Rainfall Detention Best Management Practice

BMP Workshop

September 24, 2015

EREC, Belle Glade

UF UNIVERSITY of FLORIDA IFAS

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
Water Table Management	5	Optimizing drainage and irrigation schedules to decrease discharge
PP AND SEDIMENTS: MINIMIZE MOVEMENT OF PARTICULAT 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

Definitions

Detention: temporarily holding water until conditions for release are met; object is to control discharge rates to reduce impact on downstream receiving systems.

Retention: preventing water from discharging into receiving waters; water is held until it is lost to percolation, evapotranspiration or evaporation.

EAA Detention BMP is a hybrid of detention and retention

Rainfall Detention BMP

(On-Farm Water Management)

Goal: reduce volume of water pumped off-farm

Benefits: less soil subsidence + lower P conc

Risks: higher WTs may harm crop, reduce yields

Processes: ET, seepage, water tolerant crops

Unknown: subsurface drainage/seepage shellrock

Effective, versatile, and completely farm-specific

EAA Farm P Load Calculation

FARM P LOAD = VOLUME X CONCENTRATION

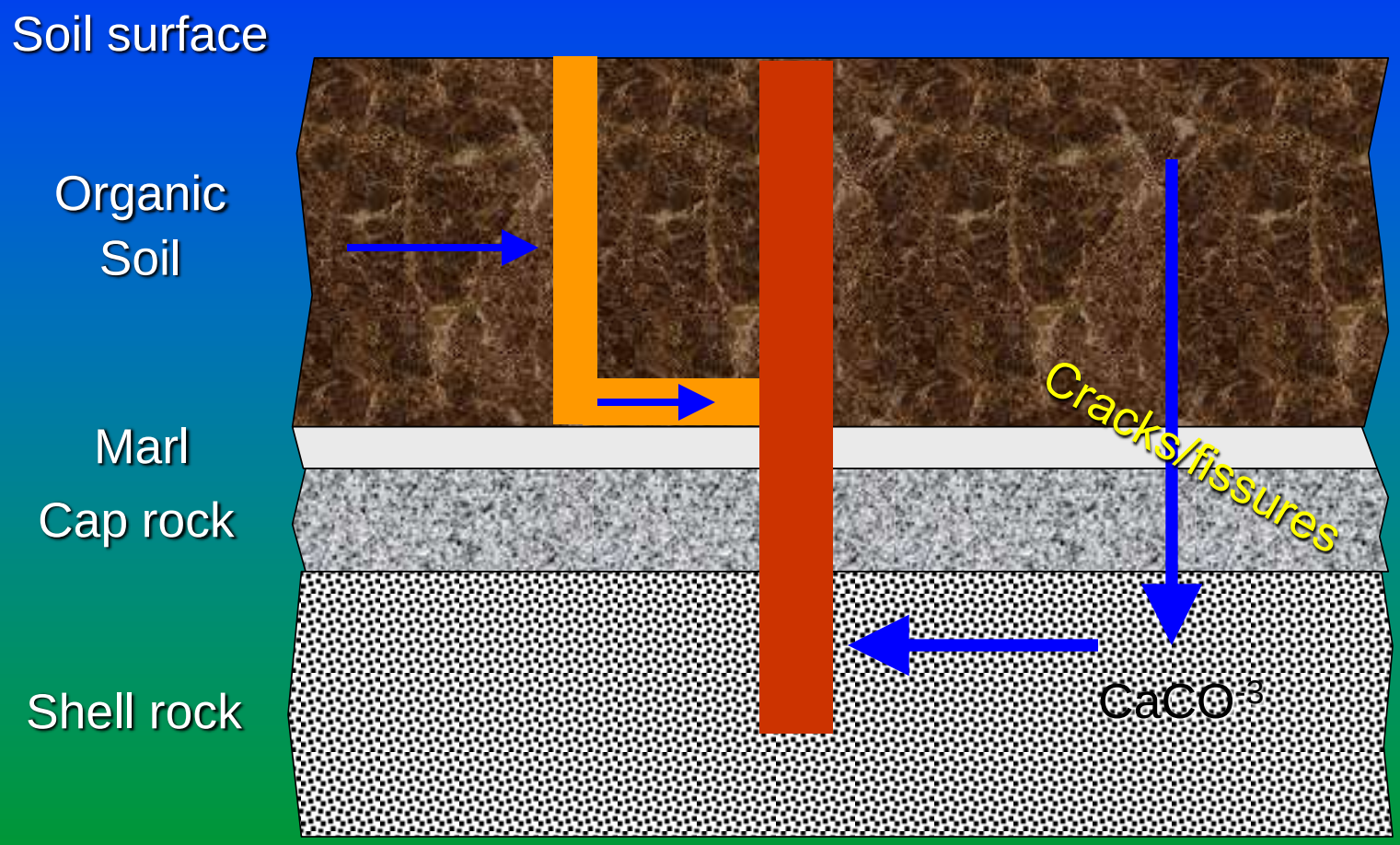
Reduce volume pumped off-farm

- Rainfall: amount and distribution
- Drainage needs of crop
- Irrigation methods, quantity, capacity
- Seepage into and off farm

Lower concentration of P in drainage water

- Soil oxidation (subsidence)
- Irrigation water quality
- Fertilizer use efficiency
- Cover crops, rotational crops

EAA Surface Geology and Hydraulics



Water Detention Methods

- Rainfall detention
  - Selected fields with high/low water tables
    - Booster pumps, gates, culverts
  - On-farm water storage areas
    - Retention pond
    - Seasonally flooded fields or blocks
  - Higher water tables across whole farm
    - Use of water tolerant crops/varieties
    - Regulated pumping practices

Barry Glaz: Flooded Sugarcane Research

If planted cane is covered in the furrow, pump flood water off after 2 days, unless CP 89-2376, then 6 days maximum.

For all varieties, if furrows are still open, you have more flexibility, probably about 10 days if temperatures remain warm (before November).

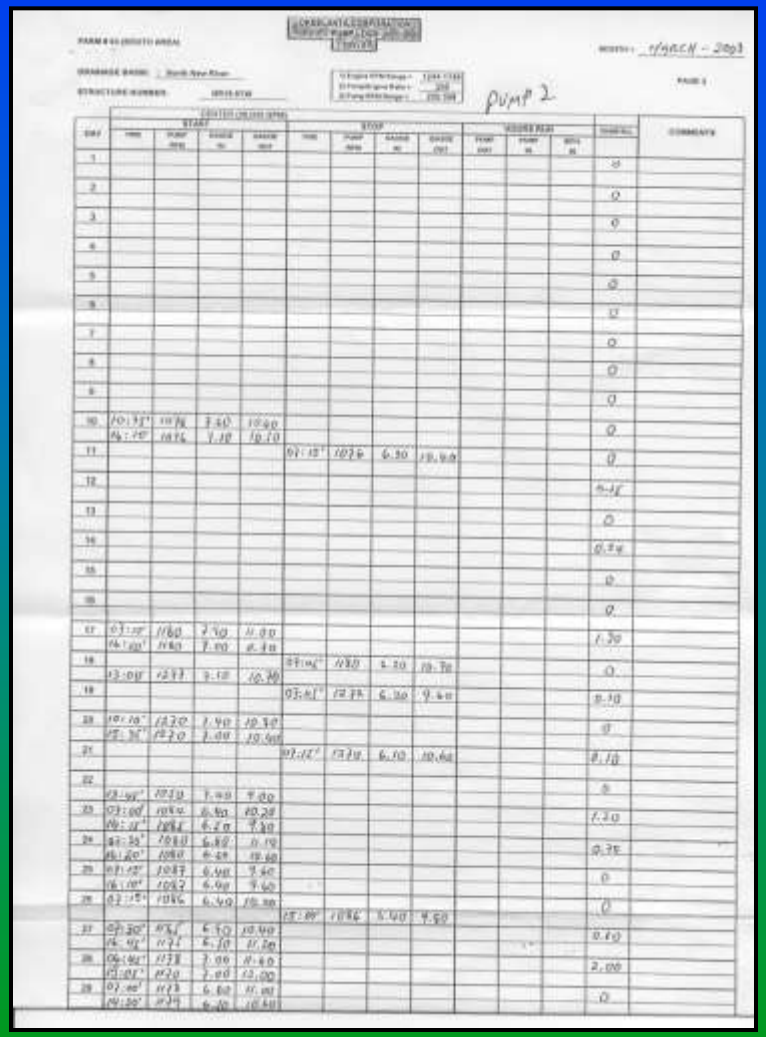
Sugarcane has some flood tolerance, but there are limitations.

