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

Soil surface

Organic Soil

Marl

Cap rock

Shell rock

CaCO₃

Cracks/fissures
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
Early Flooding

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

<table>
<thead>
<tr>
<th>Pump Number</th>
<th>Engine RPM</th>
<th>Date</th>
<th>Time</th>
<th>Gage In</th>
<th>Gage Out</th>
<th>Date</th>
<th>Time</th>
<th>Gage In</th>
<th>Gage Out</th>
<th>Discharge Code</th>
<th>Engine Number</th>
<th>Hour Reading</th>
<th>Operator's Initials</th>
</tr>
</thead>
</table>

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

Rain Today?

Rain > 24hr Threshold?

Rain in past 24 hrs?

72 hr rain > 72 Threshold?

Is Freeboard Acceptable?

Irrigation in past 24 hrs?

No Pumping Required

Pumping Required
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

Daily Rainfall vs. Pumping

Rain (inches)

Volume (Kgal)

RAIN
TOTALV

A

B
Implementation of Rainfall Detention – Example
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]
Increased farm canal capacities

Lower P loads
Can pump less after improving drainage control for specific fields
Installed booster pumps

Still Lower P loads
Routing drainage water internal to the farm can greatly reduce reliance on main farm pump.
- 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.

**Lowest P loads**

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

CONTROL BLOCK

CON TP
CON PP
CON TDP
CON Velocity
CON Flow

BMP BLOCK

BMP TP
BMP PP
BMP TDP
BMP Velocity
BMP Flow
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

Shallow Soil 1

Shallow Soil 2
**Closing Thoughts**

Farm Drainage Process

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

m/sec = (m³/sec)/(m²)
Water Year % Reduction

<table>
<thead>
<tr>
<th>Water Year</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>WY2011</td>
<td>79%</td>
</tr>
<tr>
<td>WY2012</td>
<td>71%</td>
</tr>
<tr>
<td>WY2013</td>
<td>41%</td>
</tr>
<tr>
<td>WY2014</td>
<td>63%</td>
</tr>
<tr>
<td>WY2015</td>
<td>79%</td>
</tr>
</tbody>
</table>

EAA Monthly P Load

EAA Rainfall Monthly
Closing Thoughts

![EAA Monthly FWMC P Graph](#)
Closing Thoughts

WY1996-WY2000 Average TP UAL = 1.23 lbs/acre

WY2011-WY2015 Average TP UAL = 0.64 lbs/acre
Thank You!