Restoration Strategies: Stormwater Treatment Area Science Plan Update

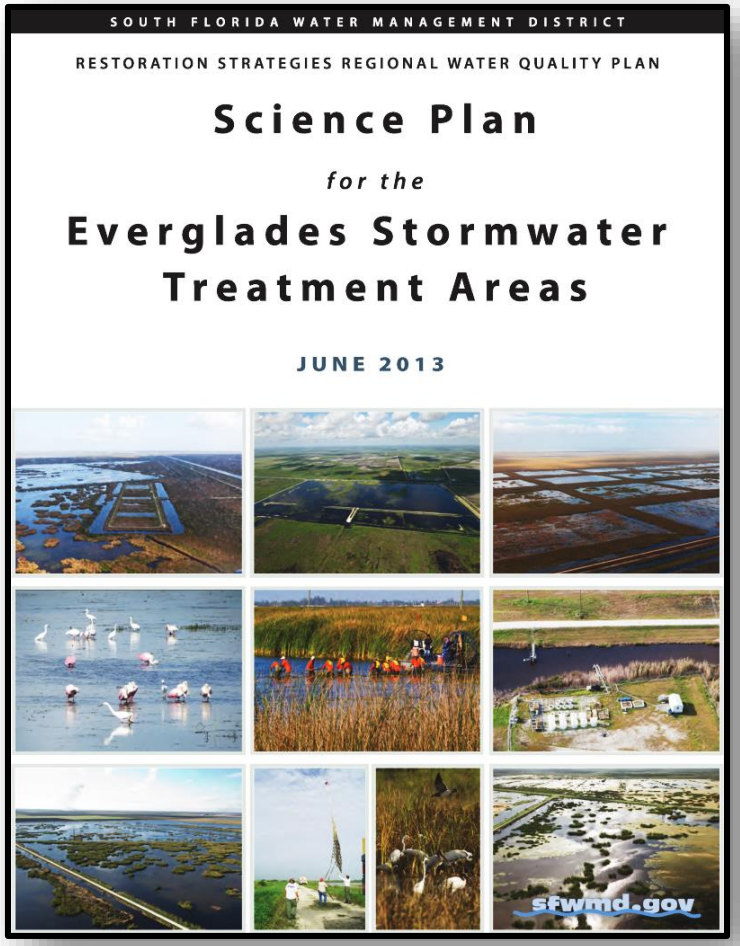
15th Annual Public Meeting on the Long-Term Plan for Achieving Water Quality Goals for Everglades Protection Area Tributary Basins

February 23, 2018

Delia Ivanoff: Section Administrator and
Tom James: Principal Scientist
Water Quality Treatment Technologies Section
Applied Sciences Bureau, Water Resources Division

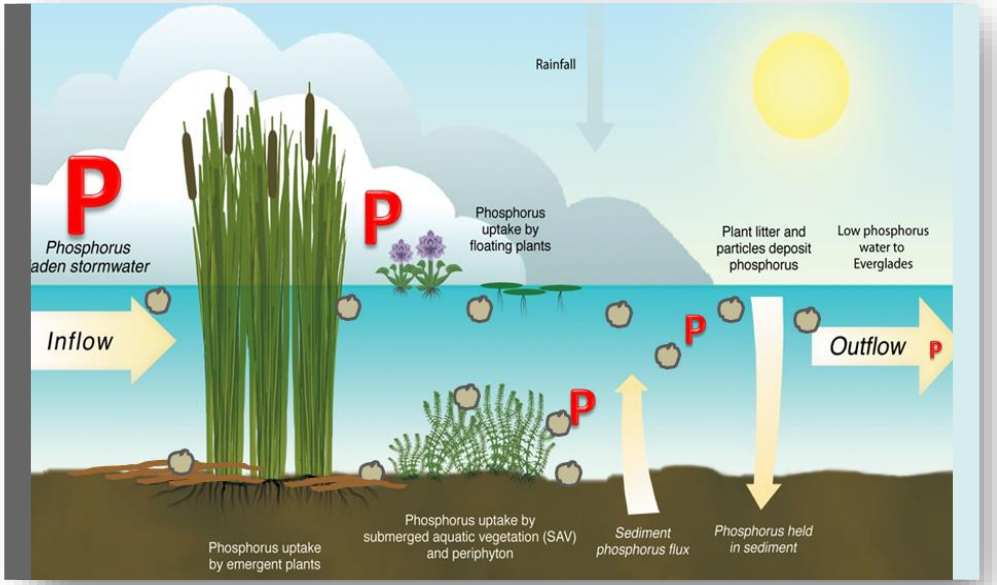
Purpose of the Science Plan

- Specified in Restoration Strategies and required by STA permits and consent orders
- Study key factors and processes that affect phosphorus removal in the STAs
- Use results to aid design, operation, & management of STAs to achieve WQBEL



