Restoration Strategies

Science Plan
and 5-Year Work Plan Update

Long Term Plan
Communications Meeting

August 23, 2013

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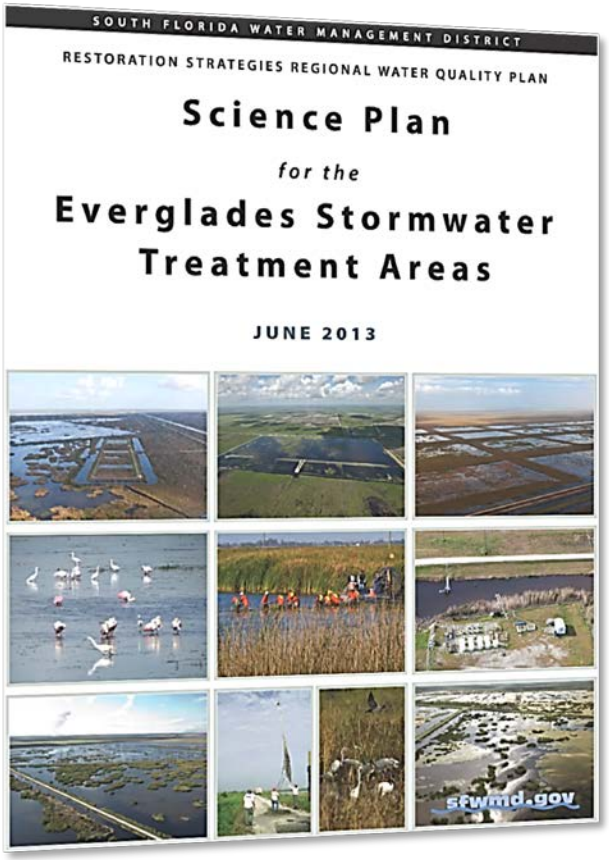
Science Plan: Purpose and Objectives

Consent Orders and Framework Agreement require SFWMD to develop and implement a Science Plan

- **Purpose and Objectives:**
  - Identify the key factors that collectively influence phosphorus reduction and treatment performance in order to meet the WQBEL
  - Identify studies that investigate these key factors that influence phosphorus treatment performance
  - Focus on better understanding design and operations that sustain low outflow phosphorus concentrations (<20 ppb)
  - Use information gathered to inform design and operations which will improve the ability of STAs to achieve the WQBEL

Science Plan: Progress to Date



- Technical Representatives (Tech Reps) meetings (**Nov. 2012 – May 2013**)
- Draft Science Plan available for public review and comment (**Apr. 11, 2013**)
- Stakeholder/Public review of Draft Science Plan (**Apr. 11 – May 22, 2013**)
- Status update at Long-Term Plan Quarterly Communication Meeting (**May 22, 2013**)
- Final Science Plan submitted to FDEP (**June 7, 2013**)

Science Plan: Progress to Date (cont.)

- Initial nine proposed study plans approved by SFWMD RS Steering Group **June 3 – July 15, 2013**
- Science Plan implemented **July 15, 2013** (*ahead of Sep. 10, 2013 deadline*)
- Study Plan-focused workshops with Tech Reps, federal agency experts and consultants **July – Aug. 2013**

Science Plan:
Initial Study Plans

1) Use of Soil Amendments/Management to Control P Flux

2) Evaluation of P Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment of the STAs

3) Development of Operational Guidance for FEB and STA Regional Operation Plans

4) Evaluate P Sources, Forms, Flux, and Transformation Processes in STAs

5) Investigation of STA-3/4 PSTA Technology Performance, Design and Operational Factors

6) Evaluation of the Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow TP Concentrations

7) Evaluation of Impacts of Deep Water Inundation Pulses on Cattail Sustainability

8) STA Water and Phosphorus Budget Improvements

9) Evaluation of Sampling Methodologies for TP

Science Plan:
Initial Study Plans

1) Use of Soil Amendments/Management to Control Phosphorus Flux

STA water column concentrations may increase through the flux of phosphorus from the soil

