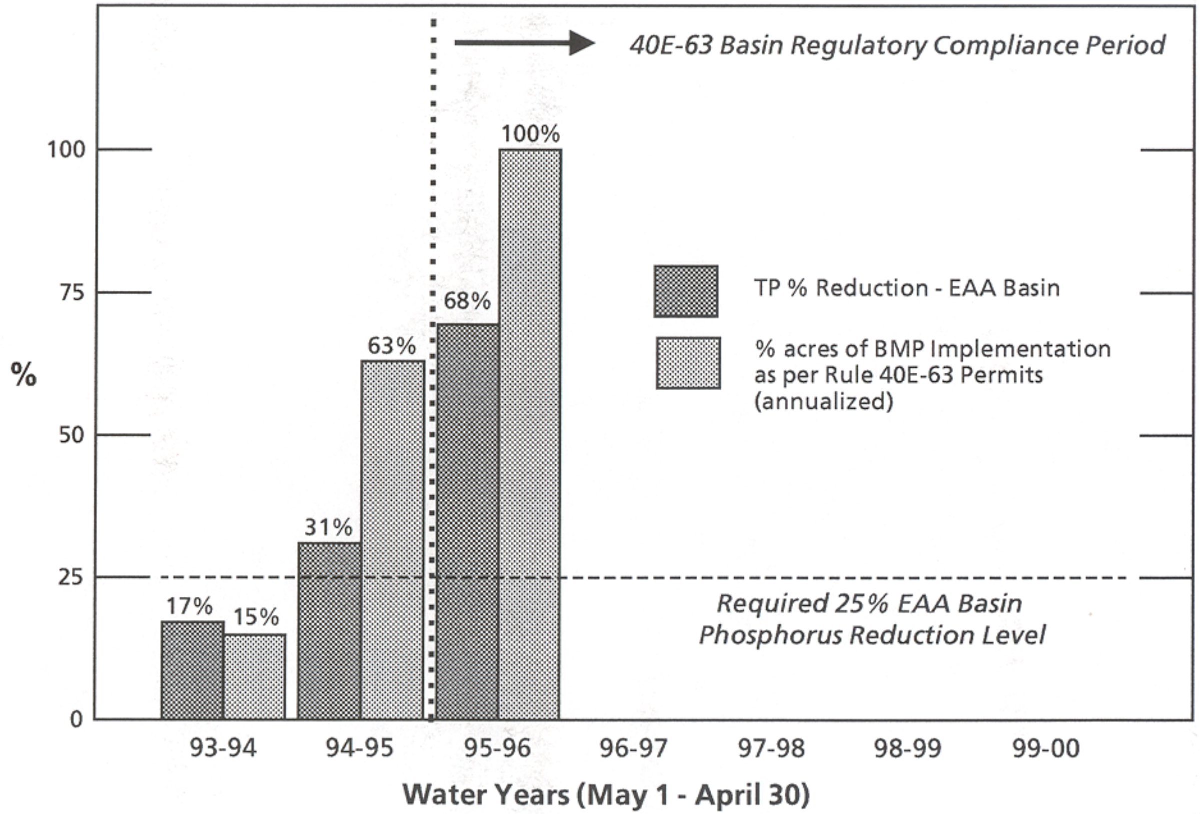

Figure 8. 40E-63 EAA Basin annual total phosphorus % reduction.

