RESTORATION STRATEGIES SCIENCE PLAN

Public Comments and Agency Responses to These Comments on the April 2013 Draft Science Plan

June 21, 2013

May 14, 2013

Melissa Meeker
Executive Director
South Florida Water Management District, SFWMD,
3301 Gun Club Road,
West Palm Beach, FL 33406

Dear Ms. Meeker:

This letter contains the Everglades Foundation's public comment on the South Florida Water Management District (SFWMD) *Science Plan for the Everglades Stormwater Treatment Areas* draft document, dated April 2013. The development of the Science Plan is a requirement imposed pursuant to the consent orders accompanying District's Everglades Forever Act (EFA) and National Pollutant Discharge Elimination System (NPDES) permits. The Everglades Foundation understands that the purpose of the Science Plan is to "identify the factors that collectively influence phosphorus reduction and treatment performance in order to meet the WQBEL." While the consent order does not expressly limit the research and investigation to factors impacting the treatment performance of the Stormwater Treatment Areas (STAs) with regard to phosphorus (P) removal, it appears the District has chosen to focus solely on STA performance and treatment. Therefore, the Everglades Foundation will provide comments based on this limited focus. However, this should not be construed as the Foundation condoning the limited focus the District has chosen for the first phase of the Science Plan.

The science staff at the Everglades Foundation has reviewed the Science Plan and is generally supportive of the parts of the Plan that focus on understanding, optimizing and enhancing the performance of STAs. However, in our opinion, basic research should not be included in the final list of technical projects to be selected and included in the five-year work plan (e.g. key question # 6). Instead, the work plan – and technical projects included in it – should be focused on improving the performance of the STAs in order to slow down the degradation of the Everglades.

We would like to offer the following constructive comments to the five-year work plan as envisioned and presented by the SFWMD.

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Timeline, Cost and Budget

The proposed plan details activities to be conducted over the next five years; the projects are to be concluded by 2018. This timeline and the selection of projects are critical since, with the exception of the second STA-1W expansion, all the projects will be designed already and the construction phase started. Therefore, this initial study phase is essential, as the results will have an important impact on the design and operation of several projects (e.g., A1-FEB, L8-FEB, expansion of STA-1W, etc.).

Since the Science Plan was developed behind closed doors, we do not know the thought process followed to prioritize and select the projects. The SFWMD should carefully select the projects that would 1) elucidate phosphorus attenuation processes in the STAs, and 2) lead to important applicable findings to effectively optimize the performance of the STAs to ensure the attainment of the Water Quality Based Effluent Limit (WQBEL). As stated in further detail below, we believe the actual selection of the projects should be done in an open forum where the public can provide meaningful comments.

While the document details the proposed technical activities and the suggested timeline by phase, we have concerns because the associated costs and budget are missing. This information is particularly important since some of the scientific projects will be conducted by the SFWMD, other projects are already in progress, and others still will be conducted by outside contractors. In order to move forward, the cost estimates of the selected projects need to be assessed and summarized in an appropriate budget that would reflect the parts performed by SFWMD scientists and the ones in progress. Each proposed study should include specific details of the work to be conducted (items) with the corresponding costs and budget – as customary in proposal submissions for funding. We also think that for several of the suggested projects, the methodology section would need to be expanded. More details about the type of field experiments / monitoring / data analysis to be conducted should be given.

Public Participation and Peer Review

The Science Plan was developed with limited public participation. No reason has been given to explain and support this decision. We have continually recommended that this science process should be open because (a) it leads to better technical products, and (b) it avoids unnecessary controversies later on. Presenting the key questions in three or four public meetings was insufficient public involvement when developing a $55 million project funded with taxpayer dollars. It is contrary to public policy of this State, which is committed to conducting government in the sunshine, and it fails to comport with Judge Gold's demand for openness and involvement of all stakeholders. We hope that stakeholders will be regularly updated on the results of these projects and there will be more openness in deciding about the future project activities.

