Restoration Strategies

Update: Science Plan for the Everglades Stormwater Treatment Areas

Long Term Plan Communications Meeting
November 28, 2012

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Science Plan

- Consent Order and Framework Agreement require the District to develop and implement a science plan
- 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).
  - Obtain information that can be incorporated into modeling efforts/refinements.
  - Use information gathered to inform the design and operations which will improve the ability of STAs to achieve the WQBEL.

Science Plan: SFWMD Requirements (from Consent Order)

- Identify the critical information gaps and research areas that influence treatment performance
- Prioritize the science needs
- Develop and implement the science plan
- Evaluate the results of ongoing scientific efforts to meet the prioritized science needs
- Modify the science plan as needed based on results of completed or ongoing scientific studies
- Determine how the results of the scientific studies could be implemented to improve phosphorus reductions and treatment performance.

Science Plan: SFWMD Requirements (from Consent Order)

- SFWMD shall:
  - Convene the Technical Representatives to discuss the Science Plan within 6 months of permit issuance

    Deadline: March 10, 2013

    Held First Meeting: November 6, 2012
  - Develop the Science Plan and an associated work plan within 9 months of permit issuance

    Deadline: June 10, 2013
  - Begin to implement the Science Plan within 12 months of permit issuance

    Deadline: September 10, 2013

Science Plan: Key Areas Being Considered for Study (from Consent Order)

- Phosphorus loading rates
- Inflow phosphorus concentrations
- Hydraulic loading rates
- Inflow water volumes, timing, pulsing, peak flows and water depth
- Phosphorus speciation
- Microbial activity and enzymes
- Phosphorus re-suspension and flux
- Stability of accreted soils
- Phosphorus concentrations and forms in soil and floc
- Soil flux management measures
- Influence of water quality constituents such as calcium
- Vegetation speciation
- Vegetation density and cover
- Weather conditions

Science Plan Development

- SFWMD Restoration Strategies Science Plan Team
  - Meeting since August 3, 2012
  - Organized into a Core Team and 6 Subteams
  - Consists of over 35 scientists and engineers
  - Represents the following SFWMD groups:
    - Water Quality Treatment Technologies
    - Everglades Systems Assessment
    - Vegetation Management
    - Hydrologic and Environmental Systems Modeling
    - Everglades Policy and Coordination
    - Engineering and Construction
    - Water Quality

Science Plan Development: Draft Schedule

Activity	Target Dates
Identify key questions, information gaps	August 3 – October 31, 2012
Develop Science Plan Outline/Table of Contents	October 1 – 31, 2012
Present Draft Science Plan Update at LTP Meeting	November 28, 2012
Develop Draft Science Plan	November 1, 2012 – February 1, 2013
Prepare 5-year Project Work Plan/Schedule/Budgets (Appendix)	December 1, 2012 – February 28, 2013
Present Draft Science Plan at LTP Meeting	February 12, 2013
Prepare Final Science Plan and Work Plan	February 2, 2013 – May 30, 2013
Present Final Science Plan at LTP Meeting	May 22, 2013
Develop SFWMD Internal Processes	June 1, 2013 – August 31, 2013
Initiate Science Plan	September 1, 2013

Science Plan: Progress to Date

- Core Team:
  - Formulated six draft Key Questions for the Science Plan
  - Developed Science Plan Outline
  - Commenced drafting of Science Plan Sections
- Subteams:
  - Conducted individual STA assessments
  - Explored each Key Question, deliberated on what is known, not known and developed focused subquestions to fill information gaps
  - From subquestions, identified major areas of investigation

Science Plan: Approach Used to Formulate Questions/Define Areas of Investigation

- Compiled key factors affecting STA phosphorus removal performance, particularly at low phosphorus levels
- Listed physical, chemical and biological mechanisms/processes for phosphorus treatment
- Developed preliminary list science/operations/ engineering questions related to STA performance, leveraging over 20-years of technical experience
- Rolled questions up into six overarching key questions

Science Plan: Approach Used to Formulate Questions/Define Areas of Investigation (Cont.)

- Six subteams expanded on key questions:
  - Performed preliminary literature and data review
  - Deliberated on what is known, what is not known and developed set of focused subquestions to fill information gaps
  - Reviewed the condition of each STA to inventory potential factors affecting phosphorus performance (good and bad)
  - Identified areas needing further studies or possible engineering refinements
  - Organized subquestions into three overall areas of investigation
    - Engineering and operational components
    - Management of vegetation-based treatment systems
    - Internal STA processes/factors related to increased P treatment

Science Plan: Draft Key Questions

1. How can the FEBs be designed and operated to moderate and optimize **phosphorus and hydraulic loading rates entering the STAs**, possibly in combination with water treatment technologies, and/or inflow canal dredging/lining?
2. How can **internal loading of phosphorus** to the water column be reduced or controlled, especially in the lower reaches of the treatment trains?

Science Plan: Draft Key Questions

3. What measures can be taken to enhance **vegetation-based treatment** in STAs and FEBs?

4. How can the biogeochemical and/or physical mechanisms be managed to further reduce **particulate and dissolved organic phosphorus concentrations at the outflow?**

Science Plan: Draft Key Questions

5. What **operational and/or design refinements** could be implemented at existing STAs and future features (i.e. STA expansions, Flow Equalization Basins) to improve and sustain treatment performance?
6. What is the influence of **wildlife and fisheries** on the reduction of phosphorus in the STAs?