Areas of Investigation

FEB



1. Design & operation of FEBs
2. Design & operation of STAs
3. Vegetation improvement
4. Internal loading of phosphorus
5. Biogeochemical or physical mechanisms
6. Role of fauna

6 key questions & 39 subquestions on these topics

First 5 Years of Implementation



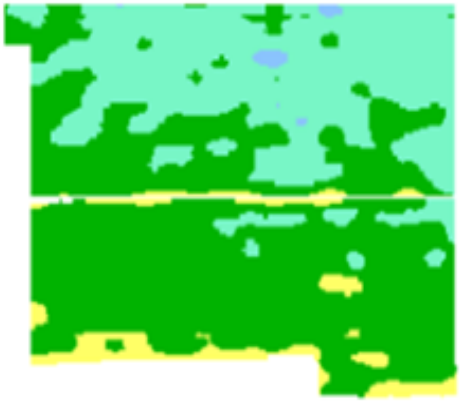



Initial Studies

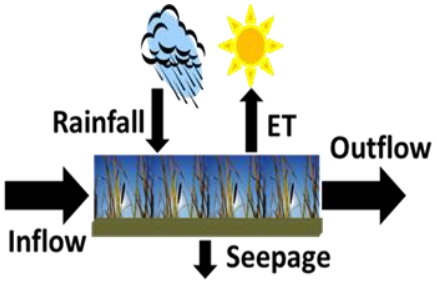
Study	Description
Role of rooted floating aquatic vegetation	Ongoing. Compared water quality and soil within patches of water lily, American lotus, and spatterdock vs. SAV
Cattail sustainability	Ongoing. Assess effects of deep water condition on cattails and determine flooding depth and duration threshold.
P Storage and Release within the flow-ways	Ongoing. Investigating P dynamics in water, soil, and biota.
STA 3/4 PSTA	Nearing completion. Cell achieved ≤13 ppb long-term. Performance was found to be stable.
Soil Amendments	Literature review completed; many amendments could sequester P, but costs are high and there are uncertainties in large scale application and effects on downstream marsh. Investigating benefits of soil inversion in STA-1W Expansion #1.

Initial Studies

Study	Description
Developing modeling and other tools to enhance STA operation	Wave tests in selected flow-ways to better understand the physical systems affecting flows. Models and tools have been developed.
STA Water and P Budget Improvements	Ongoing. Improve flow data and calculations for water budget and phosphorus budget
Influence of canals on inflow and outflow TP concentrations	Completed. Findings supports the importance of FEBs to reduce peak flows. No significant release of P at outflow canals.
Evaluation of Sampling Methodologies for TP	Completed. Compared autosampler, grab, and remote P analyzer



Water depth model, STA-3/4 Western Flow-way



Water budget components

Phosphorus Storage and Release within the STAs

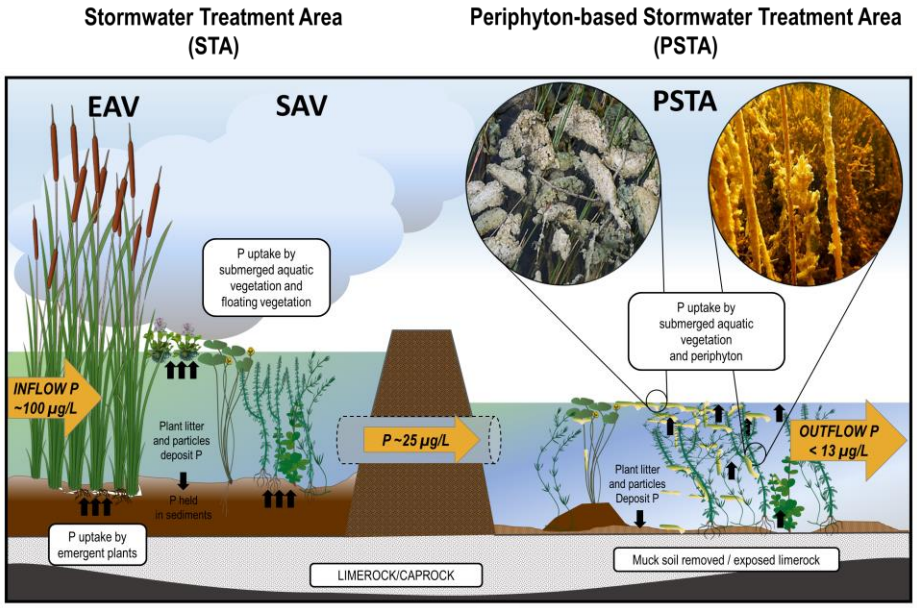
- Steady loading of Phosphorus into the STAs
  - Major fraction of P stored in soil
  - Greater P accretion (in soil and plant biomass) in the inflow region than in the outflow region
- No P release from soil was detected in the outflow region
- Water column P increases during no-flow periods, particularly after heavy loading

