Rules of the South Florida Water Management District

EVERGLADES PROGRAM
Chapter 40E-63, F.A.C.

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BMP Training September 26, 2013

Everglades Research and Education Center

UF UNIVERSITY of FLORIDA

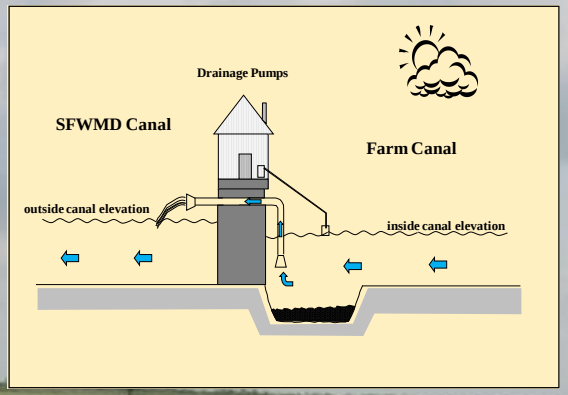
Outline

- The Everglades Agricultural Area (EAA)
- Why was the BMP program created?
- What is the BMP program?
- What are the BMPs?
- What are the requirements of the BMP program?
- How is the EAA annual P load calculated?
- How has the BMP program performed?
- BMP program incentives
- Promising new research

Everglades Agriculture Area

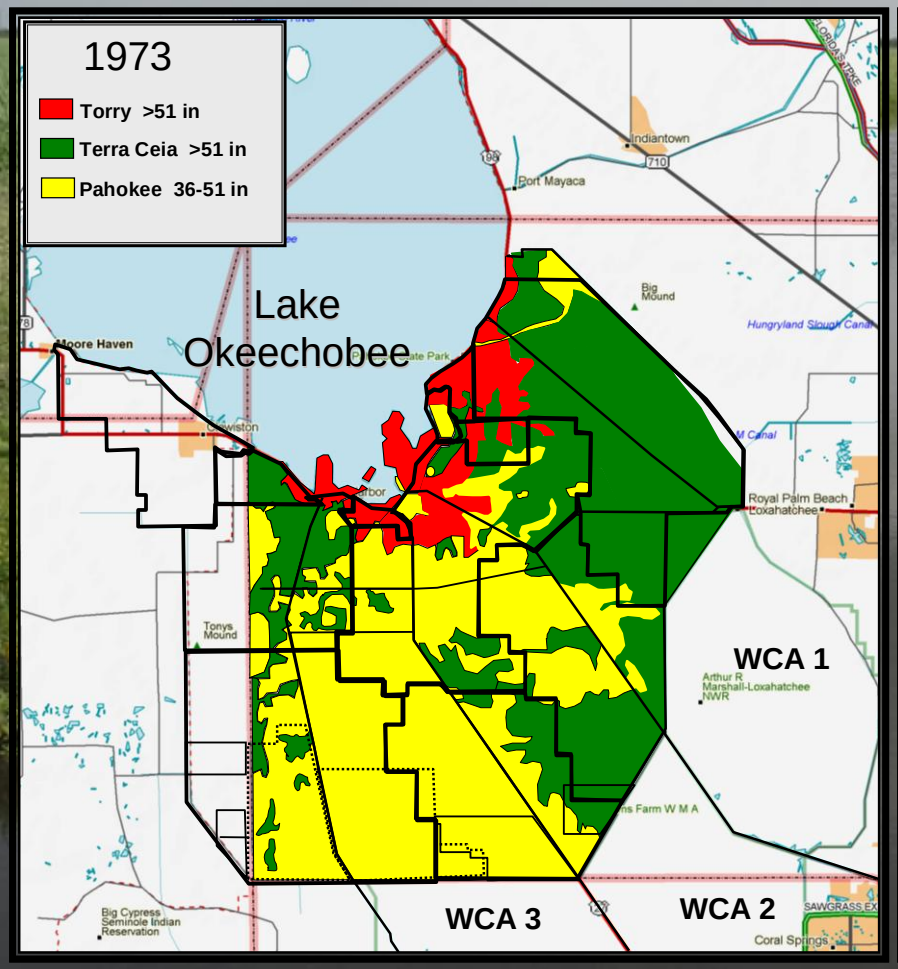
- The EAA is a highly productive agricultural area comprised of muck/peat soils. This area has 430,000 acres of sugarcane harvested annually and about 70,000 acres of sod, rice and vegetables. The EAA is considered one of Florida's most important agricultural regions.
- The major sources of water for the EAA are rainfall and Lake Okeechobee.
- The area is drained and irrigated by a canal network and a system of structures and pumps. Canals and flooded fields serve as habitat for wading birds and various biota, including endangered species.

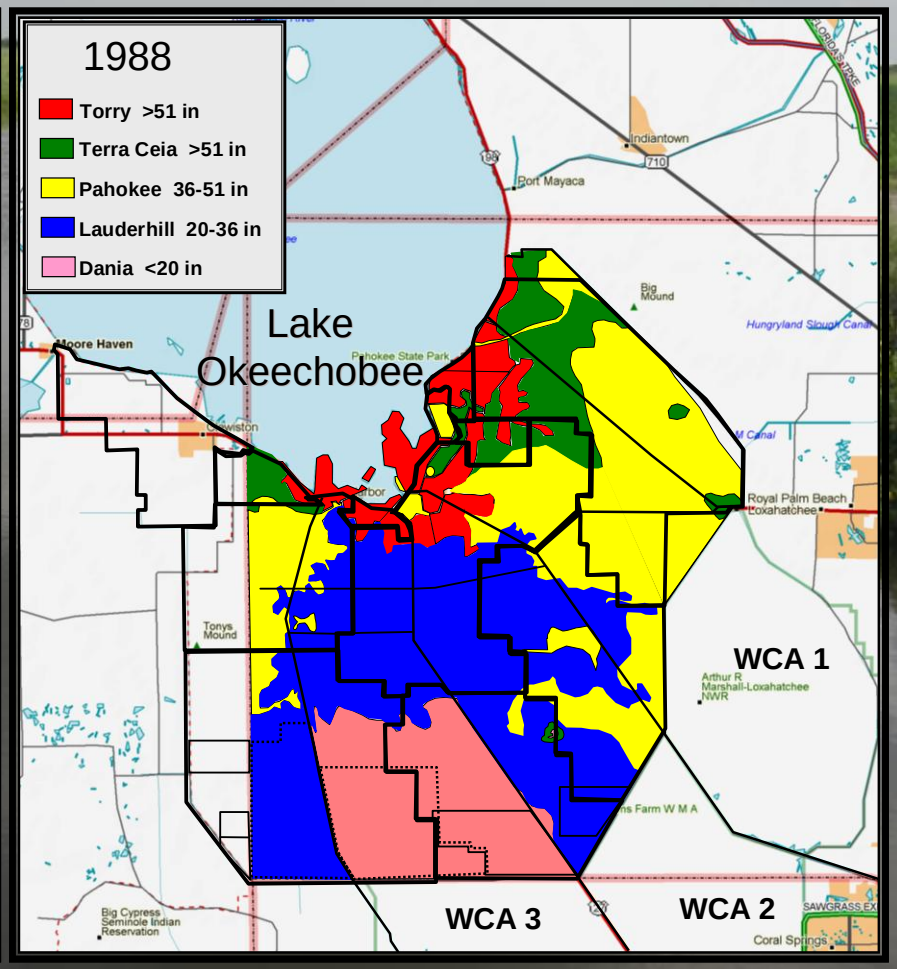
EAA Drainage



- The drainage of the EAA caused decomposition of organic soil (subsidence), which continues today at a slower rate. Soil loss impacts the hydrology and ecology of the Everglades.
- The loss of elevation has meant a loss of the hydraulic head that once drove water south. Pumping is now required to move water southward.
- Soil loss has also meant a loss of water storage capacity, which has meant a reduction in the ability of the area to hold water and mediate seasonal and long-term variations in rainfall.