If you understand sugarcane's flood tolerance, you can use it to your advantage as you comply with BMPs and maintain yields.

Your successful compliance with BMPs is beneficial for the natural Everglades and helps conserve your muck soils, but the challenge is to do so while keeping high yields.

Shallow Muck/Water Mgt/N Fert

Rainfall Detention Tools



Pump Logs

UNITED STATES SUGAR CORPORATION

Pumps Station Report - Daily Readings

*****Note Pump Discharge Codes*****

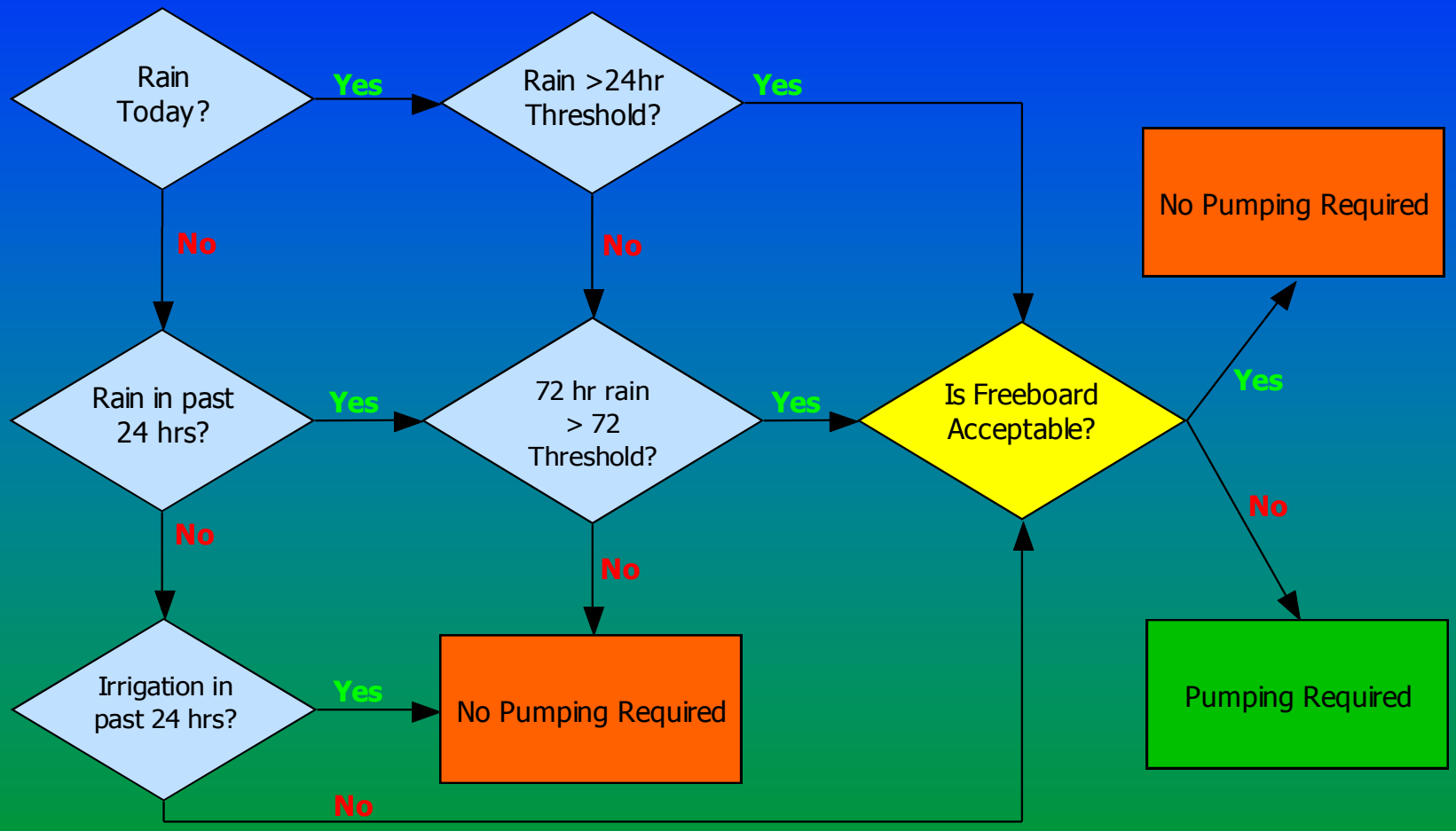
1. Meets BMP (Rain), 2. Seepage, 3. Unexpected rain during Irrigation, 4. Late control of prior rainfall, 5. Planting
6 Harvesting, 7. Weed Cultivation or Spraying, 8. Calibration, 9. Removal of fire control water
10. Canal and ditch cleaning, 11. Work on crossing or culverts 12. Removal of water from fallow flooded fields
13. Dike failure, 14. Approach of large storm 15. Land preparation and laser plane operations
16. Maintenance with Discharge, 17. Maintenance without Discharge.

		Started				Stopped				** Pump **			
Pump Number	Engine RPM	Date	Time	Gage In	Gage Out	Date	Time	Gage In	Gage Out	Discharge Code	Engine Number	Hour Reading	Operator's Initials

Time is 24 hour time. 00:00 being midnight the start of the day and 23:59 is the end of the day

Future enhancement - Propose that we enter the engine number and hour reading and transfer the data to MLS for PM purposes.