- **Study Objective/Purpose**
  - Determine if flux of phosphorus from the soil can be reduced with soil amendments or management techniques such as lime rock caps or deep tilling

Science Plan:
Initial Study Plans

1) Use of Soil Amendments/Management to Control Phosphorus Flux

Potential Approaches to Reducing Soil P Flux

- **Status/Path Forward**
  Approved through FY 2014 (Phase 1)

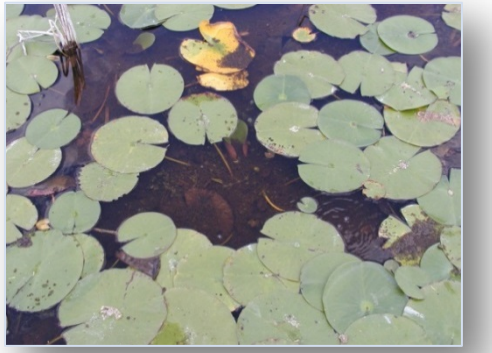
  - **Phase 1**
    - Summarize past work, literature review, feasibility study
    - **Stop-Go**
  - **Phase 2**
    - Bench-scale screening of amendments
    - **Stop-Go**
  - **Phase 3**
    - Field-scale trials in large scale constructed experimental wetlands within STAs to provide recommendations for full-scale implementation

Science Plan:
Initial Study Plans

2) Evaluation of Phosphorus Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment of STAs

Preliminary results from this ongoing study indicate that water lily and/or sawgrass may reduce phosphorus concentrations below that of cattail and/or SAV

- **Study Objective/Purpose**
  - Evaluate nutrient removal efficacy of water lily and sawgrass under very low phosphorus conditions and examine major processes and mechanisms underlying phosphorus assimilation functions
- **Status/Path Forward**
  - Approved through FY 2014
  - Data collection phase to be completed in2013
  - Currently evaluating path forward



Science Plan: *Initial Study Plans*

3) Development of Operational Guidance for FEB and STA Regional Operation Plans

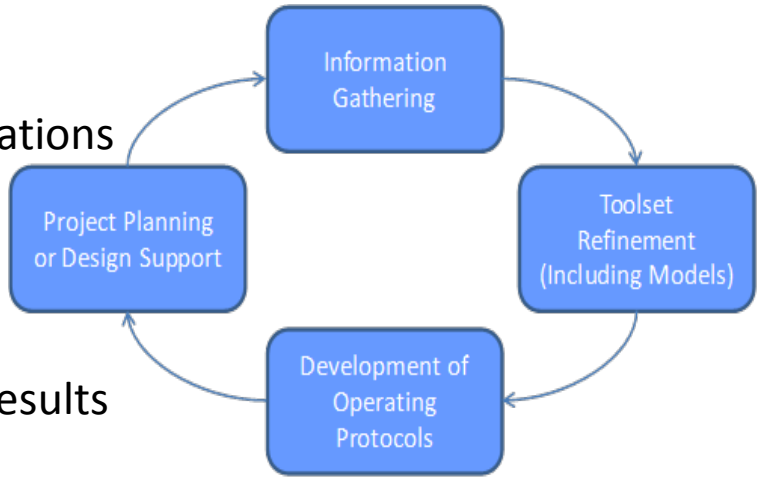
This **ongoing** project involves development of operational protocols to operate FEBs in conjunction with STAs to optimize hydraulic and treatment performance

- **Study Objective/Purpose**

  To develop operational protocols for FEBs/STAs to:

  - Manage FEB storage to minimize STA deep water conditions, diversions and dry-out
  - Manage FEB outflows and STA inflows to minimize STA outflow phosphorus concentrations

- **Status/Path Forward**
  - Approved through FY 2016
  - Support initial FEB operating plans
  - Protocol refinement based on operational results