Organic Soil Oxidation

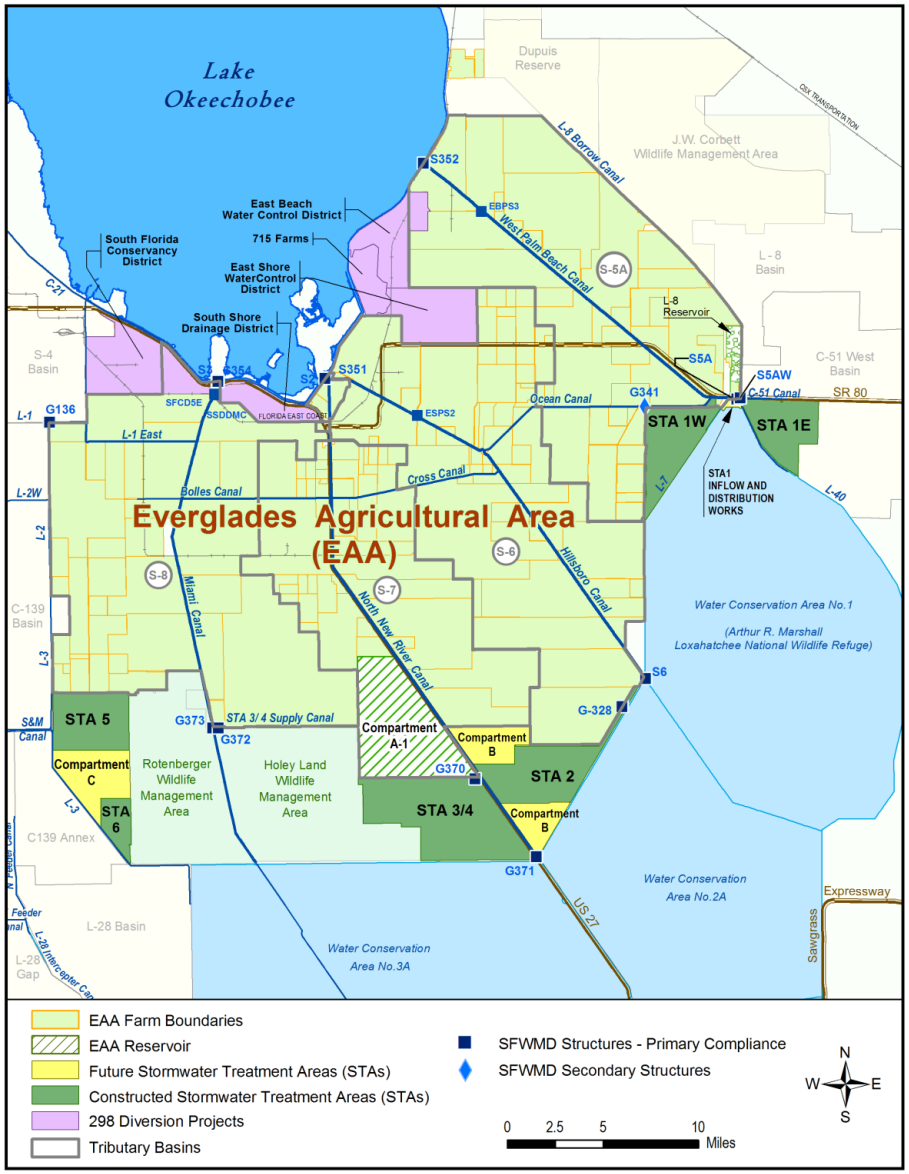




Why was the EAA BMP program created?

- The EAA was the single largest source of phosphorus loads to the Everglades. A 47 percent contribution of the historical phosphorus load to the Everglades for the 1979-1988 baseline period represents the largest single source of this nutrient to the ecosystem. Lesser amounts come from Lake Okeechobee, other agricultural and urban basins, and from rainfall

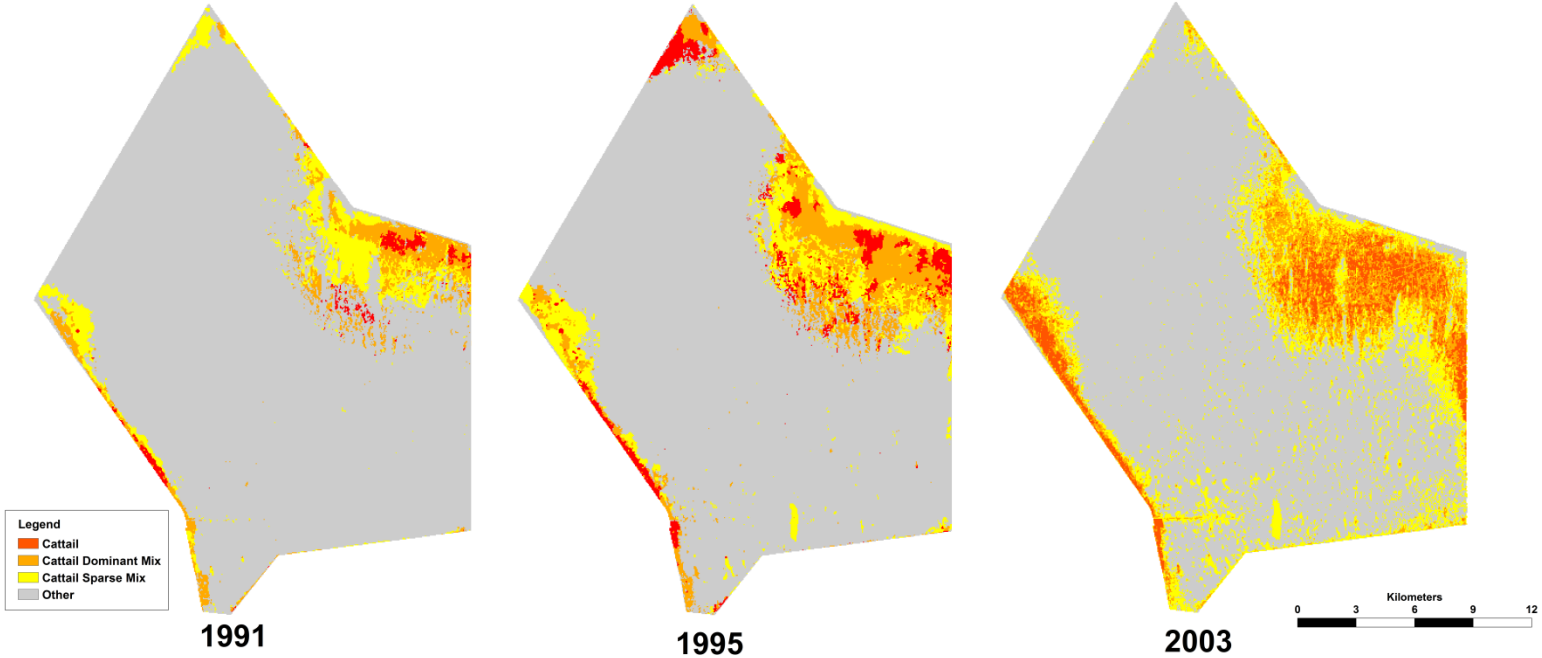
Why was the BMP program created?