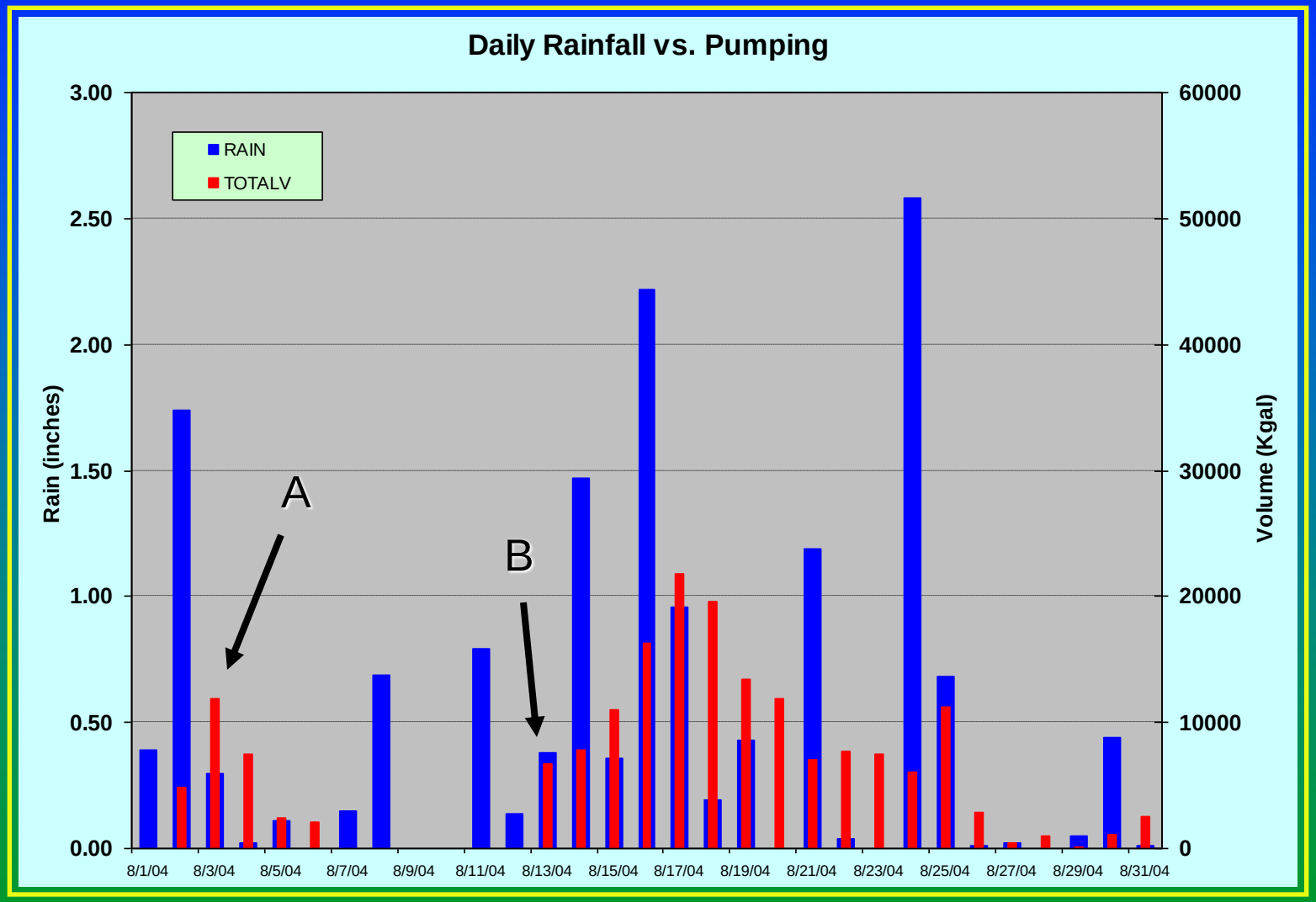
Regulated Pumping Practices



Pumping Exceptions

- Seepage
- Irrigation followed by unexpected rainfall
- Late control of prior rainfall
- Cultural practices: planting, harvesting, tillage, etc.
- Weed cultivation or ground spraying operations
- Removal of fire control water
- Removal of water from flooded fallow/rice fields
- Approach of large storm system
- Land prep or laser plane operations