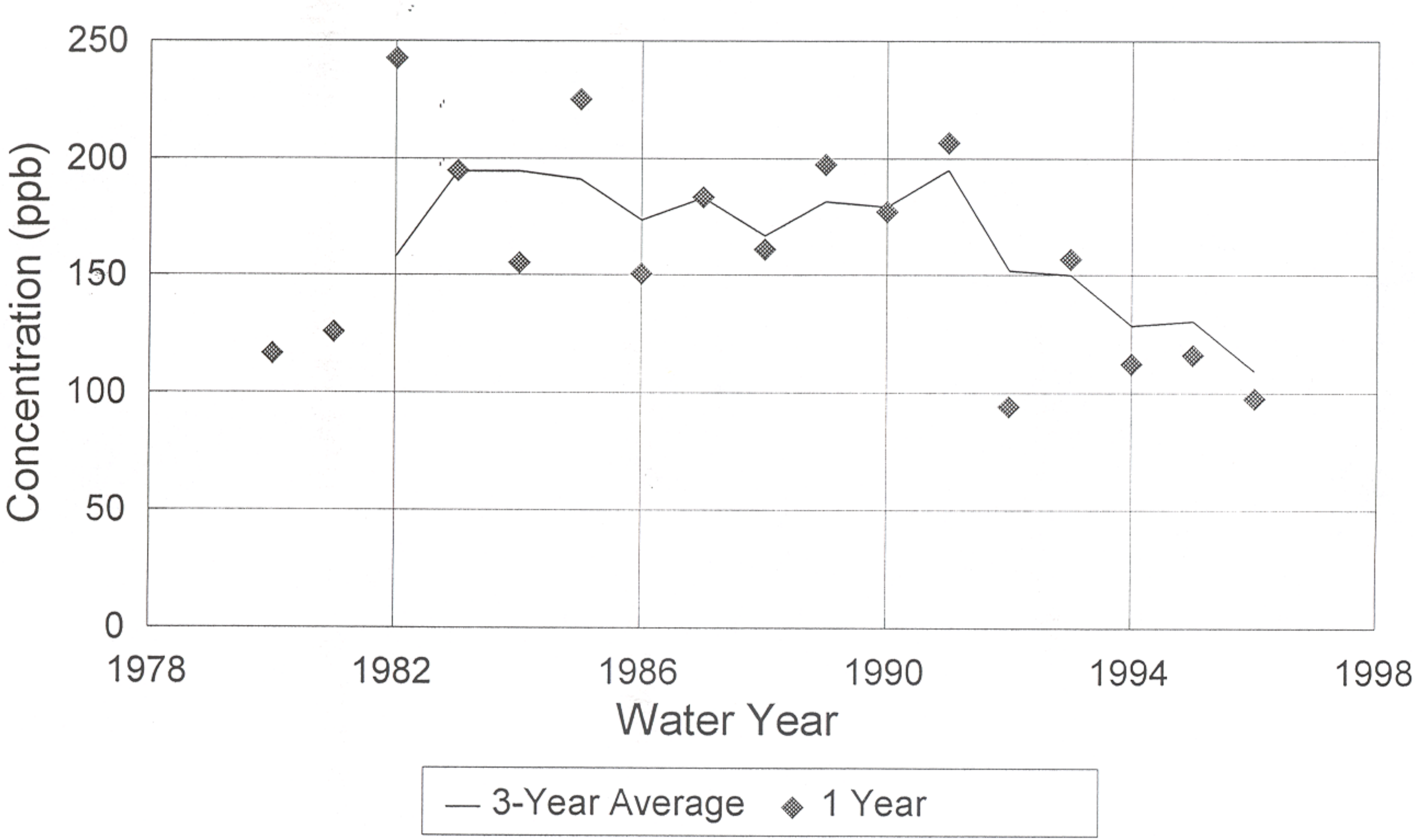

Figure 9. 40E-63 EAA basin total phosphorus concentration trend.

