Restoration Strategies

Science Plan and 5-year Work Plan Update

Long Term Plan Communications Meeting
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Science Plan: Progress to Date

- ✓ Consent Orders and Framework Agreement require SFWMD to develop and implement a Science Plan
- ✓ Initiated Plan development in August 2012 with contributions from 45 District scientists, modelers and engineers, 6 Technical Representatives and two federal consultants
- ✓ Formulated 6 overarching key questions and detailed sub-questions to address information gaps and guide research needs
- ✓ Prioritized science questions based on 4 criteria (testability, feasibility, timeliness and importance)
- ✓ Identified initial suite of 9 studies for first phase of 5-year work plan
- ✓ Held 4 workshops with Technical Representatives and their consultants during **December 2012 - March 2013**

Science Plan: Progress to Date (Cont.)

- ✓ Incorporated suggestions/comments from Technical Representatives/Consultants into plan development
- ✓ Provided opportunity for public/stakeholder input to Science Plan at Long Term Plan Communications Meetings – **November 2012 and February 2013**
- ✓ Review of draft Science Plan documents by Technical Representatives (**March 2013**)
- ✓ Provided Science Plan update at WRAC meeting (**April 4, 2013)**
- ✓ Review of draft Science Plan documents by external stakeholders/public (**April 11 – May 22 2013**)
- ✓ Provide Science Plan update at Long-Term Plan Communication Meeting (**May 22, 2013**)

Science Plan: Review Process

- The Science Plan process includes several levels of review:
  - SFWMD Restoration Strategies Science Plan Team
  - Technical Representatives Meetings
  - SFWMD Restoration Strategies Steering Group
  - Long-Term Plan Quarterly Communications Meetings
  - Principals Meetings
  - Water Resources Advisory Commission/Governing Board Meetings
  - South Florida Environmental Report
- Peer Review of research proposals and results will be conducted as needed

Science Plan: Table of Contents

Science Plan: Appendices

A) Consent Orders and Framework Agreement

B) STA Schematic Maps

B) Five-Year Work Plan

- 9 study plans
- Schedules

C) STA Water Quality Monitoring Plans

5-year Work Plan: *Initial Suite of Proposed Studies*

- ✓ 1) PSTA Technology Performance, Design, and Operational Factors (STA-3/4 PSTA)
- ✓ 2) Operational Guidance for FEBs and STAs and a Regional Operation Plan
- ✓ 3) Phosphorus Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment of the Stormwater Treatment Areas
- ✓ 4) STA Water Budget Improvements
- 5) Phosphorus Sources, Forms, Flux, and Transformation Processes in STAs
- 6) Influence of Canal Conveyance on STA Inflow and Outflow Phosphorus Concentrations
- 7) Impacts of Deep Water Inundation Pulses on Cattail Sustainability
- 8) Soil Management/Amendments to Control P Flux
- 9) Sampling Methodologies for Total Phosphorus

5-year Work Plan: Proposed Studies

- Duration of studies -1 to 6+ years
- Leverages existing research:
  - Evaluation of phosphorus removal efficacy of water lily and sawgrass in a low nutrient environment
  - Investigation of PSTA technology performance, design, and operational factors (STA-3/4 PSTA)
- Identified two special areas requiring investigation:
  - Phosphorus Sampling Methodologies
  - STA Water Budgets
- 4 studies have phased approach with Go/Stop decision points; others multiple components
- Budget and resource allocation undergoing refinement

Periphyton-based Stormwater Treatment Area (PSTA) Technology Performance, Design and Operational Factors

- Issue
  - The STA 3/4 PSTA Cell has consistently achieved concentrations below 12 parts per billion, but further investigation is needed to better assess performance and understand mechanisms and factors to achieve and sustain ultra-low TP concentrations at STA outflows
- Study Objective/Purpose
  - Continue investigation of PSTA cell performance to determine design elements, operational factors, and biogeochemical characteristics that enable the PSTA cell to achieve ultra-low outflow TP levels
- Challenges/Risks
  - Scalability and transferability of the technology will have to be evaluated via modeling and feasibility study (outside of this study)
- Estimated Study Duration (ongoing)
  - 4 years through September 2017