Water Detention: SFWMD

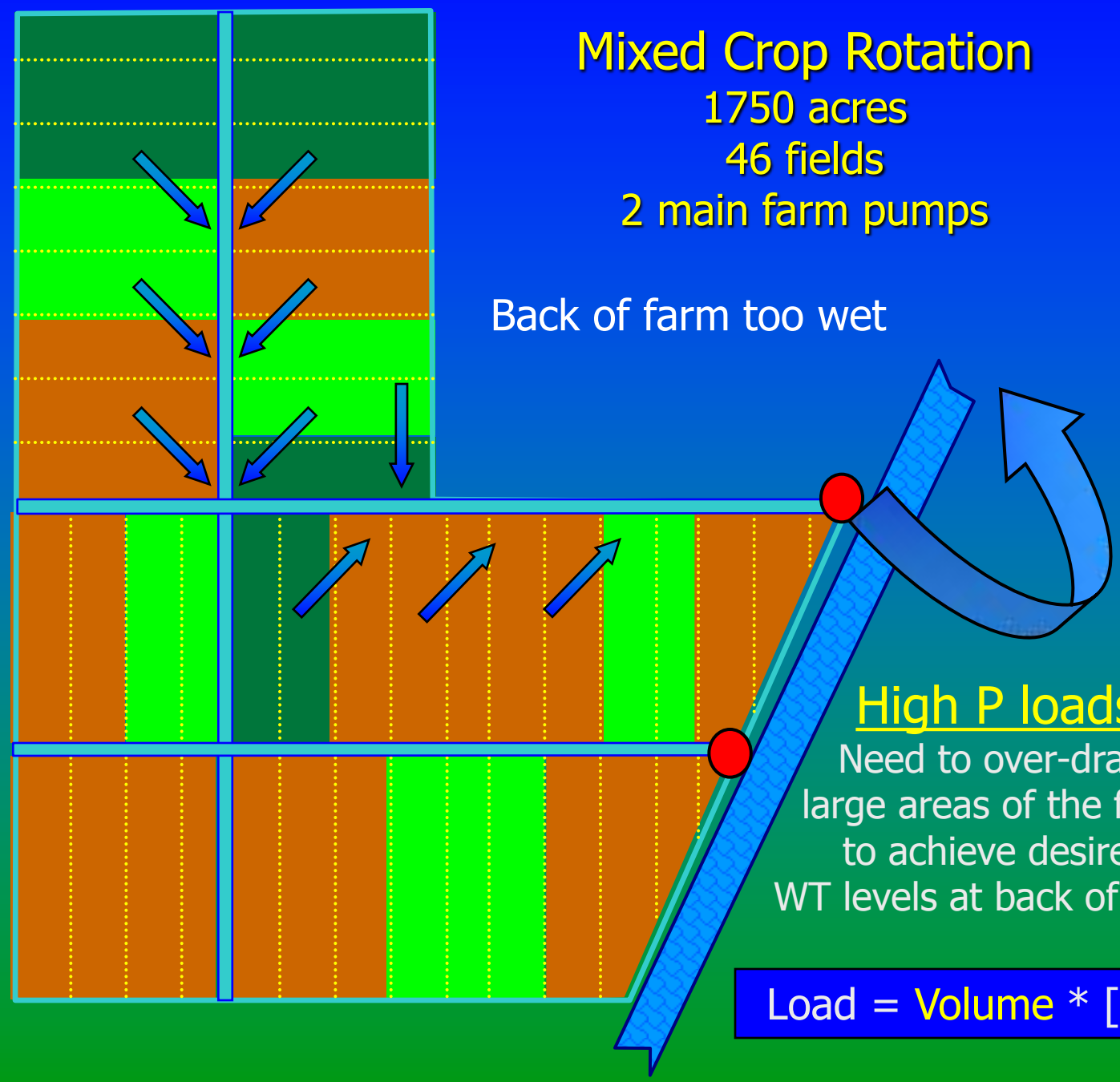


Implementation of Rainfall Detention – Example

Sod

Leaf

Cane



Mixed Crop Rotation

1750 acres

46 fields

2 main farm pumps

Back of farm too wet

High P loads

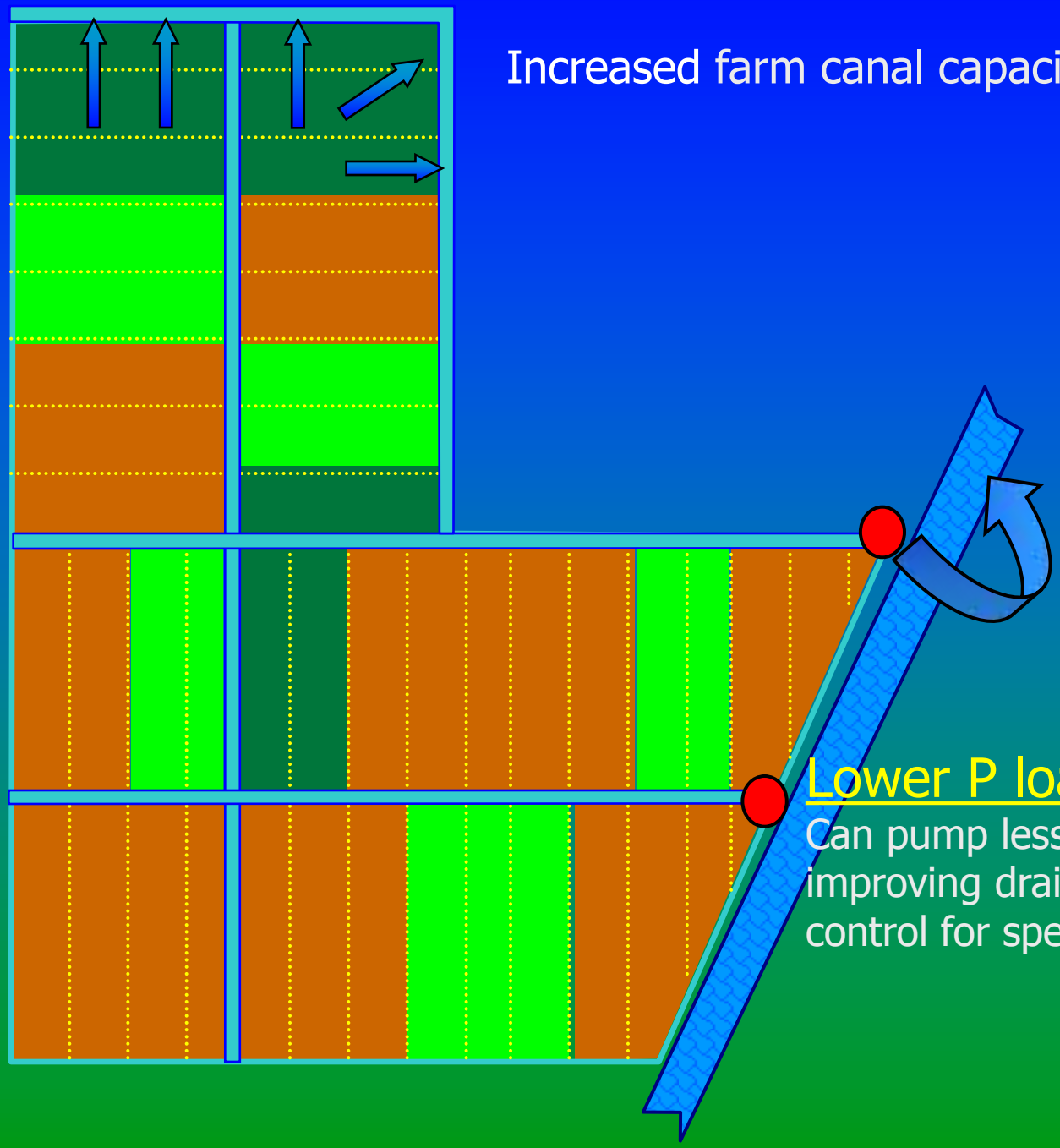
Need to over-drain large areas of the farm to achieve desired WT levels at back of farm.

Load = Volume * [P]

Sod

Leaf

Cane



Increased farm canal capacities

Lower P loads

Can pump less after improving drainage control for specific fields

Sod

Leaf

Cane

Installed booster pumps

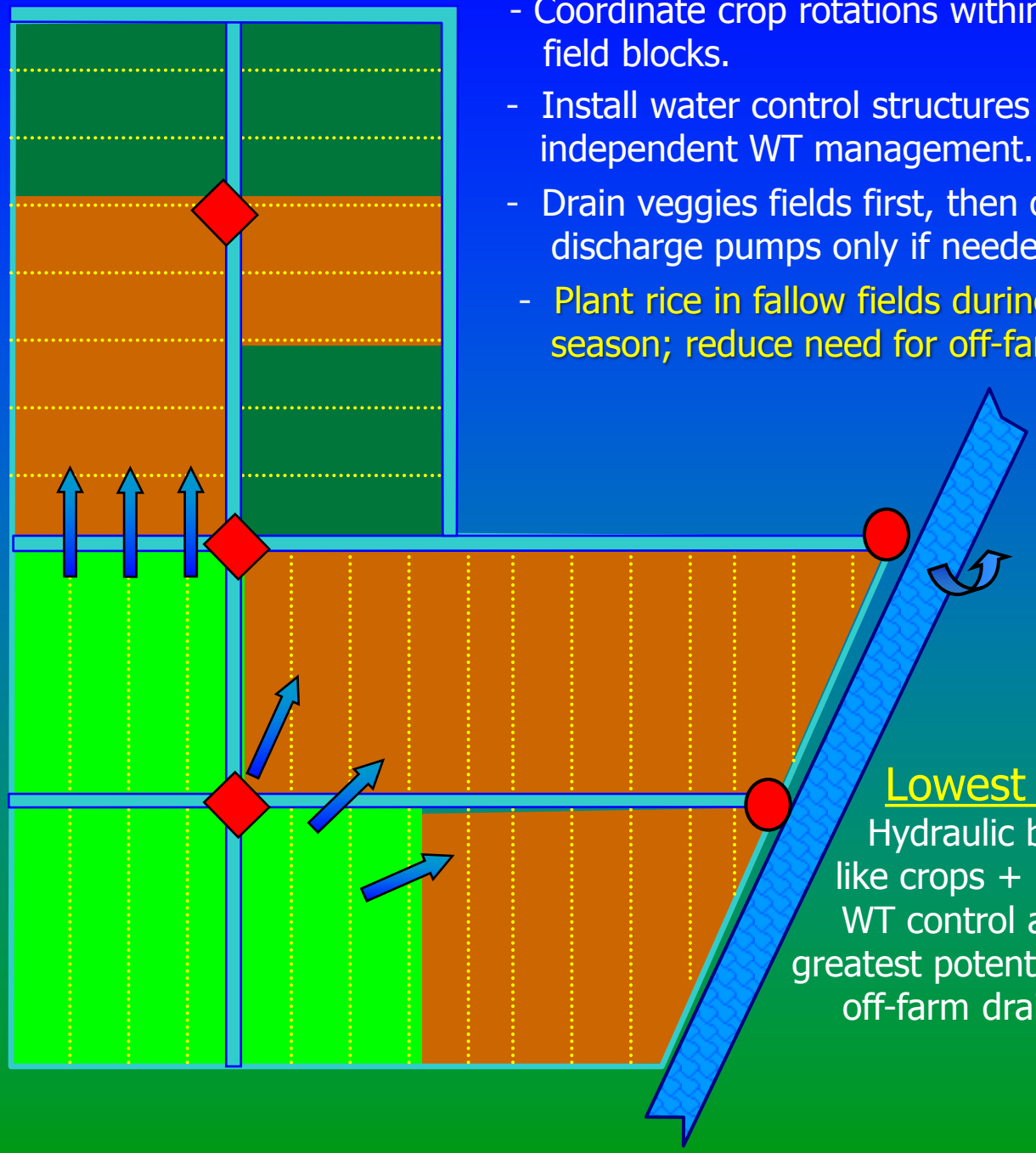
Still Lower P loads

Routing drainage water internal to the farm can greatly reduce reliance on main farm pump.