Soil core from an STA cell

Monitoring platform at interior location in STA-2

STA-3/4 Periphyton-based STA

- WY2008-2017 - achieved ≤13 ppb
- Cell features:
  - Scraped muck
  - SAV and periphyton
  - Low inflow TP concentration
- Stable performance despite variable operational conditions
  - Performance is optimal when inflow concentration is <22 ppb
- Limerock capping is a potential alternative to muck removal



Revisions to the Science Plan

- New work plan for the next five year implementation
  - Review knowledge gained from initial 5 years implementation and from previous years
  - Review uncertainties and knowledge gaps
  - Update list of questions as needed
- Submit to FDEP by June 2018

Key Questions

1. How can the FEBs/Reservoirs be designed and operated to moderate phosphorus concentrations and optimize phosphorus loading rates and hydraulic loading rates entering the STAs, possibly in combination with water treatment technologies, or inflow canal management?
2. What operational or design refinements could be implemented at existing STAs and future features (i.e., STA expansions, FEBs/Reservoirs) to improve and sustain STA treatment performance?
3. What measures can be taken to enhance vegetation-based treatment in the STAs and FEBs?
4. How can internal loading of phosphorus to the water column be reduced, especially in the lower reaches of the treatment trains?
5. How can the biogeochemical or physical mechanisms be managed to further reduce phosphorus concentrations at the outflow of the STAs?
6. What is the influence of aquatic fauna and waterbirds on the reduction of phosphorus in the STAs and how can they be managed to increase benefits and reduce impacts on STA performance?

Work Plan Focus - Next 5 Years

- **STA & FEB Operation**
  - Optimal FEB & STA Operation
  - Optimal EAA canal levels to benefit STA performance
  - Downward advective P transport
- **Vegetation Sustainability**
  - Improving resilience of vegetation (emergent & submerged)
  - Evaluate benefits of prescribed burns on EAV resilience
  - Factors affecting cattail sustainability
  - Prescribed burns on EAV resilience
- **Fauna**
  - Role of fauna on P uptake and release
  - Potential fauna management strategies
- **Biogeochemistry**
  - Sources, storage, transformations, & release of P
  - Soil inversion
  - Marl consolidation
  - Challenges in STA performance
- **Other**
  - Water and phosphorus budget improvements
  - Data synthesis & integration

Current Projects (timelines)

Study Name	Current Activities and Completion date
Use of Soil Amendments/ Management to Control P Flux Management	Field trials 1/2019-12/2020
Evaluation of P Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment of the STAs	Phase II monitoring and reporting 1/2018 – 12/2018
Development of Operational Guidance for FEB and STA Regional Operation Plans	Ongoing through 2020
Evaluate P Sources, Forms, Flux, and Transformation Processes in the STAs	Data collection 1/2018 – 12/2019
Investigation of STA-3/4 PSTA Performance, Design and Operational Factors	Mesocosm studies and final reports 1/2018-12/2018
Evaluation of Impacts of Deep Water Inundation Pulses on Cattail Sustainability	In-situ study 1/2018 -12/2018 Test cell study 1/2019-12/2020
STA Water Budget Improvements	Ongoing through 2020
Improving Resilience of Submerged Aquatic Vegetation in the STAs	Literature review 1/2018-8/2018 Data mining and reporting 8/2018 -12/2018
Investigation of the Effects of Abundant Faunal Species on P Cycling in the STA	Experiments to Quantify faunal biomass and herbivory 1/2018 -6/2020
Evaluation of Factors Contributing to the Formation of Floating Tussocks in the STAs.	Literature review 1/2018-8/2018 Data mining and reporting 9/2018-2/2019
Linking Sources of Particulate Organic Matter and P in STA Applications of Chemical Biomarkers	Sample collection 1/2018 – 8/2018 Analyses 9/2018-12/2018

Questions?

Tom James
tjames@sfwmd.gov