Why was the EAA BMP program created?

Ecosystem Disruption: Cattail Encroachment

Water Conservation Area 2A Cattail Trend Analysis 1991 - 2003



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Everglades Division

Time series trend analysis of cattail (Typha spp.) within Water Conservation Area 2A (WCA-2A) was performed utilizing 1:24,000 scale color infrared aerial photography captured in 1991, 1995 and 2003. Each cattail map was generated utilizing stereo photointerpretation techniques. The 1991 and 1995 cattail maps were delineated using a vector system with a minimum mapping unit of one acre (Rutchey and Vilchek, 1999). The 2003 cattail map was compiled utilizing a quarter hectare (50 x 50 meter) grid method constituting a minimum mapping unit of 0.6 acres (Rutchey et al. submitted). The quarter hectare grid was generated and superimposed over the 2003 aerial photography, resulting in 170,500 individual grid cells covering all of WCA-2A. Vegetation within each individual grid cell was observed utilizing a Leica SD2000 stereo-plotter. Cattail cover was estimated for each grid cell and assigned one of four possible categories. The categories of this classification are: "cattail monotypic" (greater than or equal to 90% cattail), "cattail dominant mix" (50% - 89% cattail), "cattail sparse mix" (10% - 49% cattail), or "other" (less than 10% cattail). For ground-truthing, seven hundred and forty-two locations within WCA-2A were visited using differential GPS navigation by airboat or helicopter. These points where determined to be areas in question or "unknown" during the photointerpretation process.

Advantages of the grid system mapping include greater time and cost efficiency and the unique ability to classify vegetation within the same quarter hectare grid cells from this analysis during future mapping efforts. This allows for the past, present and future analysis of each individual quarter hectare of the entire area under study. In addition, the grid system more accurately depicts the overall heterogeneity of Everglades vegetation.

Results show that cattail continues to spread throughout WCA-2A, with monotypic cattail patches expanding throughout the eastern portion of the impoundment and along the southwestern boundary. In addition, sparse cattail continues to spread along distinct cattail-sawgrass boundaries and throughout the southern regions of WCA-2A. The rate of spread appears to be slowing down, however, when compared to the 1991-1995 period. This decrease in rate may be due to the reduction in annual total phosphorus loads to WCA2A during the 1995 to 2003 period. Excess nutrients, hydrologic alterations, invasive habitat availability, and fire have been shown to influence successful establishment of cattail in the Everglades. The relative importance of these factors influencing cattail coverage in WCA-2A from 1995 to 2003 still needs to be determined. A small area in the northern tip of WCA-2A shows a decrease in cattail coverage. It is hypothesized that the loss of cattail in this area is due to a combination of events including fire, a reduction in phosphorus loading, and water levels with the closing of structure S10E in 1996. Structure S10E regulates water flow from the Hillsboro Canal into northern WCA-2A.

For additional information contact Ken Rutchey at (561) 682-6618 or email at krutchey@sfwmd.gov.

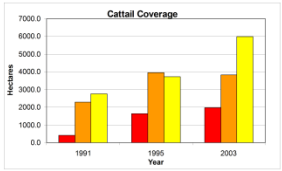
Rutchey, K., and L. Vilchek, 1999. Air Photo-Interpretation and Satellite Imagery Analysis Techniques for Mapping Cattail Coverage in a Northern Everglades Impoundment, Journal of Photogrammetric Engineering and Remote Sensing, 65(2):185-191.

Rutchey, K., T. N. Schall, and F.H. Sklar, In review. Development of a Water Conservation Area-2A Vegetation Map for Everglades Restoration, Wetlands.

Cattail coverage of Each Sampling Date

	Cattail	Cattail Dominant Mix	Cattail Sparse Mix	Total Cattail	Change between mapping efforts	Average yearly change
1991	421.6	2287.3	2760.9	5469.8		
1995	1646.3	3944.0	3721.7	9312.0	3842.2	960.6
2003	1978.8	3832.8	5996.2	11807.8	2495.8	312.0

*Number are in hectares



What is the EAA BMP Program?

- 1994 Everglades Forever Act
- Regulatory program goal: reduce EAA P loads by 25%
- EAA BMPs in place by February 1, 1995
- Master and individual BMP permits
- Compliance and enforcement procedures
- EAA load calculation methods
- STA creation and management

What are the BMPs?

BMP	PTS	DESCRIPTION
NUTRIENT CONTROL: MINIMIZE MOVEMENT OF NUTRIENTS OFF-SITE		
Nutrient Application Control	2½	Controlled application of nutrients; banding, controlled application
Nutrient Spill Prevention	2½	Formal spill protocols: storage, handling, transfer, and education/instruction
Rotational Vegetable Planting	2½	Rotation planting of high P/low P demand crops to avoid P build up
Plant Tissue Analysis	2½	Determines plant nutrient requirements via tissue testing
Soil Test Based Fertilization	5	Determine soil P requirements and follow standard recommendations
Split Nutrient Application	5	Applying split P without exceeding total recommendation
Slow Release P Fertilizer	5	Specially treated fertilizer
Reduced P Fertilization	5	P application rate is at least 30% below recommendation
WATER MANAGEMENT: MINIMIZE THE VOLUME OF OFF-SITE DRAINAGE DISCHARGE		
½ Inch Detained	5	Delay discharge: based on measuring daily rain events using a rain gauge
1 Inch Detained	10	Delay discharge: based on measuring daily rain events using a rain gauge
Improved Infrastructure	5	Re-circulate water; fallow field flood; increase water detention; booster pumps
Water Table Management	5	Optimizing drainage and irrigation schedules to decrease discharge
PP AND SEDIMENTS: MINIMIZE MOVEMENT OF PARTICULATE MATTER AND CANAL SEDIMENTS		
Any 2 Any 4 Any 6 Any 8	2½ 5 10 15	• Leveling fields • Slow drainage velocity near pumps • Grassed swales/field ditch connections • Ditch bank berms • Canal cleaning program • Aquatic weed control • Field ditch drainage sumps • Barriers at discharge locations • Ditch bank stabilization • Sediment sump/trap in canals • Soil stabilization through infrastructure improvements • Cover crops • Culvert bottoms above ditch bottoms • Vegetated ditch banks
Other BMPs	TBD	BMPs proposed by permittee and accepted by SFWMD

What are the BMPs?

Example: Sugarcane Farm - Shallow Soil

BMP	Points
1/2” Rainfall detention	5
Controlled fertilizer application	2.5
Fertilizer spill prevention	2.5
Soil testing program	5
Sediment controls (6)	10
Total	25

Level fields	Field ditch sumps
Ditch bank berms	Raised culverts
Main canal sump	Riser boards

What are the requirements of the EAA BMP Program?