Sod

Leaf

Cane

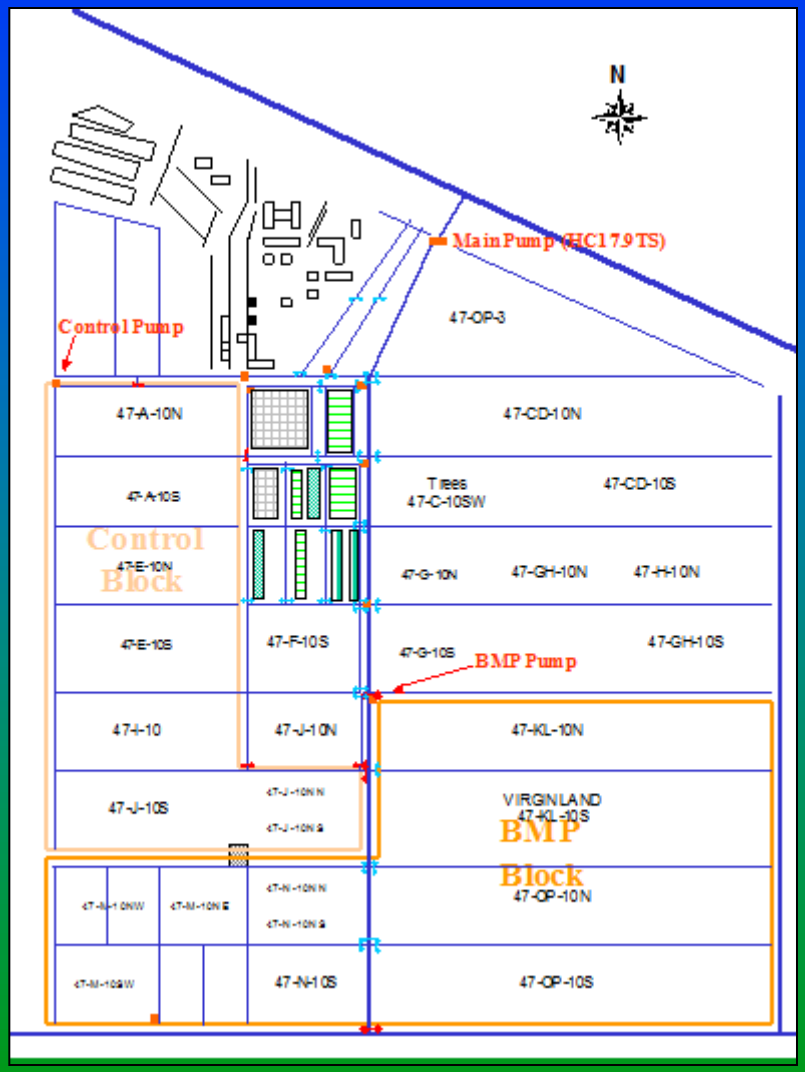


- Coordinate crop rotations within contiguous field blocks.
- Install water control structures to allow independent WT management.
- Drain veggies fields first, then operate main discharge pumps only if needed.
- Plant rice in fallow fields during wet season; reduce need for off-farm pumping

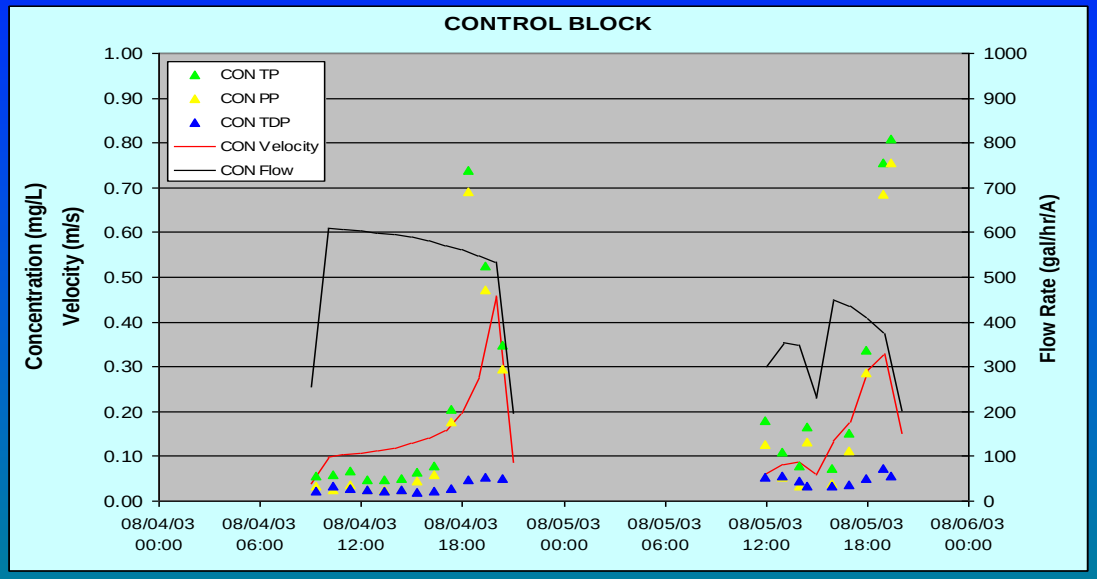
<u>Lowest P loads</u>

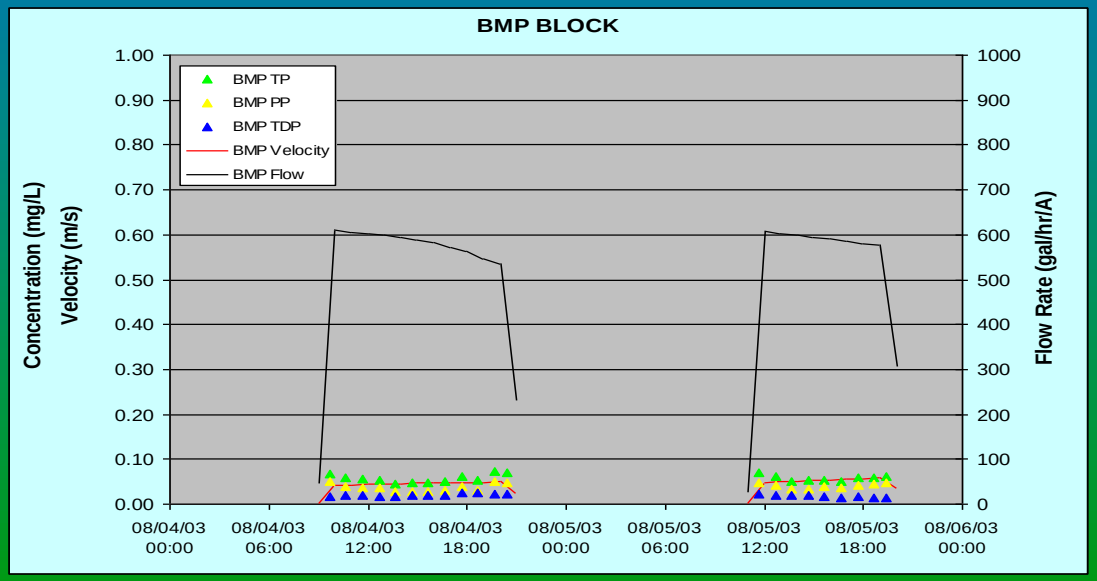
Hydraulic blocking of like crops + independent WT control achieves the greatest potential for reducing off-farm drainage loads.