Furthermore, the process of selecting / funding specific projects needs rigorous peer-review. As in any project proposal procedure, the first step would be to peer-review the project selection to ensure that only the most qualified proposals are chosen and carefully prioritized. It seems that the final list of projects was developed and selected by the SFWMD scientists without any peer-review for the prioritization and/or selection of the projects. Quite beneficial external overview, critical examination and "second thought' are invariably contributed through a peer-review procedure commonly practiced (particularly) in science. Peer review brings the opportunity of fresh perspective into projects that might otherwise tend to be developed with the best of intentions but with unduly narrow enthusiasm.

Study # 1: Use of Soil Amendments to Control P Flux

Many studies have already examined the benefits of applying soil amendments to reduce the mobility of accumulated legacy phosphorus (P) in soils. Soil amendments generally are lime, gypsum, silica, aluminum and iron salts, and water treatment residuals (we do not think that wastewater treatment residuals would be adequate for this purpose, as stated in the Science Plan text). These compounds are either raising the soil pH to enhance P binding or directly binding P to the applied compounds. Technically, these soil amendments have four disadvantages that greatly limit their effectiveness in controlling P:

1) Soil amendments attempt to treat the entire legacy P pool within the soil, which is about 50 to 200 times larger than the P being discharged per year. This procedure requires large amounts of chemicals that have to be applied at high costs.

2) It is very difficult to get the amendments mixed into the soil adequately to maximize their effectiveness and to avoid their run-off and downstream impacts.

3) Soil amendments do not reduce the actual amount of legacy P in the soil and, over time, many of the amendments can lose their binding properties with the legacy P becoming mobile again. The application of lime and iron salts is particularly vulnerable to eventual P remobilization.

4) Soil amendments toxicity has to be considered and investigated particularly when the STAs were designed to deliver marsh ready water. The effect of soil amendments on the broader ecological balances in the environment is not well understood ('unintended consequences').

Consequently, soil amendments are generally not considered as a viable and long term P control practice. In addition, there are also significant costs associated with application of chemicals accompanied by logistical problems.

All considered, we believe that this project should be given a low priority. Alternatively, if the project is to go forward, we suggest that the first month of the first phase should be aimed at assessing the engineering and economic feasibility of this technology in the STAs.

Study # 2: Evaluation of P Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment

This is an important study that would address the role of specific vegetation type in transforming refractory phosphorus. Even though we generally support this type of study, it is hard to understand the reasoning of the SFWMD scientists in selecting this project. Indeed, and as clearly reported in the document, the selection of this project was based on the proof-of-concept project initiated in 2010 using mesocosms filled with soil from STA-1W. For two years of this study, the outflow P was extremely high and exceeding the inflow P levels (even for sawgrass and water lily). The latest results of the study (after soil stabilization) are showing that the best performance observed to date was in water lily treatment and the worst performance was in sawgrass treatment. The results of this study after more than three years are, at best, not conclusive and would indicate the apparent preference for using only water lilies to reach low P levels.

At this stage, we need more details on the design of experiments to be conducted in Phase - I. As it is reported in the text, the mesocosms study would be extended for one year to evaluate water lily efficiency to reduce P levels in SAV cells. The first questions that would need to be answered are:

Will other types of vegetation be tested?
Will water lily efficiency to reduce P levels in SAV cells be tested in the mesocoms study?
What is the P dynamic model and what would it be used for?

We would recommend that the Phase I study be conducted under the close supervision of SFWMD staff, and we think that a stop/go step should be enforced before initiating Phase II.

Study # 3: Development of Operational Guidance for FEB and STA

This is a critical study that would impact the operation and design of all the current and future Flow Equalization Basins (FEBs) and STAs. We have three important comments regarding this study as developed:

1) This project would need to address the A-1 FEB case in particular. This FEB has been modeled to reach a P removal efficiency of about 35%. The operation of this FEB would need to be developed and optimized not only to provide a steady flow to the STAs but also to provide a high P removal performance. SFWMD would need to consider adding several new monitoring stations in this FEB to follow and optimize the P removal performance in the three FEB cells.

2) This project would also need to consider the Everglades ecosystem downstream. Indeed, the STA and FEB operational optimization should also take into consideration improving Everglades ecosystem hydropatterns – the timing and flow of surface water to the Everglades. Optimizing STAs flow discharge to improve the natural timing and pattern of inundation through the ecological communities in the Everglades is needed at this stage.