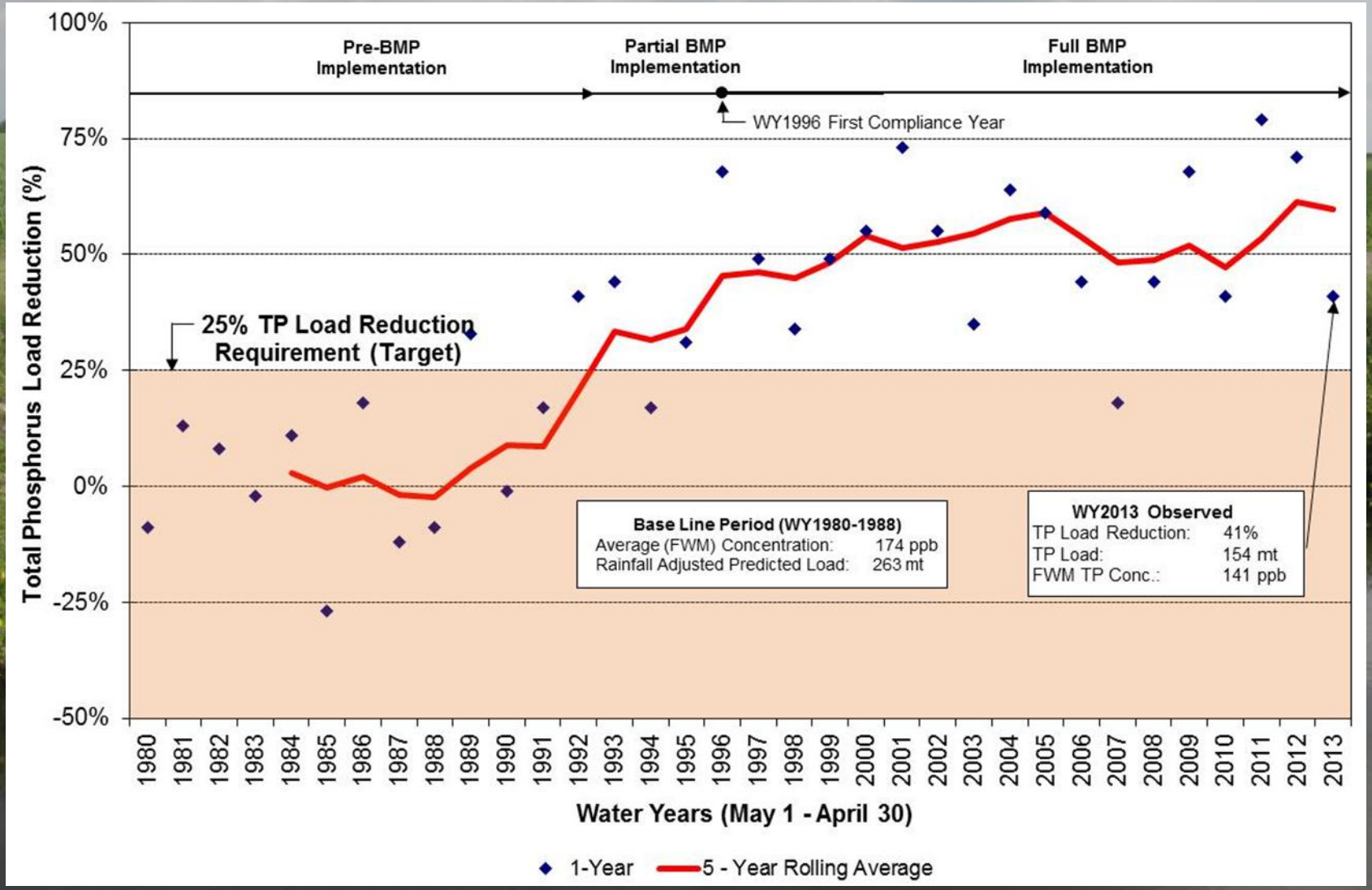
Conditions for Permit Issuance/Renewal

- Submit BMP Plan-description, rationale, explanation, fertilization and water management for each crop, water management design, monitoring, education and training, schedule for implementation
- Submit WQ Plan-description of WQ monitoring program, map of locations, description of sample collection methods, flow calculation methods, QA/QC, data mgt, data submittal

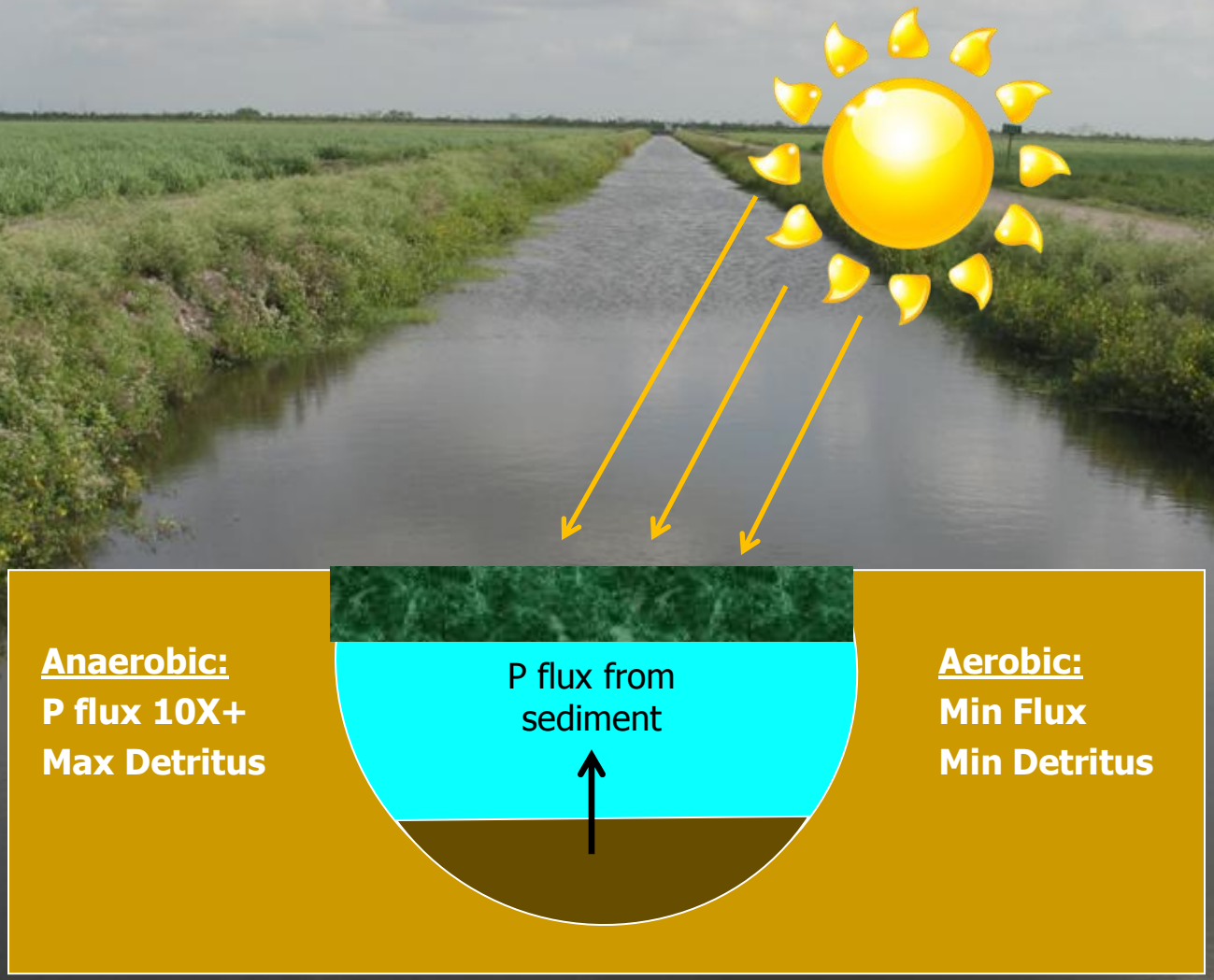
BMP Program Incentives

- Agricultural Privilege Tax
- Farm basin level P load monitoring
- Shining example for CERP
- Coexistence of Agriculture and Environment

How has the program performed?