BMP Demonstration Farm



BMP Demonstration Farm





Closing Thoughts

Recirculation

- Enables the cultivation of higher P requiring crops without greatly impacting discharge water quality by rerouting high P water
- Especially important for rice drawdown waters

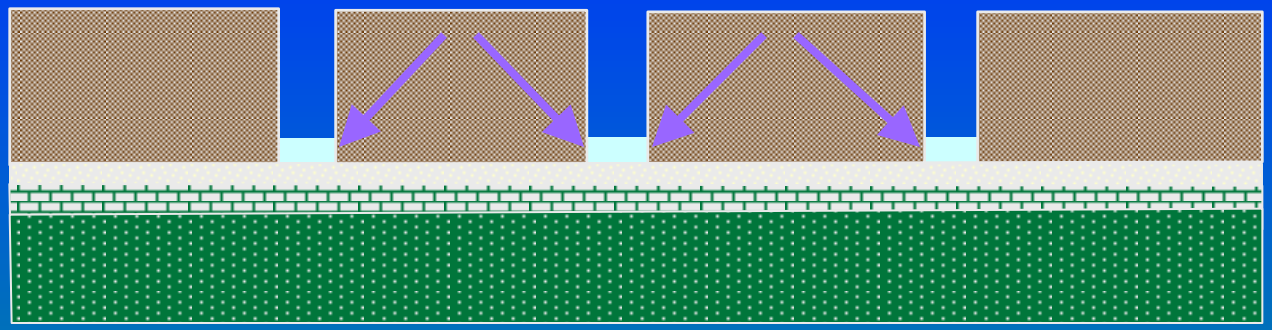
Hydraulic Canal Dredging

- Relocation of canal bottom sediments and particulate matter into fields by intensive targeted pumping (canal cleaning)