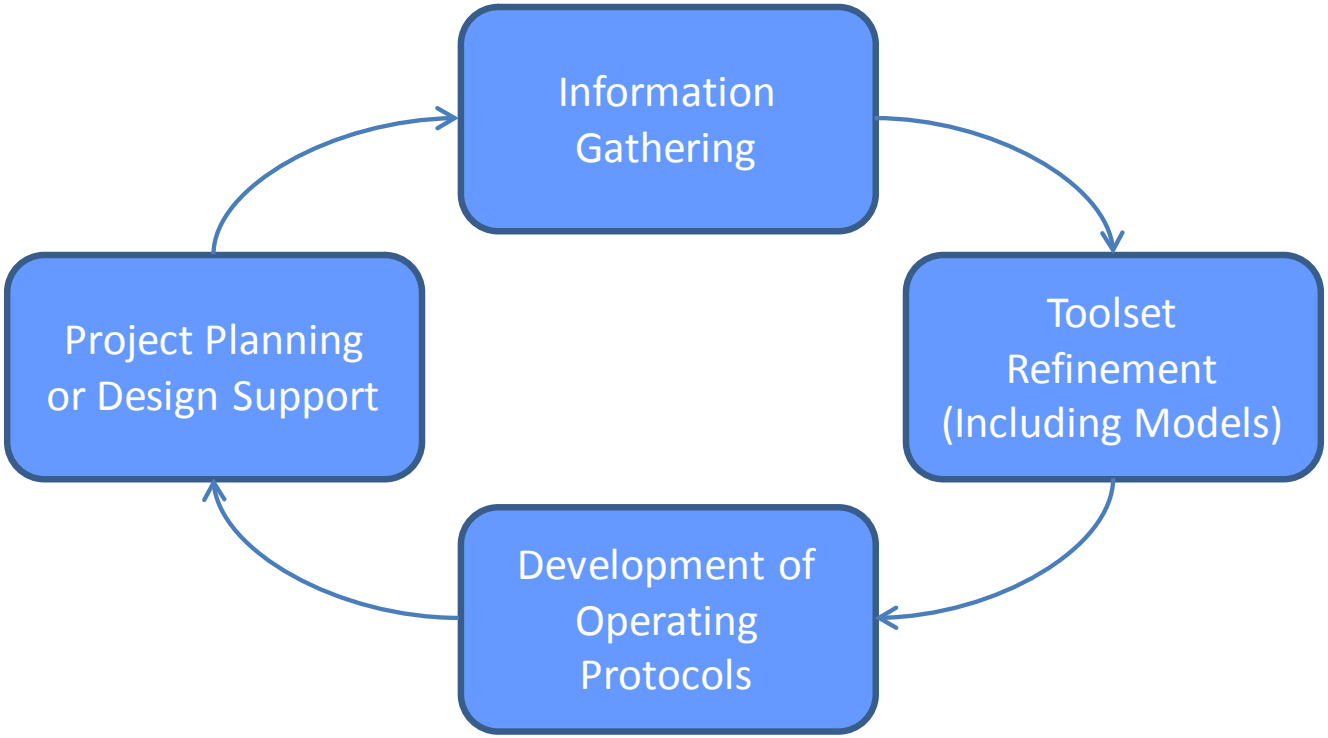
Operational Guidance for FEB and STA Regional Operational Plans

- Issue
  - Operational protocols needed for operating FEBs in conjunction with STAs to optimize hydraulic and treatment performance
- Study Objectives/Purpose
  - To develop modeling tools and operational protocols for FEBs/STAs to:
    - Manage storage in the FEBs to minimize dryout, deep water conditions and bypass
    - Manage FEB outflow and STA inflows to minimize STA outflow phosphorus concentrations
- Challenges/Risks
  - Complexity

Operational Guidance for FEB and STA Regional Operational Plans

Approach:

- Process life cycle



Operational Guidance for FEB and STA Regional Operational Plans

- Approach
  - Information gathering/data analysis
  - Field Experiments
  - Analytical/modeling tool refinement, development and testing
  - Application of toolset to aid in FEB/STA design
  - Development of FEB/STA/Regional Operating Protocols
- Estimated Study Duration (ongoing)
  - 3 years through September 2016

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

- Issue
  - Preliminary studies indicate that water lily and water lily/ sawgrass mix may reduce TP concentrations below that of SAV and cattail
- Study Objective and Purpose
  - Evaluate nutrient removal efficacy of water lily and sawgrass under very low P conditions (downstream end of STA) and examine major processes and mechanisms underlying P assimilation functions
- Challenges/Risks
  - Scalability
  - Recruitment and sustainability