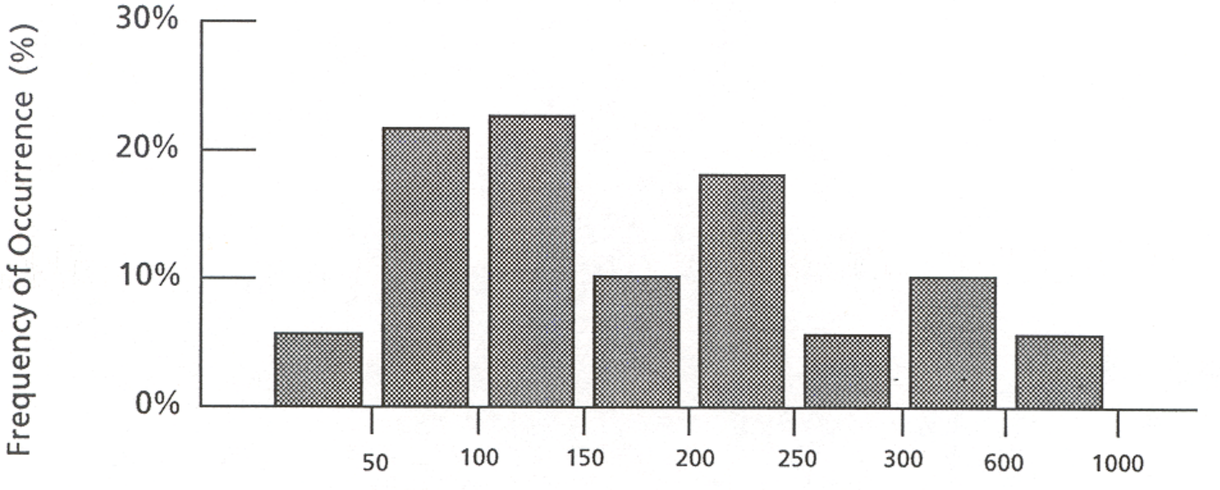

Figure 10. WY95 farm total phosphorus concentration discharges (ppb).

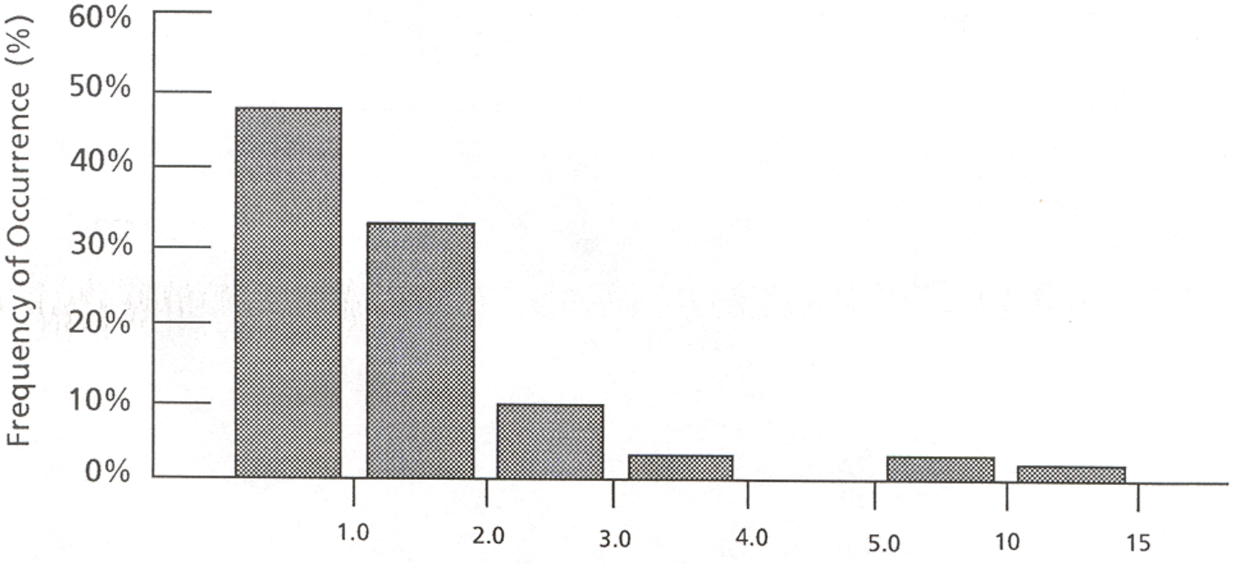

Figure 11. WY95 farm total phosphorus load discharges (lbs / acre).