Promising New Research



FAV Project Update
Objectives

1. Evaluate FAV management practices in the EAA farm canals for impact on
   a) farm drainage water phosphorus (P) load
   b) P speciation of farm drainage water
   c) canal sediment properties
2. Use research results to develop a BMP for managing FAV in farm canals that further lowers farm P loads.

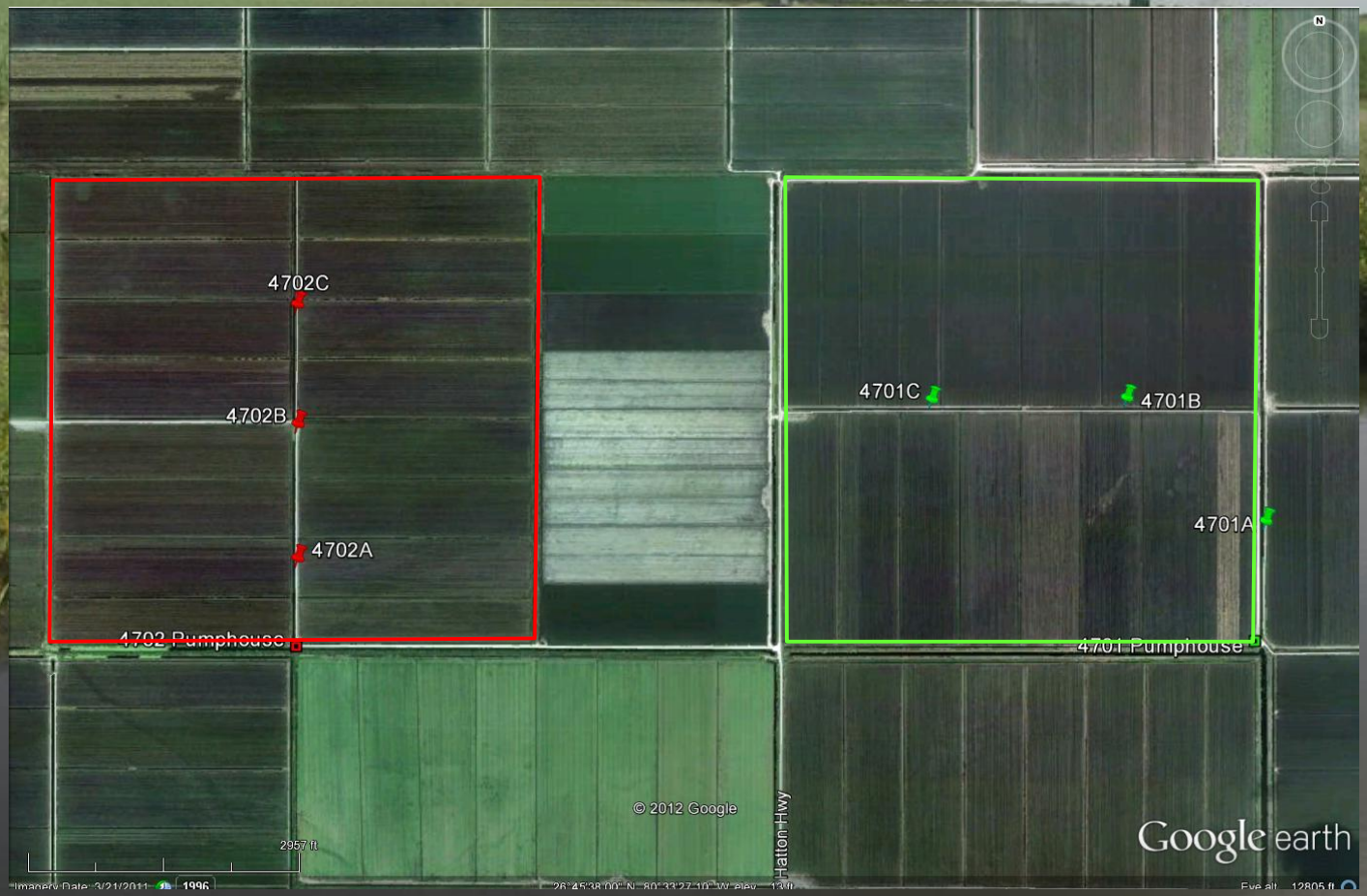
The goal is to provide growers an additional tool in their efforts to reduce off-farm P loading in the Everglades Agricultural Area.

FAV Project Update
Methods

Paired farms study (4 pairs)

- Two pairs each in S-5A and S-6 sub basins
- 2-yr calibration and 3-yr treatment periods
- Calculate changes after initiation of practices
- Improved vs. typical FAV control practices