Closing Thoughts

Field Drainage Process

Deep Soil

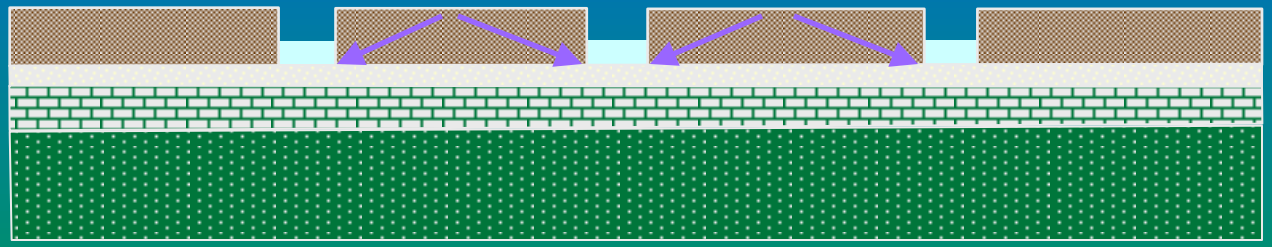


Soil

Marl Caprock

Shell rock

Shallow Soil 1

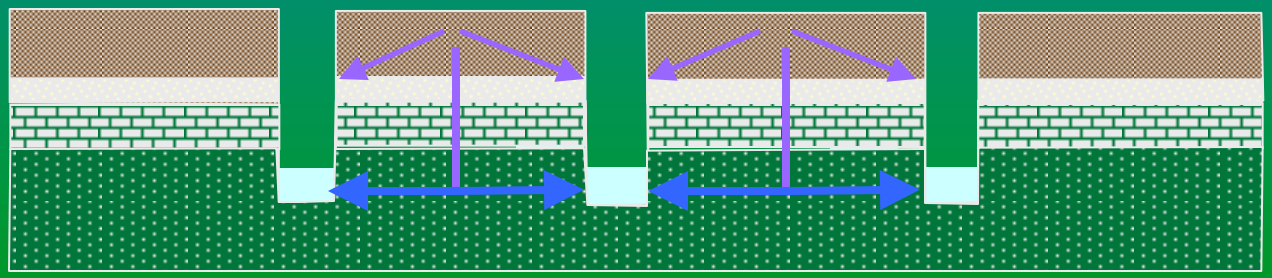


Soil

Marl Caprock

Shell rock

Shallow Soil 2



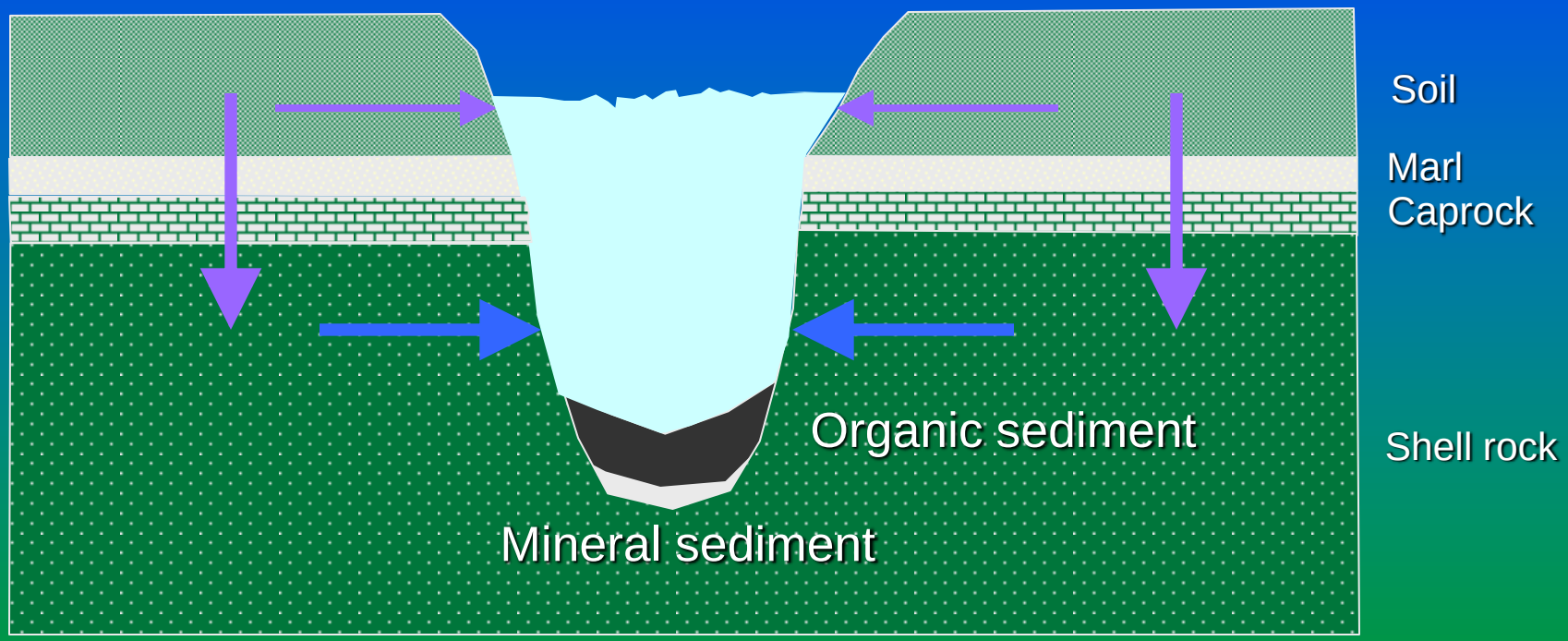
Soil

Marl Caprock

Shell rock

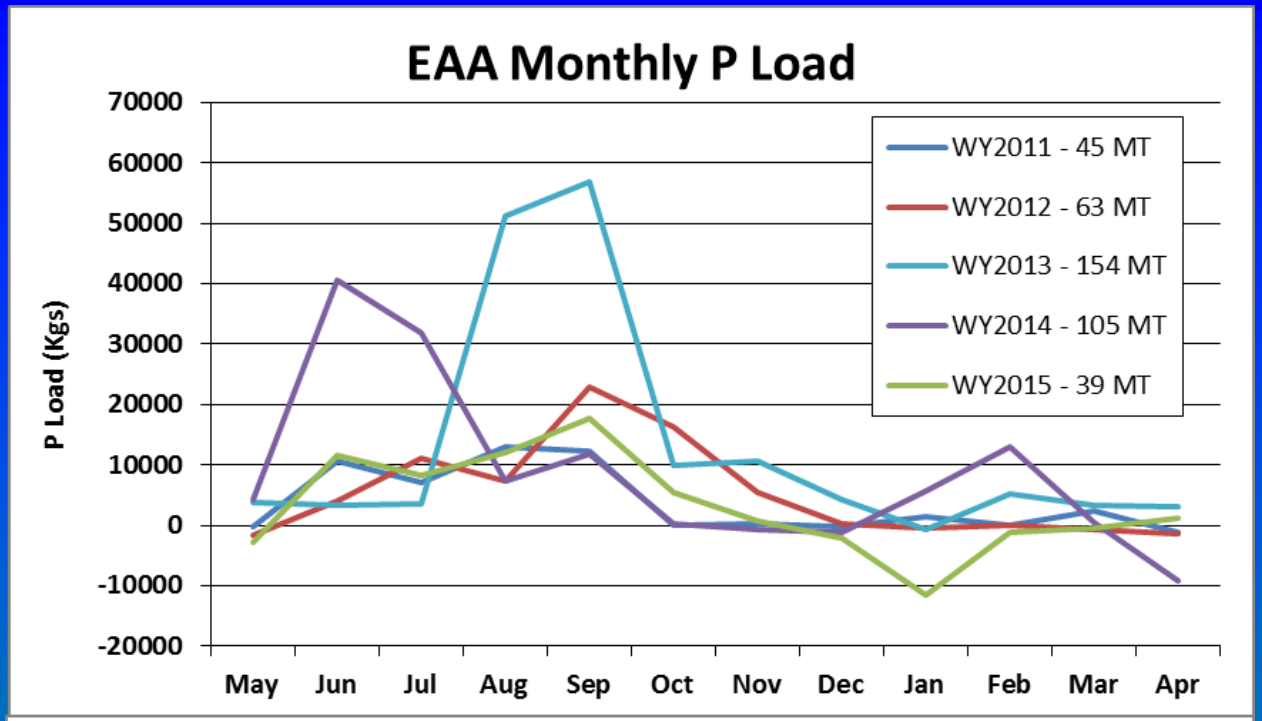
Closing Thoughts

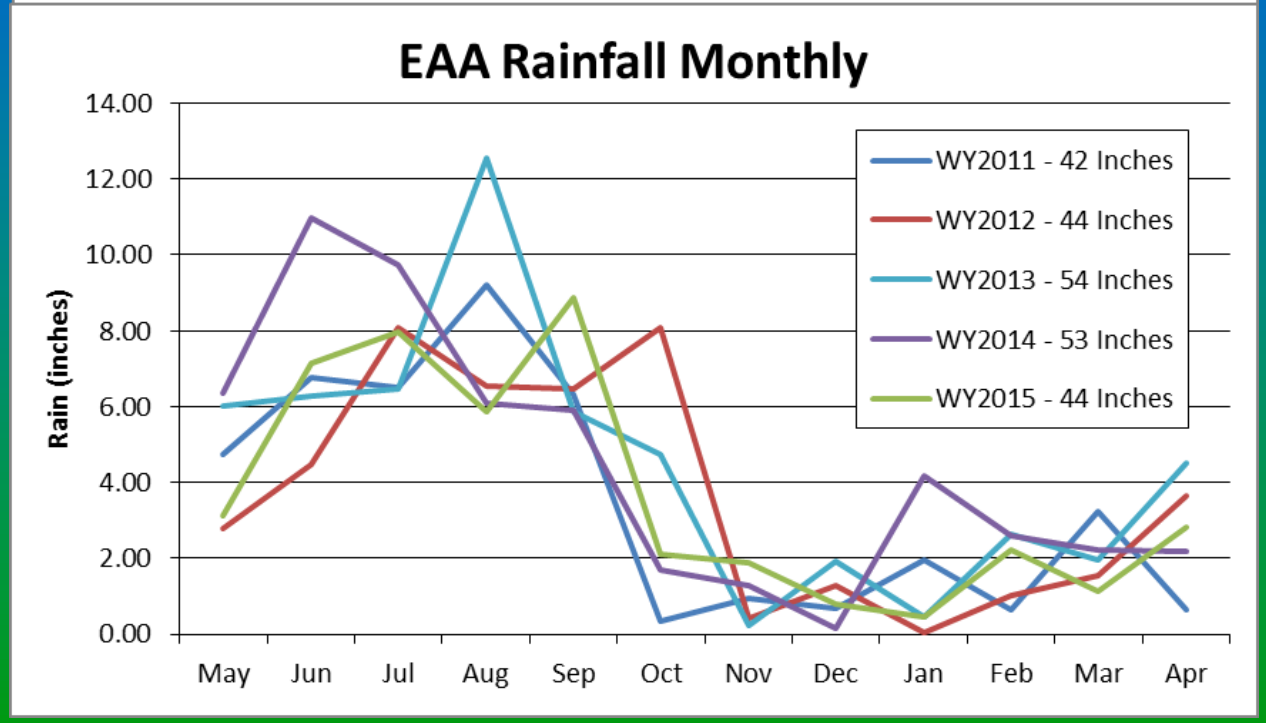
Farm Drainage Process



velocity = (drainage flow rate)/(canal cross-sectional area)