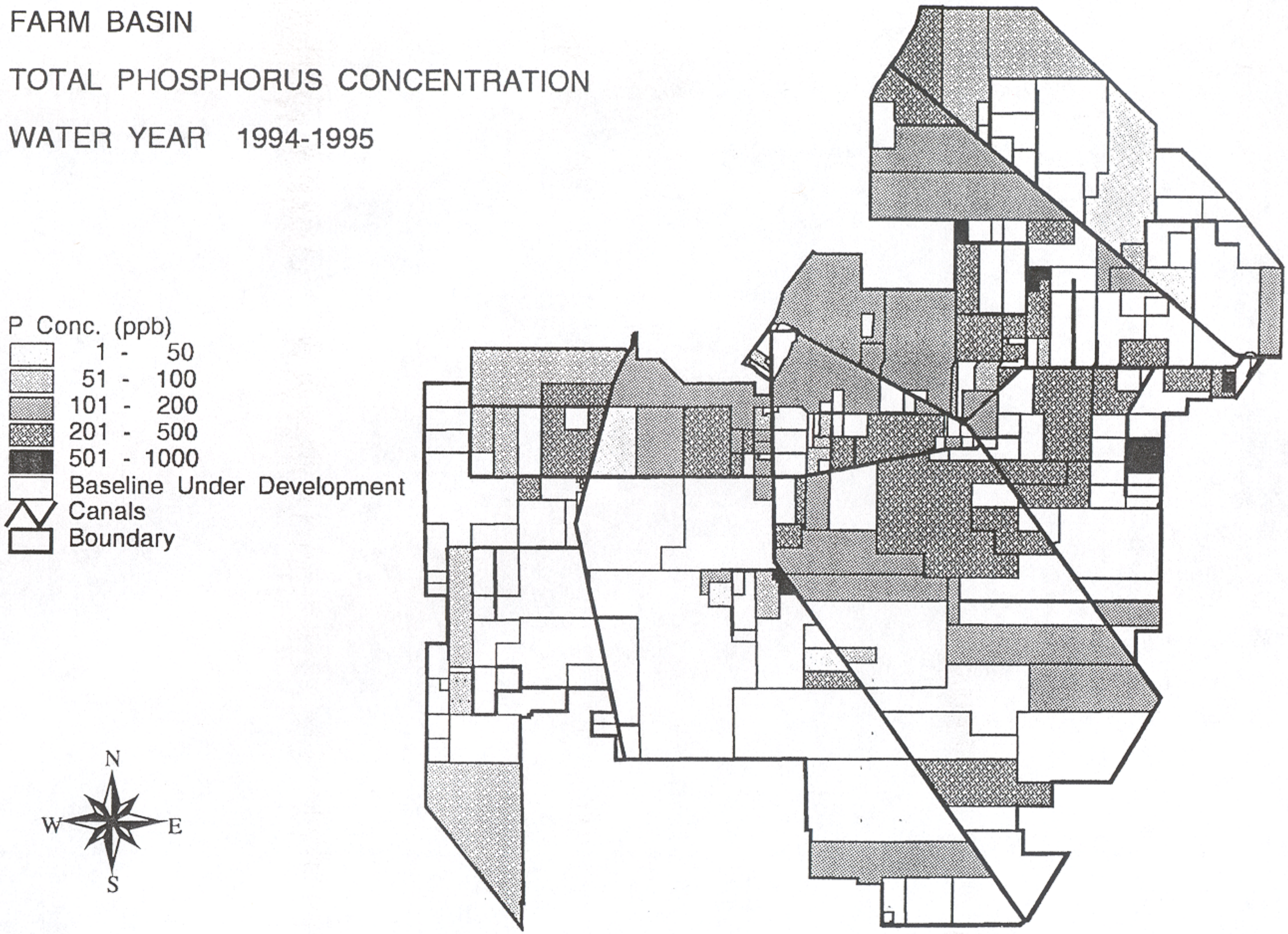

Figure 12. WY95 spatial distribution of farm basin total phosphorus concentrations.