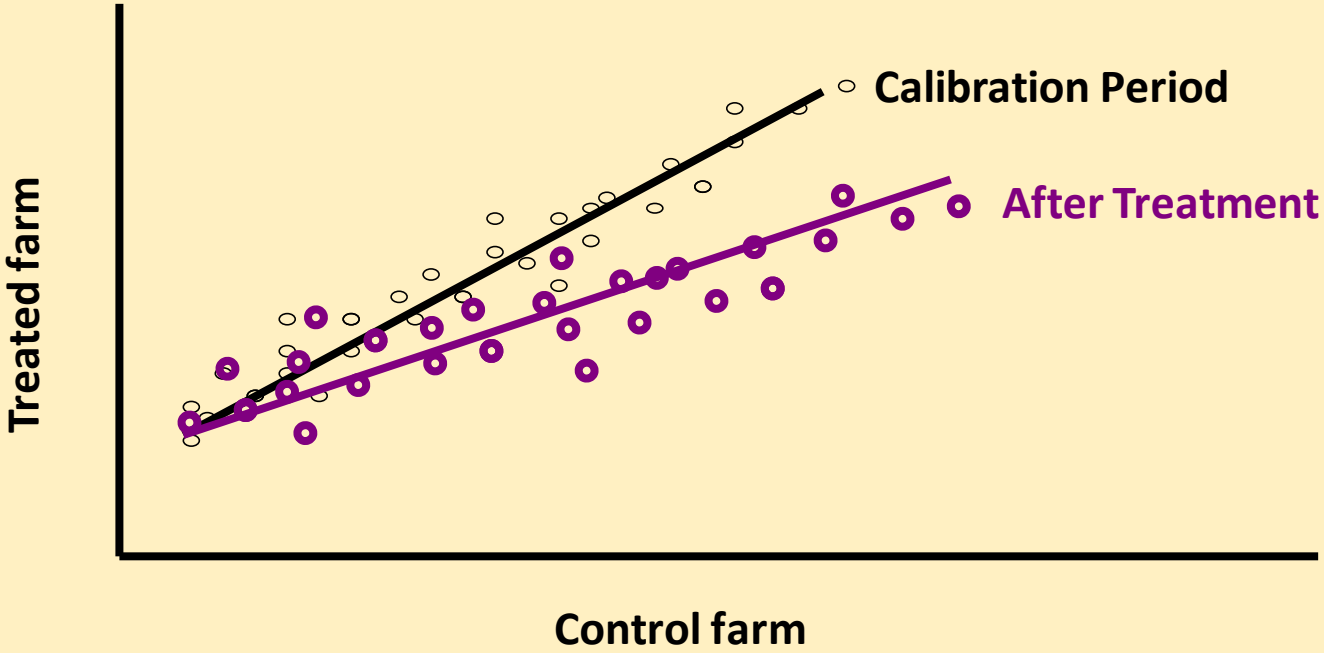
Example: Farm Pair Aerial View



FAV Project Update

Comparative Regression Analysis For P Load

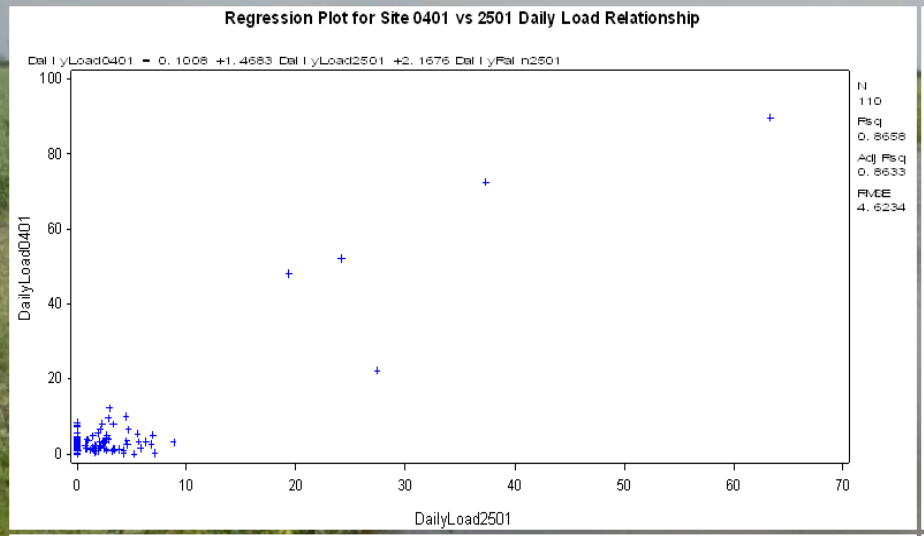
$$Treated_i = b_0 + b_1 (Control_i) + e$$

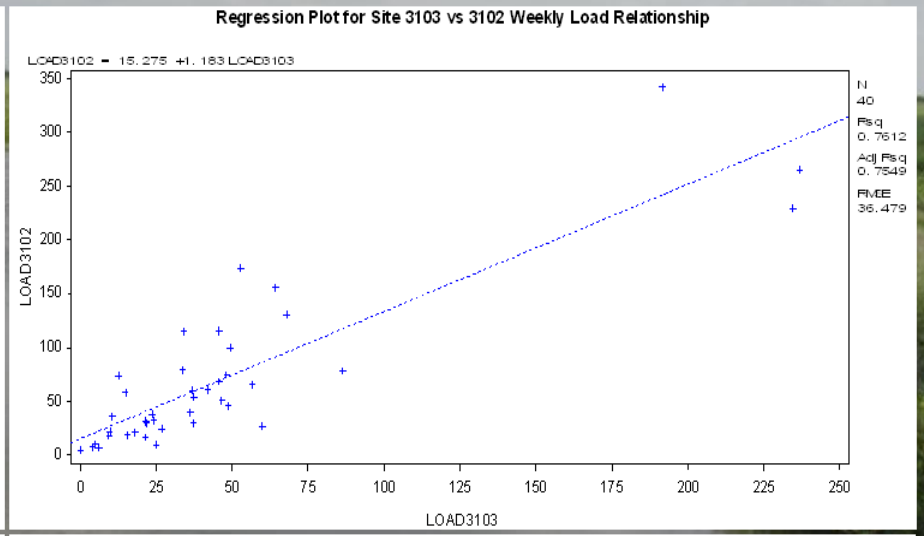


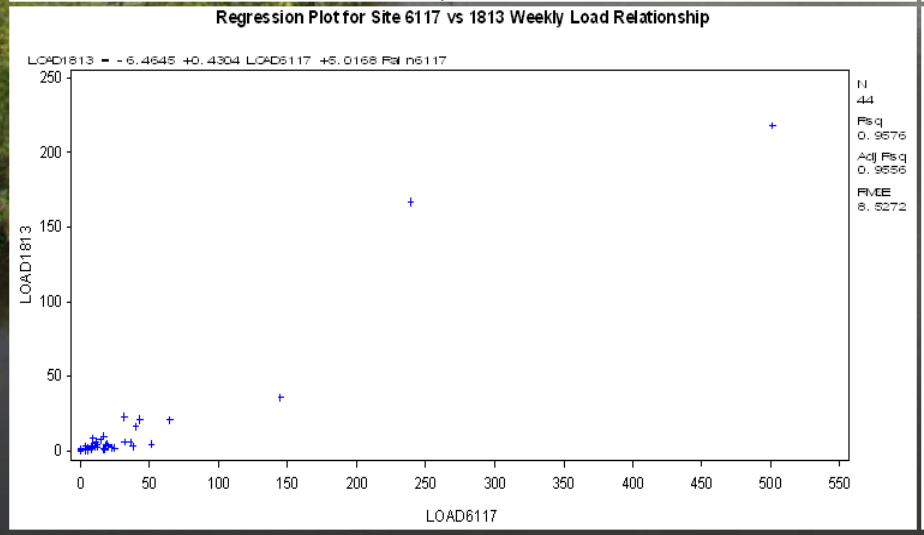
Calibration Period

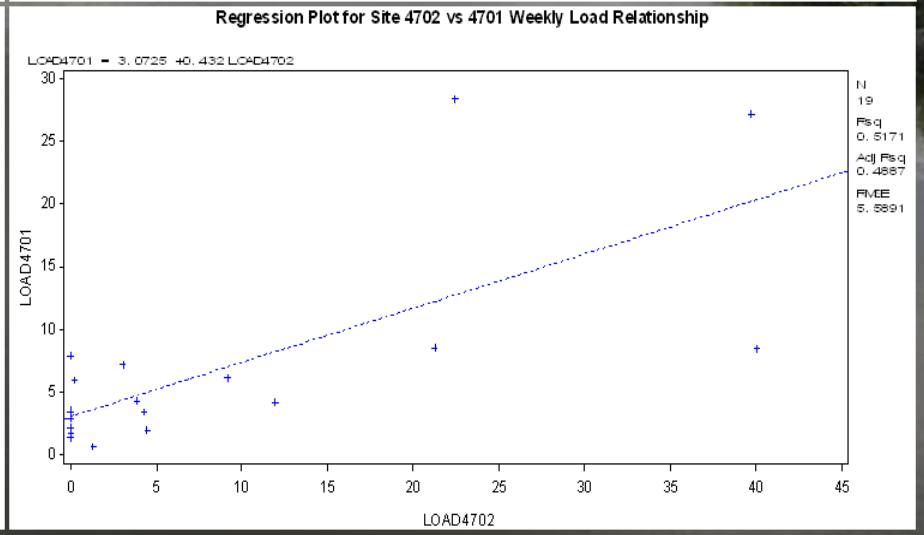
- Calibration: Nov 2010 through April 30, 2013.
- Collected two full water year data:
  - May 1, 2011 – April 30, 2013
- Conducted regression analysis on P loads between farm pairs to determine if the relationship is significant

Calibration Period Regression Load Graphs









Calibration Period Regression Equations

Weekly P Load 6117 vs 1813:

P Load1813 = -6.464 + 0.430 P Load6117 + 6.02 Rain6117

Observations = 44, Adj R^2= 0.955, RMSE = 8.52

Weekly P Load 3102 vs 3103:

P Load3102 =-68.85 + 1.45 P Load3103 + 68.2 Rain3102

Observations= 41, Adj R^2= 0.838, RMSE = 81.52

Daily P Load 0401 vs 2501:

P Load0401 = 0.1821 + 1.42 P Load 2501 + 2.00 Rain2501

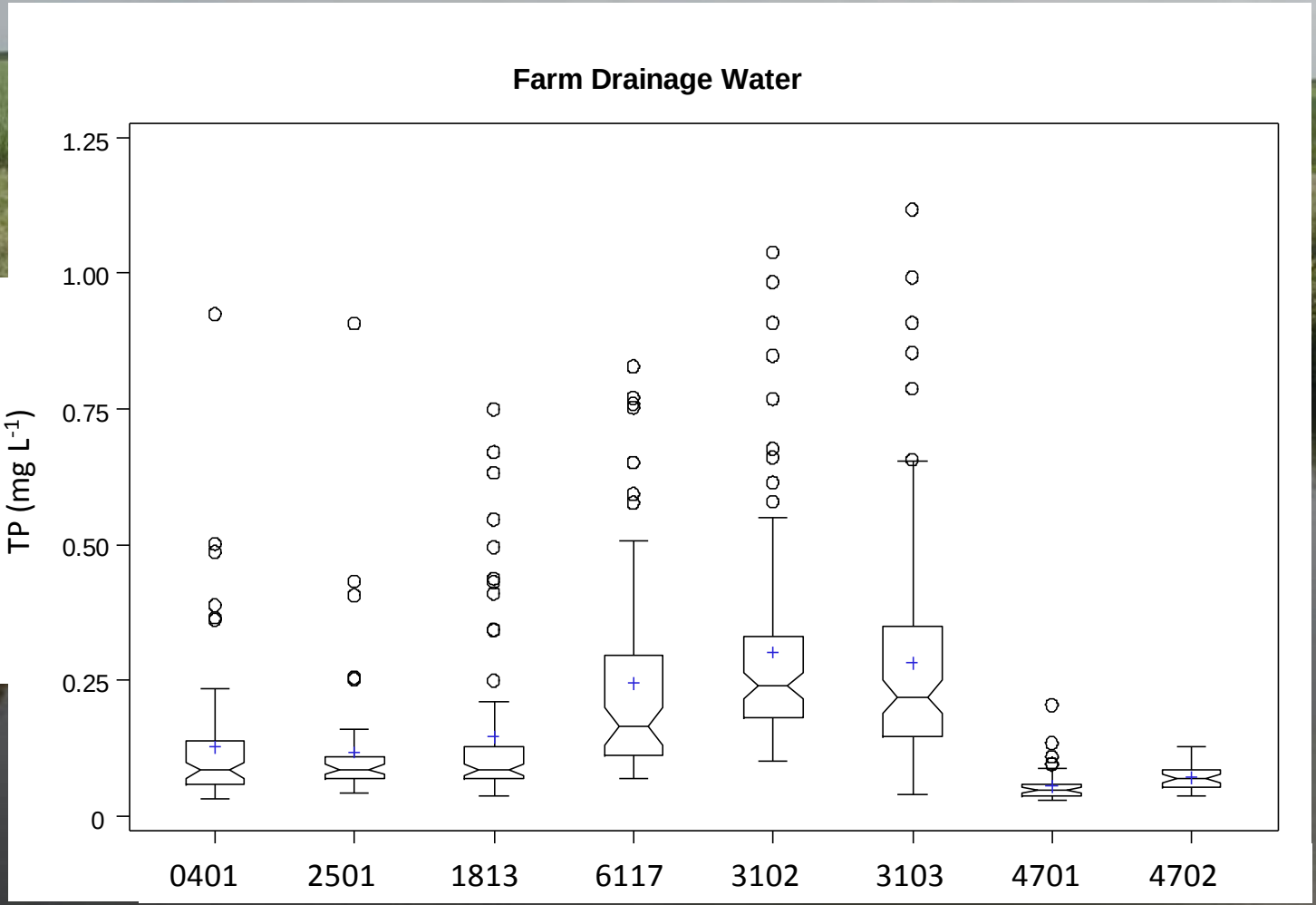
Observations= 110, Adj R^2 = 0.877, RMSE = 4.44

Weekly P Load 4701 vs 4702:

P Load4701 = 3.072 + 0.432 P Load4702

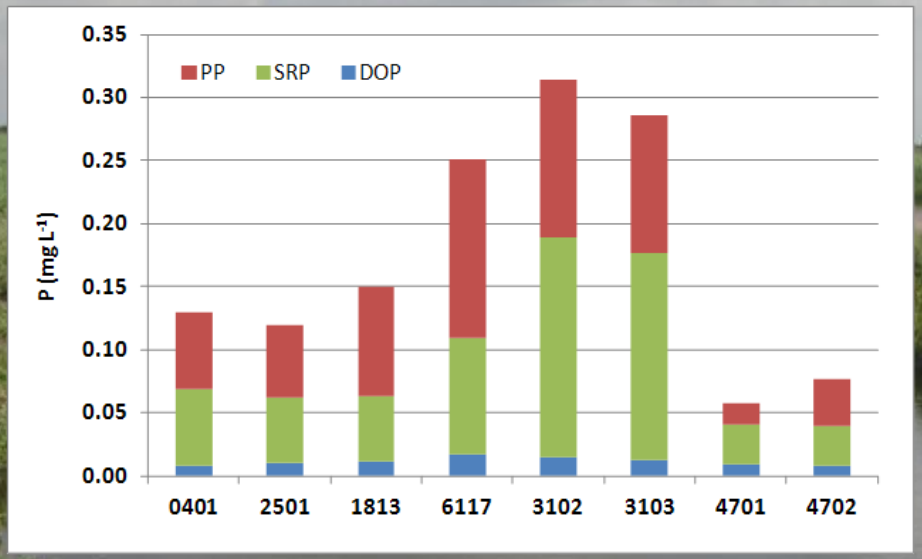
Observations = 19, Adj R^2= 0.488, RMSE = 5.59

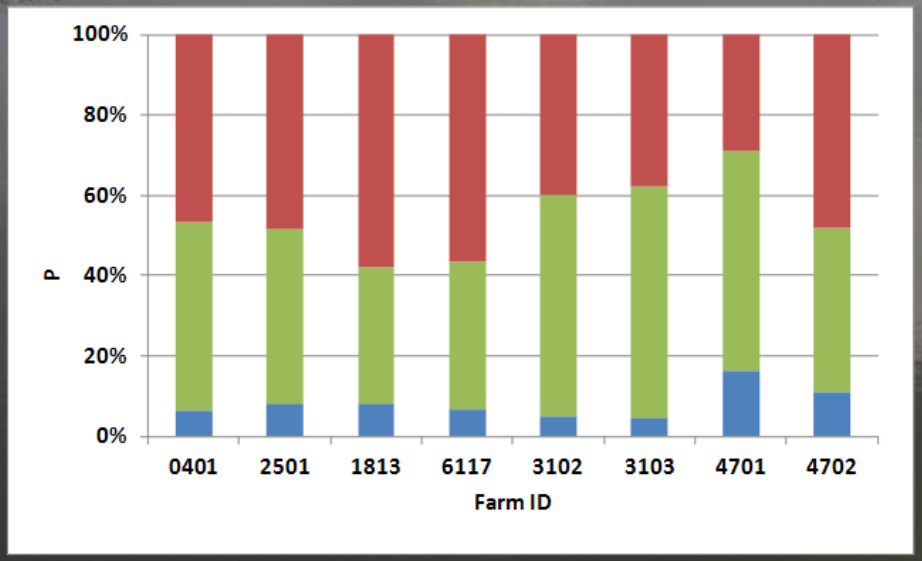
FAV Research Project
Farm Drainage Water