3) We have serious concerns about the SFWMD's decision to develop a new model from scratch to guide operational plans. This is an extremely time consuming step, particularly when peer-reviewing the model is a necessary step to confirm its validity. There is no reason to abandon the existing DMSTA model, which has taken significant time and resources to develop and has served so well. The DMSTA model is being widely used by the scientific community across the agencies, attesting not only to its good performance, but also to its ease of use, ruggedness, and reliability. The RSM model platform is currently used solely by the SFWMD scientists. Will the new RSM-based model be so much more reliable and accurate to support this decision? The deployment of such a specialized model exclusively by a select SFWMD group eliminates any comparative studies and highly desirable peer participation.

Studies # 4 and # 5:
Evaluation of P sources, Forms and Flux
Investigation of STA-3/4 PSTA Technology Performance

These are extremely important studies to 1) understand the P speciation in the STAs and the parameters impacting the P cycling in the STAs, and 2) investigate an alternative technology to further reduce P at the STA outflow. However, we have two main comments for this section:

1) As reported in the main Science Plan document, the key parameters that would likely affect the STA performance are the hydraulic and phosphorus loading rates as well as the inflow P concentrations. SFWMD scientists seem to have avoided dealing with P in the STA inflow. Historical data indicate that the inflow TP is comprised largely of soluble reactive P and particulate P. Enhancing the removal of particulate phosphorus at the STA inflow should be investigated and included as part of Study # 4. Another cost-effective alternative to reduce P flowing into the STAs and to enhance the STAs performance would be to implement additional on-farm source controls

or Best Management Practices – this is another obvious project that was completely left out by the SFWMD scientists. Moreover, the SFWMD scientists also neglected to:

- incorporate the sub-regional source control strategies in this study plan,
- investigate the different alternatives for these sub-regional source control strategies, or
- develop operational guidance for these sub-regional source control projects to enhance the FEBs and STAs performance.

2) The outflow P concentrations from the PSTA cell in STA-3/4 have been very promising, and we would recommend to continue this project and to accurately assess the PSTA performance through a water quality and quantity budget analysis. As reported by the SFWMD for the first four water years of operation, the PSTA cell achieved an average annual FWM TP concentration of 10 ppb. If this alternative technology was implemented in the lower reaches of the STAs, it would guarantee the attainability of the WQBEL. We believe that at this stage the SFWMD should also include an additional investigation to assess the engineering and economic feasibility of the PSTA treatment scale-up.

Studies # 6 and # 7:
Influence of Canal Conveyance
Deep Water Pulsing on Cattail Sustainability

These two studies are aimed at 1) investigating canal management in STAs and FEBs, and 2) developing the understanding of how water depth affects the vegetation community. We have two comments on these studies.

1) The influence of canal conveyance study, as currently developed, is assessing the changes in TP concentrations in the inflow water between the primary inflow point and the treatment flow-ways (e.g. changes between pump station S6 and STA-2 flow-way control structures). We would recommend broadening the scope of this investigation to also include the Everglades Agricultural Area canal system (lower reach), which contains sediments that could be entrained and which currently contribute to the deterioration of water quality at downstream sites. This study could provide a better understanding of additional changes (e.g., dredging) that could further reduce the amount of P and particulate P reaching the STAs and FEBs.

2) The second project examining the water level pulsing effect on cattails should also include the development of specific operational guidance for FEBs / STAs during storm and hurricane events. Along with examining additional changes to managing sediments in upstream canals, the SFWMD should investigate an adequate operational procedure during storm events (water distribution between STAs, etc.). For more than two months after the Tropical Storm Isaac, the P flowing into STA-1W was reaching 350 ppb, and bypassing STA-1W and STA-1E was the only alternative selected by the SFWMD.

Studies #8: STA Water Budget Improvement

This is an extremely important study that needs to be conducted as soon as possible. It should be given the highest priority. Increasing the number of water quality and quantity monitoring stations in the STAs and FEBs is essential in order to conduct this study and to close the current STAs' water and phosphorus budgets. Enhanced monitoring and seepage management suggested as possibilities in Phase II should be given a high priority. Rigorous statistical and data analysis should be also part of this endeavor.