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

- Approach:
  - Phase 1: Extension of Ongoing Mesocosm Study
    - Bi-weekly water quality sampling, P enzyme and carbon isotope analysis, P dynamic model, final harvest and reporting
    - Preparation of Field-scale Implementation Feasibility Study with recommendations (Go/Stop)
  - Phase 2: Field-scale implementation
    - STA SAV cell and plant preparation; vegetation planting and establishment; monitoring, and reporting
- Estimated Study Duration
  - Phase 1 (ongoing) - Mesocosm Study Extension & Feasibility Study-1 year
  - Phase 2 Field-Scale Implementation - 4 years through September 2019

STA Water Budget Improvements

- Issue
  - Water budgets (WB)for many individual cells published in recent SFERs contain large errors
  - WB analysis is important tool for understanding STA treatment performance
  - Developing an accurate WB is not simple in wetland systems (structure flows (in/out), rainfall, ET, seepage, change in storage, residual)
- Study Objective and Purpose
  - Determine sources of error in WB components and how they can be reduced
  - Develop improved water budgets for select STA cells in a phased approach (Test case STA-3/4 Cells 3A and 3B)
- Challenges/Risks
  - potential for significant resources needs in subsequent phases

STA Water Budget Improvements

- Approach:
  - Phase 1 – Test Case: develop improved water budget for STA-3/4 Cells 3A and 3B; prepare summary report, recommendations and costs for Phase 2 (Go/Stop)
  - Phase 2 – Develop improved water budgets for all STA-3/4 cells; prepare summary report, recommendations and costs for Phase 3 (Go/Stop)
  - Phase 3 – Develop improved water budgets for other STA cells on priority basis according to the needs of the Science Plan
- *NOTE: Phases 2 and 3 could potentially involve field investigations, structural retrofits, operational changes, enhanced monitoring, equipment installation, new PREF DBKEYs, etc.*
- Estimated Study Duration
  - Phase 1 (ongoing) through May 2013
  - Phases 2 and 3
    - 4 years through September 2017

Phosphorus Sources, Forms, Flux and Transformation Processes in the STAs

- Issue
  - Need to better understand the biogeochemical factors and mechanisms controlling TP concentrations, particularly at the downstream end of the STA flow-ways
- Study Objectives/Purpose
  - Characterize P speciation, cycling and transport along the STA gradients
    - Determine the factors affecting P cycling along the gradient
    - Understand composition of residual P at outflow
    - Evaluate performance under different flow rates
  - Compare the findings with natural areas (WCAs)
  - Develop recommendations on improving STA performance
- Challenges/risks
  - Most complicated of the studies
  - Resource needs
  - Will require manipulation of flows in selected flow-ways during certain portion of the study

Phosphorus Sources, Forms, Flux and Transformation Processes in the STAs

- Approach:
  - Component 1 – Refinement of conceptual model, historical data analysis and evaluation of methodology improvements
  - Component 2 - Sampling along STA Transects (both well and poor performing cells, different soil types, different flow conditions) and in WCAs (natural areas)
  - Component 3 - Microcosm studies using soil collected along transects, incubated with various treatments to further isolate key influencing factors
  - Component 4 - Conducting manipulative studies (test cells or field enclosures) to isolate and test influence of key variables (e.g. carbon supply, soil minerals)

Phosphorus Sources, Forms, Flux and Transformation Processes in the STAs

- Estimated Study Duration
  - Study plan design, procurement of resources, historical data analysis, set up equipment and transect locations
    - 1 year through September 2014
  - Data collection/sampling, analysis and reporting
    - 5 years through September 2019

Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow TP Concentrations

- Issue
  - Changes in surface water TP concentration have been observed in canals of multiple STAs. Various factors that could potentially influence canal P concentrations include sediments, P speciation, flow velocities, dryout/re-wetting and seepage
- Study Objective/Purpose
  - Determine whether TP concentrations change when conveyed through STA inflow and outflow canals
  - Review existing water quality and flow data and follow up with field investigation, if warranted
  - Evaluate sediments and seepage to and from canals, adjacent water bodies or groundwater
- Challenges/Risks
  - Collection of sediments and seepage analysis in canals
  - Previous studies inconclusive
  - Cost of mitigation measures