FAV Research Project

Farm Drainage Water

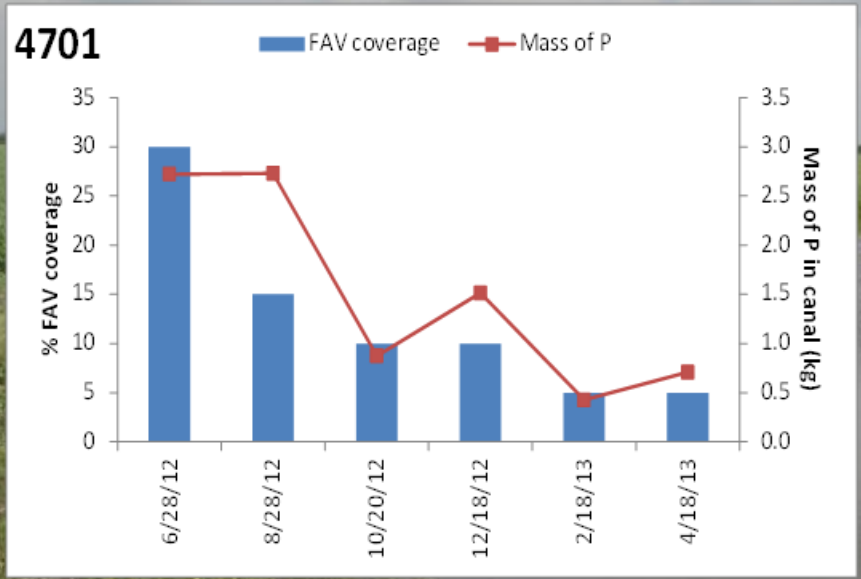


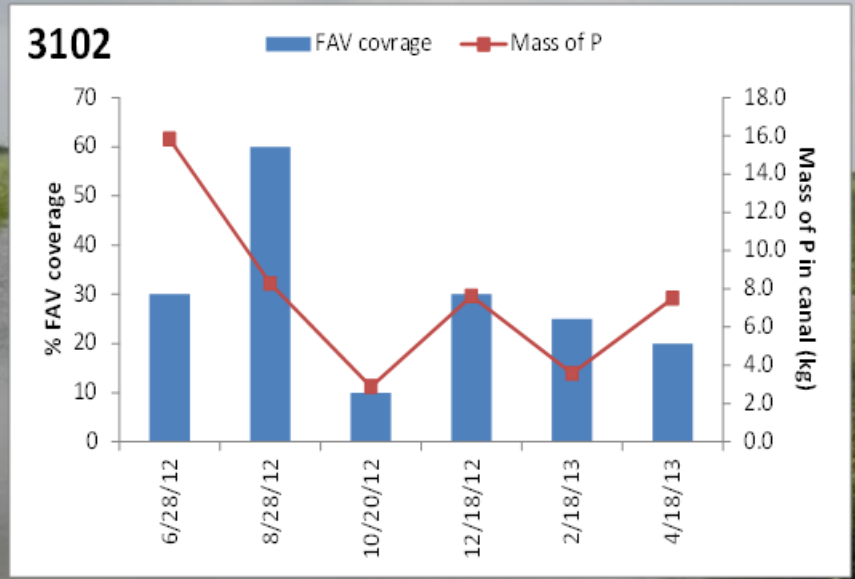


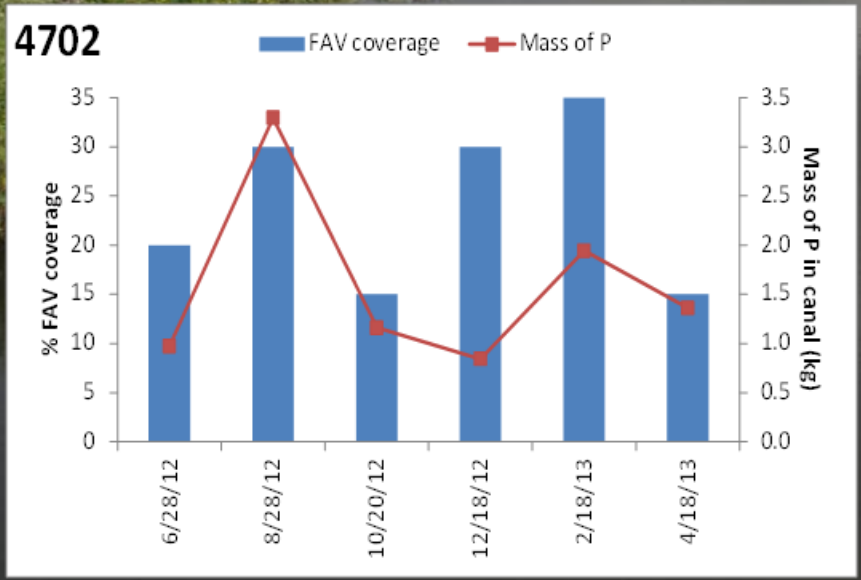
Drainage water samples from Feb 2011 thru Apr 2013

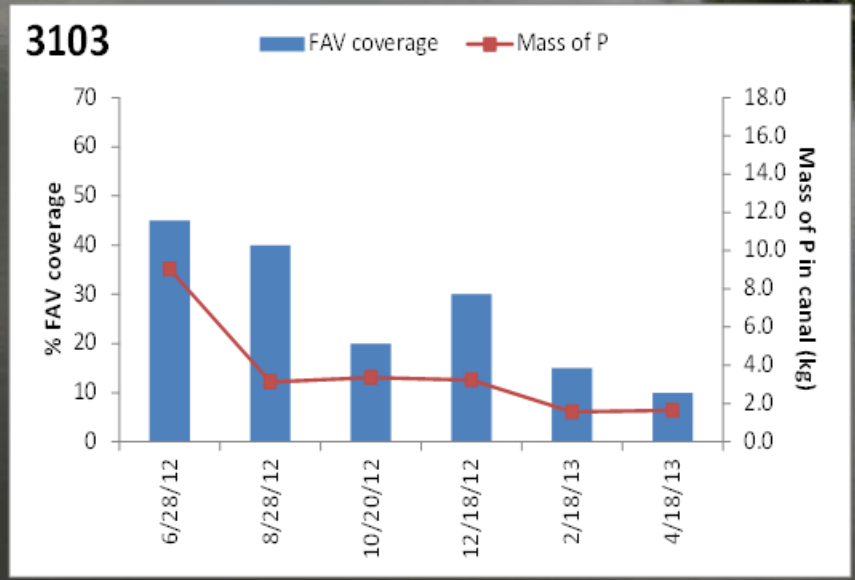
FAV Project Update

FAV Coverage and P Mass









FAV Project Status

- Treatment Farms: 3103 0401 6117
- Control Farms: 3102 2501 1813
- Continued Baseline Monitoring (one yr):

  4701 and 4702
- Treatment Initiation: May 1, 2013 for 3 farm pairs
  - Monitoring of FAV growth
  - Spot spraying with approved Aquatic herbecide
- Treatment Initiation: May 1, 2014 for farm pair 4

BMP Program Conclusions

As a result of 100% participation by EAA growers:

- The EAA achieved an estimated 71 percent [63 mt] TP load reduction for WY2012.
- The average annual reduction in TP loads due to BMP implementation since WY1996 has been 55%.

Efforts to improve BMP performance and implementation through research, extension, and training continue

The success of the EAA BMP program is the result of a group effort; all involved need to continue to be diligent and conscientious implementing BMPs


Thank you for your
participation and attention.
Any questions?