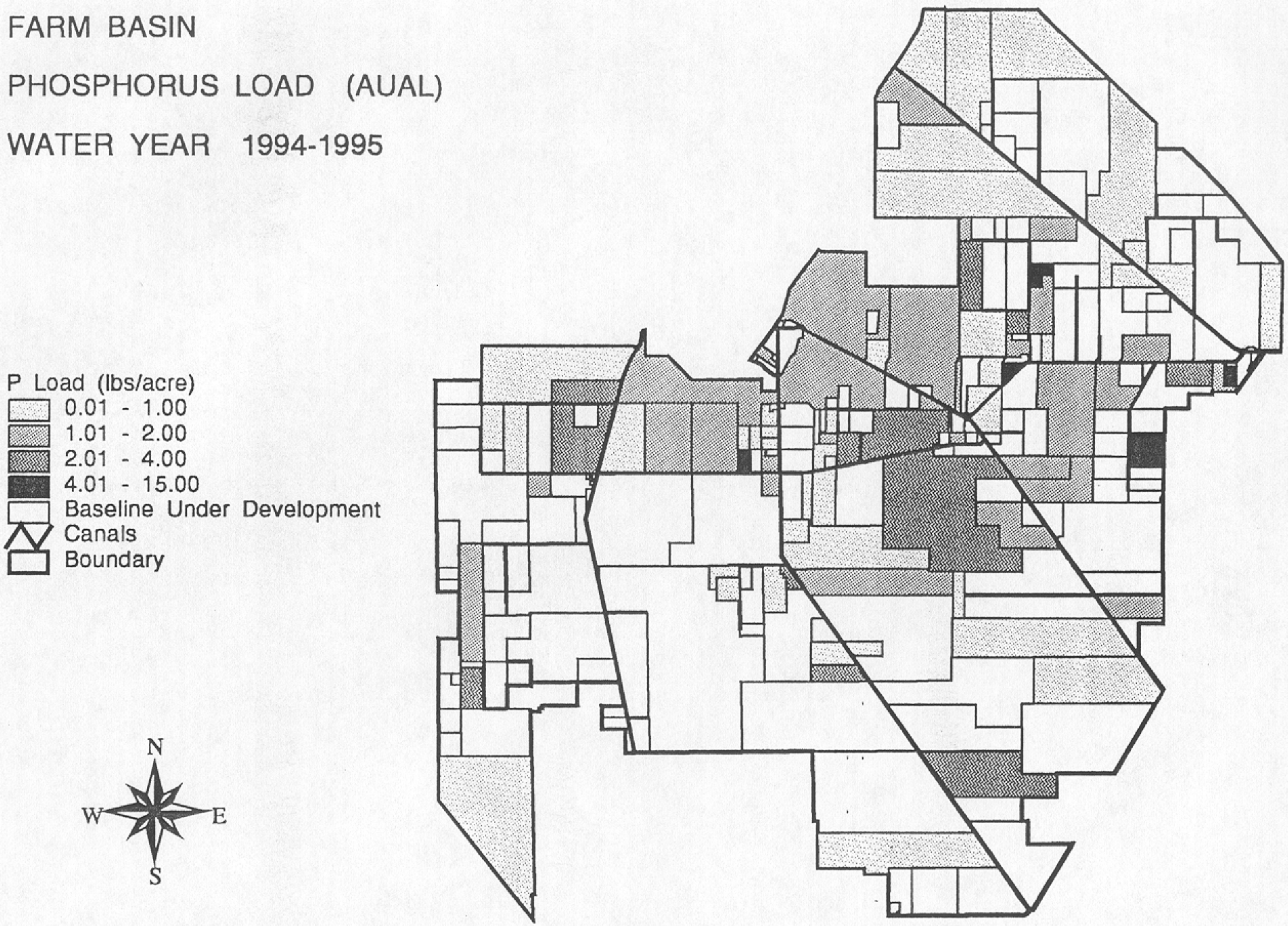

Figure 13. WY95 spatial distribution of farm basin total phosphorus unit area loads.