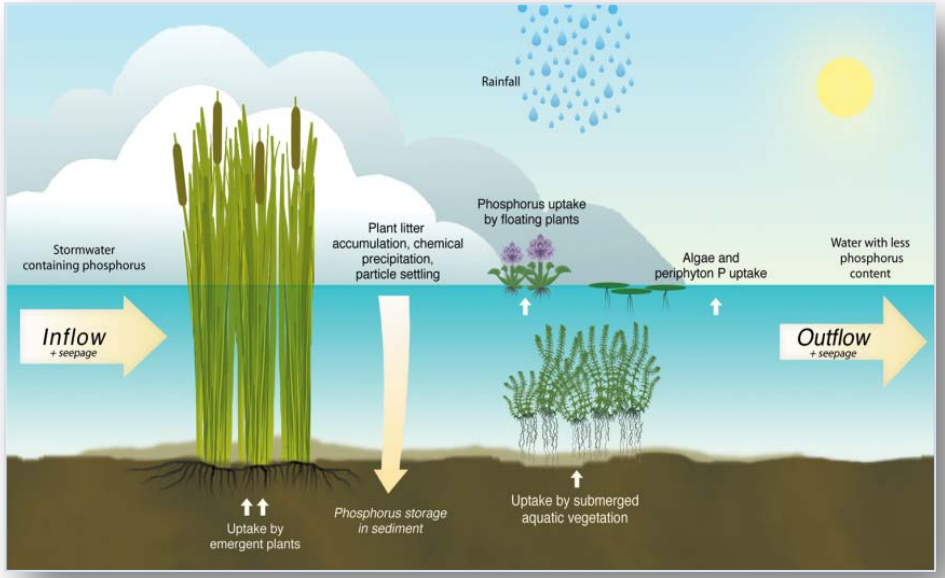


Science Plan: *Initial Study Plans*

4) Evaluate Phosphorus Sources, Forms, Flux and Transformation Processes in the STAs

A better understanding of the biogeochemical factors and mechanisms controlling TP concentrations, particularly at the downstream end of the STA flow-ways is needed

- **Study Objective/Purpose**
  Characterize phosphorus speciation, cycling and transport:
  - Determine the factors affecting phosphorus cycling
  - Understand the composition of phosphorus in STA discharges
  - Evaluate performance under different flow rates
  - Compare STA with natural areas (WCAs)
  - Develop recommendations on improving STA performance

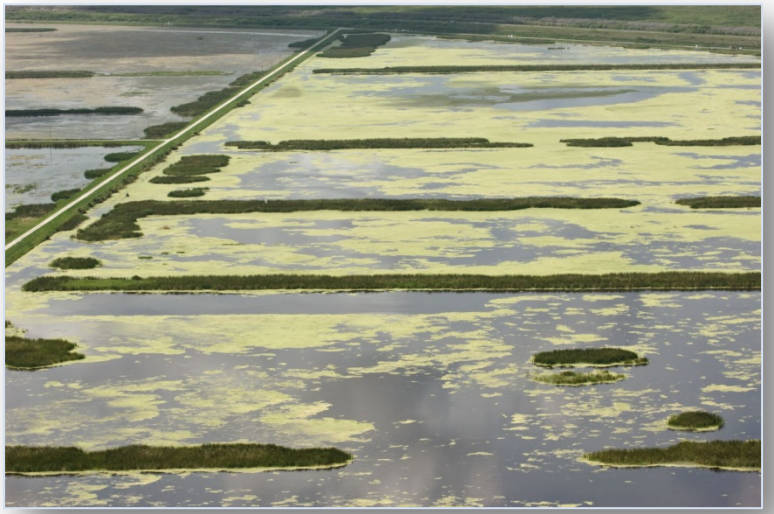


Science Plan: *Initial Study Plans*

4) Evaluate Phosphorus Sources, Forms, Flux and Transformation Processes in the STAs