Example Subteam Output: Phosphorus Flux in STAs and Canals

KNOWN

- Short term releases of phosphorus (P) after dry out were higher at sites receiving high P inflows than low P inflows
- SRP flux to the water column varied according to the duration of dryout
- Newly accreted soils have highly unstable soil P fractions
- In canals, P flux varied temporally. Organic P, Fe- and Al-bound P fractions are a significant storage pool, but Fe- and Al-bound more labile than Ca- and Mg-bound fractions
- Redox potential had a greater effect on P flux than soil P concentration in the STA 2 inflow canal.
- Soil amendments have varying effectiveness at controlling P flux

UNKNOWN

- Controlling P flux during startup and rewetting, other than keeping the systems hydrated
- Inventory of various P fractions & storage stability along the nutrient gradient
- Effects of hydrology on sediment stability, resuspension and contribution to total internal loading of P
- Treatment efficacy, long-term stability and potential negative impacts of soil amendments.

Example Subteam Output: Phosphorus Flux in STAs and Canals

SAMPLE Subquestions to fill information gaps:

- What sources and forms of P dominate residual DOP and PP pools, how do they differ across STAs and are they the same as observed in the natural system?
- What are the key physiochemical factors (e.g., UV, Ca, Fe) influencing P cycling at very low concentrations?
- What is the treatment efficacy, long-term stability, and potential impacts of soil amendments or management?

Science Plan: Example STA Assessment

STA-2 Cell 2		
Issues	**Actions**	**Status**
Hydraulic Short-Circuiting	This cell has several obvious hydraulic short-circuits, such as the borrow canal along the east side of the cell, a berm downstream of the inflow structures, and a 500-acre deep area in the NW corner of the cell. As part of the original STA-2 design and construction, the borrow canal was plugged at regular interval, however, many years of operational experience and field observations have shown that the plugs have eroded and are not effectively reducing the short-circuiting. Another feature in Cell 2 that contributes to non-uniform hydraulics and problems maintaining the target emergent vegetation is a 500-acre area in the NW corner of the cell that about 2' deeper than the rest of the cell and is generally filled with Hydrilla (see Hydrilla and FAV issues below). Another feature that contributes to short-circuiting is the berm downstream of the eastern inflow structures; inflows to the cell are channeled through constricted gaps in this berm. Previous enhancement proposals that have been considered and warrant additional consideration and/or **engineering analysis** include filling the 500-acre deep area in the NW corner, degrading the berm downstream of the inflow structures, modifying (fortifying) the N-S berm that runs along the east side of the 500-acre deep area, and filling the borrow canal along the east side of the cell.	Ongoing
Hydrilla die-off/ Hydrilla Control	The NW corner (500-acre area) of this cell is predominantly Hydrilla however, there is ongoing concern that Hydrilla is not the optimal SAV in the STAs because it can top out and crash like *chara*. Ideally this area could be filled to bring the bottom elevation up to the same level as the rest of the cell; however other less expensive options such as encouraging alternative vegetation communities (e.g. bulrush) could be evaluated. Field observations suggest that the soil thickness in this area is very shallow compared to other areas that we have planted. If so, it could be problematic to establish and sustain emergent plant (root systems, etc) in such shallow soil. **Science Plan** could include collection of more detailed soil depth information in this area, if the strategy for this area includes an attempt to establish emergents. The **Science Plan** may need to tap into Hydrilla research work that is being done by Dr. Haller (UF) in the test cells and other areas. Another potential enhancement that might be beneficial if this low area does not get filled would be to isolate the area along eastern side with a north-south berm – so flows would not go west into this deep area.	Ongoing
FAV Performance	This is an STA-wide issue. Once FAV (water lettuce, water hyacinth) gets established in a treatment cell, it can be very difficult to eradicate. It is not currently known if FAV provides any sustainable treatment (or if harvesting is needed to result in net TP removal). One long-standing issue is disposal of the harvested material. Currently there is no market for the material. FAV could also have negative impacts on performance by crowding or out-competing adjacent desirable vegetation. **Science Plan** may need to include evaluation of the pros/cons of allowing FAV to colonize the open water areas in emergent cells. Need to monitor potential impacts on adjacent stands of cattail.	Ongoing

Science Plan: Draft Outline

- Executive Summary
- Introduction
  - Background
  - Restoration Strategies Summary
  - Restoration Strategies Implementation Organization
  - Science Plan Purpose, Goals, and Objectives
  - Science Plan Scope and Schedule
  - Science Plan Annual Updates and Reports
- Stormwater Treatment Area Technical Background
  - Physical Setting
  - Driving Forces and Problems/Issues Facing the STAs
  - Past and Current Science Efforts/Activities
- Science Plan Key Questions/Areas of Investigation

Science Plan: Draft Outline (cont'd)

- Adaptive Management
- Peer Review
- References
- Appendices
  - 5- year Work Plan
    - Research Plans
    - Schedule
    - Budget and Cost Estimates
  - Back up Documentation for Key Questions

Science Plan: Review Process

- The Science Plan development process will include several levels of review including:
  - 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

Path Forward

- Prepare draft Science Plan main document (December-January)
- Prioritize and integrate questions and transform top-ranking questions into proposed studies (December – January)
- Draft Research Plans/SOWs designated for first phase of Studies/Projects in 5-year Work Plan (December – January)
- Prepare schedules and budgets for Phase I of 5-year Work Plan (February)
- Long-Term Plan Quarterly Meeting
  - February 12, 2013 (West Palm Beach)

Questions