Influence of Canal Conveyance Features on STA and FEB Inflow and Outflow TP Concentrations

- Approach:
  - Phase 1 – Analysis of historical flow and water quality data; quarterly progress and final reports with recommendations for Phase 2 field investigations (Go/Stop)
  - Phase 2 – Initiate field investigations such as sediment sampling and seepage measurements; report with recommendations for remediation (example dredging)
- Estimated Study Duration
  - Phase 1
    - 1 year through September 2014
  - Phase 2
    - 3 years through 2017

Impacts of Deep Water Inundation Pulses on Cattail Sustainability

- Issue
  - Peak flows often occur in wet season and cause deep water in treatment cells which can adversely impact cattail and negatively affect treatment performance
- Study Objective/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
- Challenges/Risks
  - Time and cost required for reconfiguration of test cells in terms of soil and water level management

Impacts of Deep Water Inundation Pulses on Cattail Sustainability

- Approach:
  - Component 1 – Study plan design, procurement of resources, historical data analysis; test cell configuration, and plot setup
  - Component 2 – Cattail establishment; implement experimental treatments; observations and measurements
  - Component 3 – In-situ study in STA-1W, STA-2 and STA 3/4 to identify the relationship between vegetation density and historical hydrology
- Estimated Study Duration
  - 5 years through 2018

Use of Soil Amendments/Management to Control P Flux

- Issue
  - STA water column concentrations may increase through the flux of phosphorus from the soils
- Study Objective /Purpose
  - Determine if flux of P from the soil in an operating STA can be reduced with soil amendments or management techniques such as deep tilling or other management techniques or a limerock cap
- Challenges/Risks
  - Cost of testing facilities
  - Scalability and cost of full-scale implementation
  - Marsh readiness issues

Use of Soil Amendments/Management to Control P Flux

- Approach:
  - Phase 1 – Feasibility Study: review and summarize past studies; assess engineering, logistical, economic and environmental (e.g., marsh readiness) feasibility of using these technologies (Go/Stop)
  - Phase 2 – Use soil cores/mesocosms to screen different soil amendments, management methods and application techniques in short-term trials using soil from existing and new STAs (Go/Stop)
  - Phase 3 – Long term field trials using most promising soil amendments/management techniques in a new experimental wetland (5-10 acres) constructed within existing or new STAs

Use of Soil Amendments/Management to Control P Flux

- Estimated Study Duration
  - Phase 1 – 1 year through September 2014 (Go/Stop)
  - Phase 2 – 1 year through September 2015 (Go/Stop)
  - Phase 3 – 4 years through September 2019

Sampling Methods for Total Phosphorus

- Issue
  - Grab samples and auto-samplers, used for compliance sampling, show significant differences
  - Results from newer technology, the Remote Phosphorus Analyzer (RPA), show similar results to grabs and auto-samplers, but highlight issues that may impact the calculation of representative flow-weighted mean concentrations
- Study Objective /Purpose
  - To determine which sampling regime/ method provides most accurate representation of TP

Sampling Methods for Total Phosphorus

- Approach
  - Use high frequency remote phosphorus analyzer (RPA) data in conjunction with flow proportional autosamplers, time proportional autosamplers, grabs samples, quality assurance samples, video imaging, and turbidity probes to identify periods during which the methods provide different data on water quality, and to potentially identify the causes of those differences. Once identified it may be possible to propose potential remedies.
- Challenges/Risks
  - Implications to method used to calculate WQBEL
- Estimated Study Duration
  - Procurement of new equipment ,Installation, training- 0.5 years
  - Sampling and analysis, Final Report and recommendations-1.5 years through September 2015

Projected Science Plan Activities

- Complete estimation of schedule, budget, staffing and resource needs for the 9 studies
- Submit Science Plan (on or before **June 10, 2013**)
- Continue work on PSTA, Operational Guidance for FEB and STAs, Phase 1: Water Lily/Sawgrass, and Phase 1: STA Water Budget projects
- Continue to refine/enhance "new" study plans and designs based on historical data analysis
- Begin procurement process for technical services (Requests for Proposals) **(July 2013)**
- ✓ Officially implement Science Plan (**September 10, 2013)**

Questions