- **Status/Path Forward**

  Phase 1 Approved through FY 2014



  - Literature review
  - Review and analysis of existing data
  - Refinement of conceptual models
  - Research plan development
  - Technical workshop
  - Research plan refinement
  - Independent peer review
  - Finalize research plan
  - Specialized methodology assessments and evaluation
  - Initial surveys and studies

Science Plan: *Initial Study Plans*

5) Investigation of STA-3/4 PSTA Performance, Design and Operational Factors

This **ongoing** project has consistently achieved TP concentrations <12 ppb, but further investigation is needed to better assess performance and understand the mechanisms and factors that achieve and sustain ultra-low TP concentrations at STA outflows

- **Study Objective/Purpose**
  - Determine design elements, operational factors, and biogeochemical characteristics that enable the achievement of ultra-low TP levels
- **Status/Path Forward**
  - Approved through FY 2017
  - Scalability and transferability of the technology will be evaluated as part of this study

PSTA Path Forward

- **Status/Path Forward**
  - **Finalize detailed PSTA Science Plan document**
  - **Continue monitoring, sampling, and implementation of studies to evaluate PSTA**
  - **Continue assessment of PSTA performance**
    - Improve water budget and P mass balance calculations
  - **Identify management practices to maintain performance**
    - Hydraulic and P loading
    - Operating depth
    - Vegetation and soil control

Science Plan:
Initial Study Plans

6) Evaluation of the Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow Concentrations

Changes in surface water phosphorus concentrations have been observed in canals of multiple STAs. Various factors that could potentially influence concentrations include sediments, phosphorus speciation, flow velocities, dryout/re-wetting and seepage

- **Study Objective/Purpose**
  - Determine whether phosphorus concentrations change when conveyed through STA inflow and outflow canals
  - Evaluate sediments and seepage to and from STA inflow and outflow canals

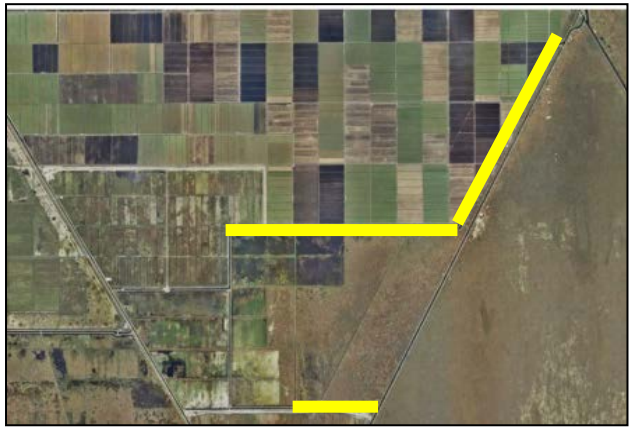
Science Plan:
Initial Study Plans

6) Evaluation of the Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow Concentrations

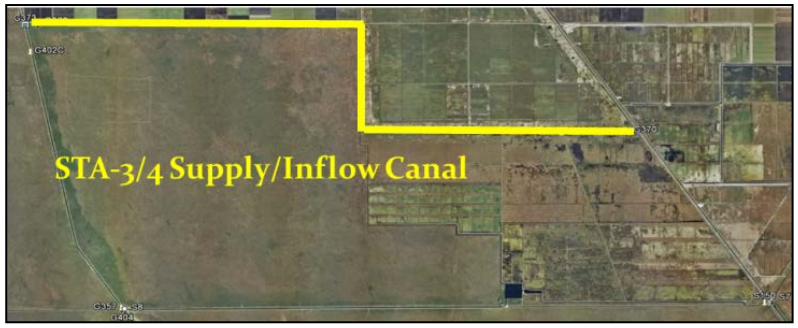
- **Status/Path Forward**

  Approved through FY 2018

  - **Phase 1**
    - Review existing water quality and flow data and limited field data to determine if TP concentrations change when conveyed through selected STA inflow or outflow canals
    - Determine main factors influencing changing TP concentrations in selected STA canals
    - Estimate TP and sediments accumulated in selected canals
    - Prepare summary report including recommendations and costs for Phase II



