Effects of Hydrology, Time and Inflow Concentration on Phosphorus Discharge From a Periphyton-based Stormwater Treatment Area

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Methods and Objectives

- Evaluate high frequency measurements of total phosphorus (TP) into and out of the STA-3/4 Periphyton-based Stormwater Treatment Area (PSTA)
- Find the signals in the noise
 - Remove extreme events
- Evaluate only flow related measurements
- Under what conditions are low TP values attained?
- Evaluate response of outflow TP concentration to
 - Flow
 - Time
 - Inflow TP concentration
 - Stage (water level) Operation

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Periphyton-based Stormwater Treatment Area



PSTA Remote Phosphorus Analyzer



RPA TP Measurements



RPA TP Measurements: Pulse Tests, TS Isaac and November 3-14, 2012 outliers removed



PSTA water levels controlled by Pump

G388 pump discharge

Controlled by water level



Pump Operation and data selection



sfwmd.gov Restoration Strategies for clean water for the Everglades

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RPA TP Measurements: Pulse Tests, TS Isaac and November 3-14, 2012 outliers removed (flow only)



Cumulative Frequency (Flow Only)



- Outflow TP concentrations are generally lower than inflow
- Over 80% of outflow samples are at or below 15 ppb

Stage Operation



Cumulative Frequency at G-388 outflow for different times of day



Cumulative Frequency at G-388 outflow at 10.0 and 10.5 feet NGVD stage operation

Flow 10.0 ft stage
Flow 10.5 ft stage
No flow 10.0 ft stage
No flow 10.5 ft stage



- TP concentrations are lower at 10.0 ft NGVD compared to 10.5 ft NGVD stage operations*
- During no flow periods, values are slightly higher but are not different between stages

* Complicated by higher inflow concentrations during higher stage operations

Cumulative Frequency at G-390 inflow during 10.0 and 10.5 feet NGVD stage operation in PSTA Cell

- TP concentrations are lower during 10.0 ft NGVD stage operation than 10.5 ft NGVD stage operation
- What is cause? Plant management activities in STA Cell upstream of PSTA



Stage and Flow Comparisons (G-388 outflow) percent of samples at or below 10 ppb, 13 and 15 ppb



- 10.0 ft NGVD stage: larger percentage of samples at or below given value *
- Problem is that inflow concentration during 10.5 ft operation are higher

RPA TP Measurements: Pulse Tests, TS Isaac and November 3-14, 2012 outliers removed (flow only)



Stage and Flow Comparisons (G-388 outflow) percent of samples at or below 10 ppb, 13 and 15 ppb



Removing the period of higher
 TP concentrations
 (February to July
 2013) the summaries are more similar

G-390 Inflow vs G-388 outflow concentrations (Weekly flow weighted means)

- Linear trends are significant
- Analysis of Covariance indicate trend lines are not significantly different (p > 0.07)
- PSTA effectiveness is similar at different stage operations
- Effect of seepage cannot be determined



stage 10.5 ft

• stage 10.0 ft

Stage and Flow Comparisons (G-388 outflow)



Highest percentage of TP measurement at or below target occur at

- 10.0 ft NGVD
 - 548-642 minutes of pump operation
- 10.5 ft NGVD
 - 534-638 minutes of pump operation

Summary

- PSTA cell effectively remove P, except at ultra low inflow concentrations (i.e. < 8 ppb phosphorus)
- Large percent of outflow measurements below 10, 13 and 15 ppb
- PSTA effectiveness was similar at 10.0 ft NGVD and 10.5 ft NGVD
 - Seepage could not be evaluated
 - Best performance at moderately high flows

QUESTIONS?

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