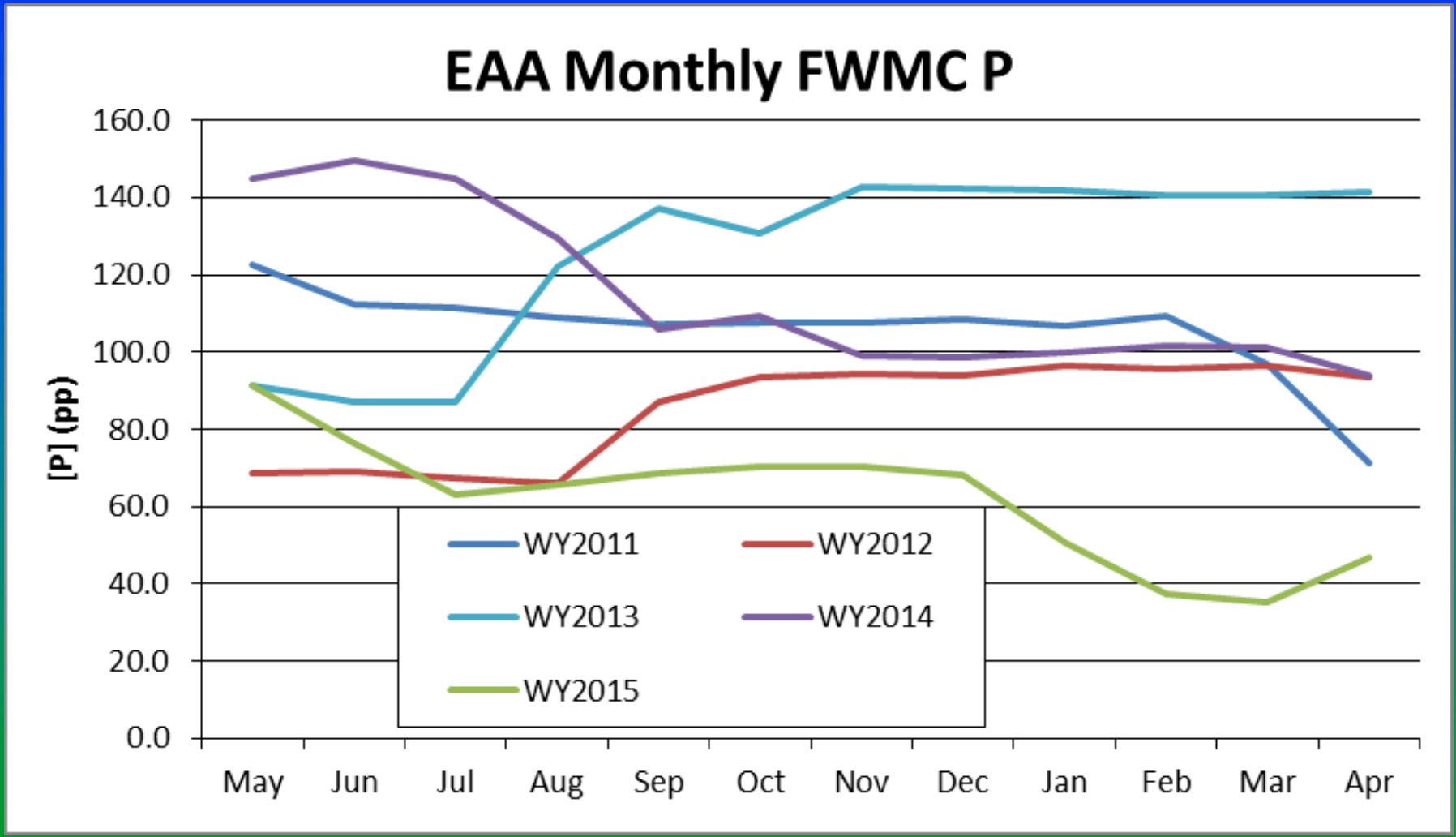
m/sec = (m^3/sec)/(m^2)



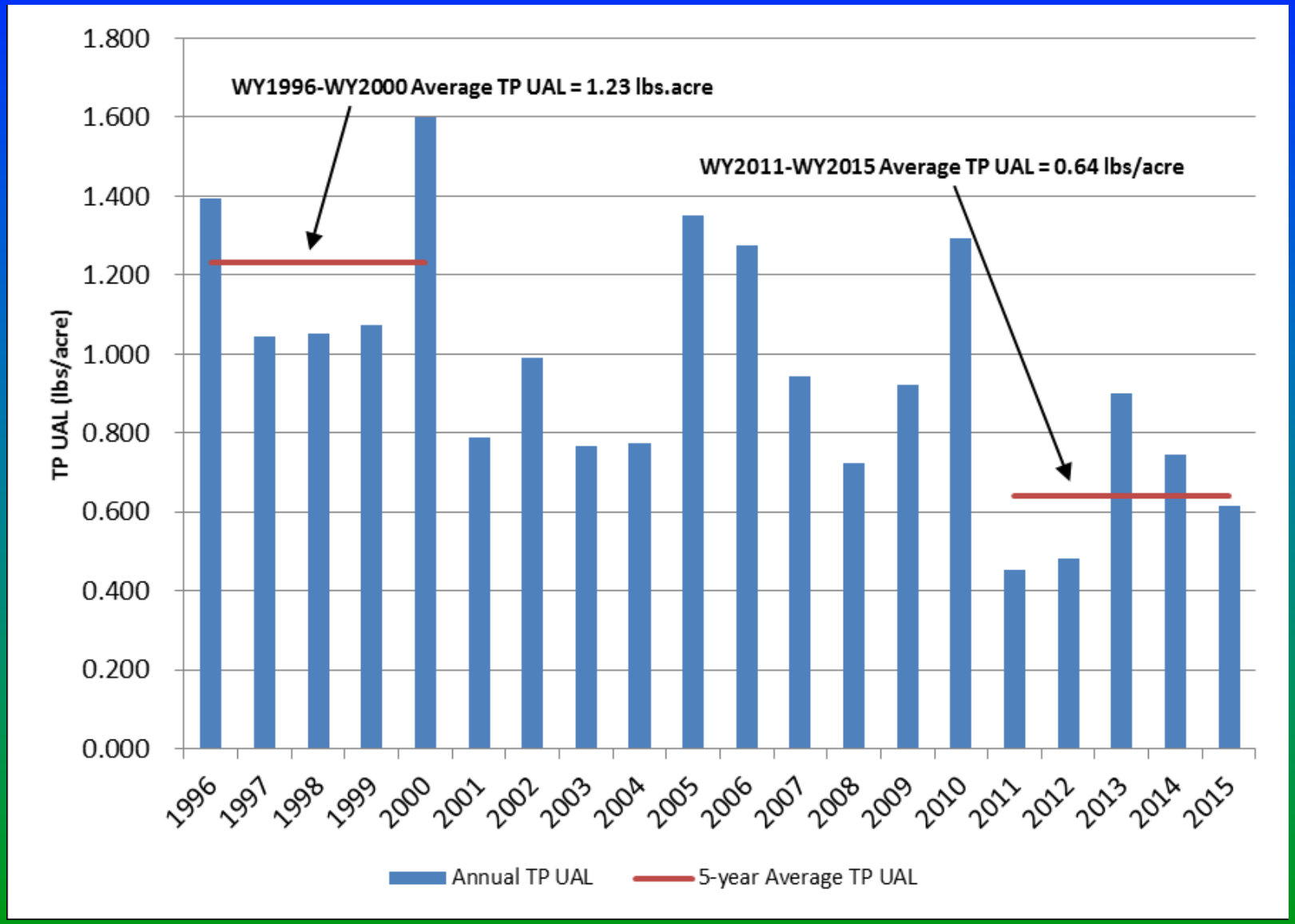


Water Year	% Reduction
WY2011	79%
WY2012	71%
WY2013	41%
WY2014	63%
WY2015	79%

Closing Thoughts



Closing Thoughts




Thank You!