Example canals:
STA-2 supply/inflow and discharge canals
& STA-3/4 supply/inflow canal



Science Plan:
Initial Study Plans

6) Evaluation of the Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow Concentrations

- **Status/Path Forward (continued)**
  - **Phase II – Stop-Go**

    If warranted could consist of:

    - Canal cross section surveys
    - Sediment sampling and laboratory studies
    - Estimate of sediment and TP accumulated in canal based on field investigations
    - Hydrodynamic modeling to simulate sediment transport and identify optimized operational factors
    - Recommendations for optimized structural operation and design to improve STA performance
    - Recommendations and cost estimates for remedial field work (eg. dredging)

Science Plan: *Initial Study Plans*

7) Evaluation of Impacts of Deep Water Inundation Pulses on Cattail Sustainability

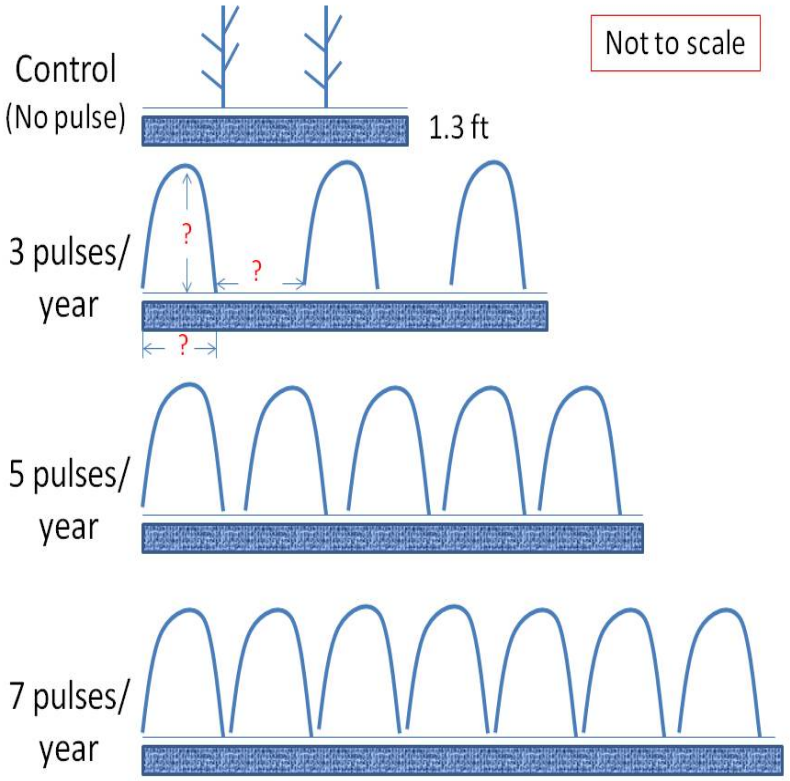
Peak flows often occur in the wet season and cause deep water in STAs which can adversely impact cattail and negatively affect treatment performance

- **Study Objectives/Purpose**
  - Evaluate the influence of deep water pulsing on cattails
  - Assess impacts of cattail stress on STA performance
  - Provide recommendations for STA and FEB operations
- **Status/Path Forward**
  - Approved through FY 2017
  - Historical data analysis phase and test cell phase

Science Plan: *Initial Study Plans*

7) Evaluation of Impacts of Deep Water Inundation Pulses on Cattail Sustainability