Table 1. Best Management Practices (BMPs) equivalent points.

BMP	PTS	DESCRIPTION
WATER DETENTION $^1/_2$ Inch Detained 1 Inch Detained	 5 10	- increased detention in canals, field ditches, soil profile, fallow fields, aquatic cover crop fields, prolonged crop flooding; - measured on an annual average basis - rainfall vs. runoff
FERTILIZER APPLICATION CONTROL	$2^1/_2$	- uniform and controlled boundary fertilizer application (e.g. direct application to plant roots by banding or side-dressing; pneumatic controlled-edge application such as AIRMAX)
FERTILIZER CONTENT CONTROLS		ANY COMBINATION
Fertilizer Spill Prevention	$2^1/_2$	- formal spill prevention protocols (handling and transfer) - side-throw broadcast spreading near ditch banks
Soil Testing	5	- avoid excess application by determining P levels needed
Plant Tissue Analysis	$2^1/_2$	- avoid excess application by determining P levels needed
Very Low P Application Rate	5	- apply fertilizer with reduced P content (must be able to thoroughly document historical practices)
Split P Application	5	- apply small P portions at various times during the growing season vs entire application at beginning to prevent excess P from washing into canals (rarely used on cane in EAA)
Slow Release P Fertilizer	5	- avoid flushing excess P from soil by using specially treated fertilizer which breaks down slowly thus releasing P to the plant over time (rarely used in EAA)
SEDIMENT CONTROLS		EACH SEDIMENT CONTROL MUST BE CONSISTENTLY IMPLEMENTED OVER THE ENTIRE ACREAGE
Any 2 Any 4 Any 6	$2^1/_2$ 5 10	- leveling fields - cover crops - veg. on ditch banks - ditch bank berm - raised culvert bottoms - drainage sump in field ditches - slow field ditch drainage near pumps - sediment trap in canal - strong canal cleaning program - sump upstream of drainage pump intake - other proposed by permittee
OTHER Pasture Management	 5	- reduce cattle waste nutrients in surface water runoff by "hot spot" fencing, provide watering holes, low cattle density, provide shade, pasture rotation, feed & supplement rotation, etc.
Improved Infrastructure	5	- uniform drainage by increased on-farm control structures
Urban Xeriscape	5	- lower runoff & P by using plants that require less of each
Det. Pond Littoral Zone	5	- vegetative filtering area for property stormwater runoff
Other BMP Proposed	TBD	- proposed by permittee and accepted by SFWMD

revised 04/10/96

Table 2. Example of BMP Equivalent plans for four different farms.

FARM 'A' *(Sugar Cane, deep soils)*	
BMP	***Points***
WATER DETENTION	
1 ½ Inch Detained	15
FERTILIZER	
Soil Testing	5
Fertilizer Spill Prevention	2½
Application Boundary Control (Banding)	2½
TOTAL	25

FARM 'B' *(Sugar Cane & Vegetables, medium soils)*	
BMP	***Points***
WATER DETENTION	
1 Inch Detained	10
BASE FERTILIZER	
Soil Testing	5
Fertilizer Maintenance	2½
Application Boundary Control (Pneumatic Spreader)	2½
SEDIMENT CONTROL	
Any 4 BMPs	5
TOTAL	25

FARM 'C' *(Sod, medium soils)*	
BMP	***Points***
WATER DETENTION	
1 Inch Detained	10
BASE FERTILIZER	
Soil Testing	2½
Fertilizer Maintenance	2½
SEDIMENT CONTROL	
Any 6 BMPs	10
TOTAL	25

FARM 'D' *(Citrus, shallow soils)*	
BMP	***Points***
WATER DETENTION	
½ InchDetained	5
BASE FERTILIZER	
Soil Testing	2½
Fertilizer Maintenance	2½
SEDIMENT CONTROL	
Any 4 BMPs	5
OTHER	
Infrastructure Improvements	5
Low volume drip irrigation	5
TOTAL	25