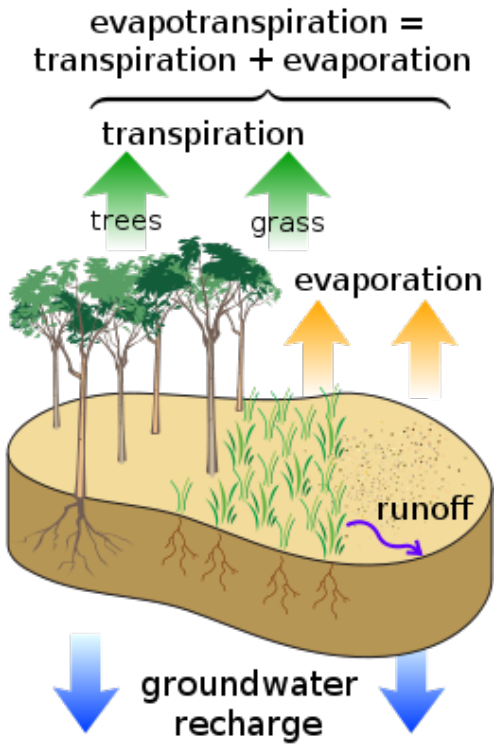
- **Status/Path Forward (continued)**
  - **Phase I**
    - Historical data analysis to determine the frequency, intensity, timing, and duration of inundation pulsing in the STAs, and to provide information on inundation pulsing for the experimental design of a test-cell study
    - Test cell study to evaluate maximum inundation depth and pulse frequency



Science Plan: *Initial Study Plans*

8) STA Water and Phosphorus Budget Improvements

Water and phosphorus budget analysis is an important tool for understanding STA treatment performance; however, developing accurate water budgets is not simple in large-scale wetland systems like STAs



- **Study Objectives/Purpose**
  - Determine sources of error in water budget components and how they can be reduced
  - Phased approach; develop improved water budgets for a test case (STA-3/4 Cells 3A and 3B)
  - Long term goal is to develop improved water and phosphorus budgets
- **Status/Path Forward**
  - Approved through FY 2014
  - Improved Water and Phosphorus Budgets for Cells/Flow-ways based on Science Plan needs

Science Plan:
Initial Study Plans

8) STA Water and Phosphorus Budget Improvements

Water Budget Test Case Results Summary

1. Low head differentials across mid-levee culverts main source of water budget error
2. Annual water budgets greatly improved with revised flow data
3. R*ainfall*, *ET* and *Change in Storage* minor contributors and current estimation methods found to be acceptable
4. Seepage estimates added as improvement to previous water budget estimates
5. Annual water budget results acceptable for TP performance estimates and hydraulic and TP modeling efforts
6. Test case results may not translate to all STA cells

Next Steps

- Currently developing scope for next phases of study
- Will include improved Water and Phosphorus Budgets for Cells/Flow-ways to meet needs of Science Plan

Science Plan:
Initial Study Plans

9) Evaluation of Sampling Methods for Total Phosphorus

Significant differences between grab samples and autosamplers and results from new technology. Remote Phosphorus Analyzers (RPAs) highlight issues that may impact the calculation of representative STA outflow phosphorus concentrations

- **Study Objective/Purpose**
  - To determine sampling method that provides the most accurate representation of total phosphorus
- **Status/Path Forward**
  - Approved for FY 2017 (one year study)

Autosampler vs. Grab Samples

- The primary method for collecting water for chemical analysis has been through grab samples
- An alternative method initiated in the early 1990s began using machines (autosamplers) to collect in response to flow or time
- While often the two methods provide similar results, there is a body of data showing differences
- This difference is a concern and a number of studies have examined and collected data on the issue

Data Interpretation

- **Grabs and RPAs appear to be comparable**
- **Autosamplers appear to be comparable to other methods most of the time, but**
  - Autosampler data should be evaluated in context of flow
  - Autosampler data is purposely biased towards high flow events, which may lead to erroneous conclusions concerning low flow or non-flowing events during the same week
  - Ephemeral events (spikes that may last less than 6 hours) may be unduly influencing weekly auto sampler results

Science Plan: Path Forward

- Continue to implement Science Plan
- Integrate input received from RS Tech Reps during Summer 2013 Study Plan-focused workshops
- Update Study Plans and Schedules
- Finalize procurement needs to assist with future Science Plan implementation activities

Questions?

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