The Everglades Foundation recognizes the complex nature of the development of a Science Plan as large as the one suggested by the SFWMD. In order to proceed efficiently in this endeavor, we would finally suggest to 1) identify a SFWMD principal investigator (PI) who would lead the work on each of the projects, and 2) select and engage an appropriate external and independent Co-PI who would also follow the work progress to ensure appropriate accountability.

Thank you for your time and attention to our comments.

Sincerely,

Eric Eikenberg
Chief Executive Officer
The Everglades Foundation

SFWMD Responses to Everglades Foundation Comments on the Draft Science Plan for the Everglades Stormwater Treatment Areas (April 2013)

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Paragraph 1 While the consent order does not expressly limit the research and investigation to factors impacting the treatment performance of the Stormwater Treatment Areas (STAs) with regard to phosphorus (P) removal, it appears the District has chosen to focus solely on STA performance and treatment.	As the South Florida Water Management District (SFWMD or District) already has a program in place that focuses on and conducts research on source controls and Best Management Practices (BMPs) through the Everglades Regulation Bureau, the District is focusing on understanding, optimizing, and enhancing the phosphorus treatment performance of the STAs and Flow Equalization Basins (FEBs) in the Science Plan. It is important to note that there is close coordination and information sharing between the areas of the District that implement the BMP research program and the STA science and research activities. The Restoration Strategies Regional Water Quality Plan proposes to build upon the success of the existing BMP Regulatory Program by focusing on areas and projects with the greatest potential to further improve water quality. The District's goal is to design projects to increase retention/detention of total phosphorus (TP), above what is currently required at the basin-ID level, in strategic onsite locations, or through sub-regional source control projects (S-5A drainage basin) in conjunction with the onsite BMPs to further reduce TP loads to the STAs.
Paragraph 2 However, in our opinion, basic research should not be included in the final list of technical projects to be selected and included in the 5-year work plan (e.g. key question #6). Instead, the work plan- and technical projects included in it- should be focused on improving the performance of the STAs in order to slow down the degradation of the Everglades	Applied science is being utilized in all the studies being considered for the Five-Year Work Plan (Appendix C). With regard to Key Question #6, while not deemed the highest priority effort at this time, the role of aquatic consumers will continue to be considered by the District as wildlife, fish, and large invertebrates contribute to the phosphorus cycling of the STAs. Investigation into this key question, while not currently scheduled, will likely begin with a literature review to determine if future efforts on this topic could provide useful STA management recommendations. The apparent importance of consumers suggests that even small changes in density and distribution could influence STA outflow TP concentrations.
<u>Timeline, Cost and Budget</u> (Para. 1) The proposed plan details activities to be conducted over the next five years; the projects	Agree. Many of the studies, including the Operational Guidance for FEBs and STAs, Investigation of STA-3/4 PSTA Technology

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are to be concluded by 2018. This timeline and the selection of projects are critical since, with the exception of the second STA-1W expansion, all the projects will be designed already and the construction phase started. Therefore, this initial study phase is essential, as the results will have an important impact on the design and operation of several projects (e.g. A1-FEB, L8-FEB, expansion of STA-1W, etc.)	Performance, Design and Operational Factors, Influence of Canal Conveyance Features on STA Inflow and Outflow Concentration, and Impacts of Deep Water Inundation Pulses on Cattail Sustainability have the potential to inform the design of the STA-1W expansion and will very likely assist the District in developing integrated operational strategies for FEBs and STAs. More importantly, the implementation of the Science Plan will provide information to adaptively manage project implementation and operations over the longer term.
Timeline, Cost and Budget (Para. 2) Since the Science Plan was developed behind closed doors, we do not know the thought process followed to prioritize and select the projects. The SFWMD should carefully select the projects that would 1) elucidate phosphorus attenuation processes in the STAs, and 2) lead to important applicable findings to effectively optimize the performance of the STAs to ensure the attainment of the Water Quality Based Effluent Limit (WQBEL). As stated in further detail below, we believe the actual selection of the projects should be done in an open forum where the public can provide meaningful comments.	The Consent Orders and Framework Agreement require the District to develop and implement a Science Plan. Sections 3.1 and 3.2 of the Science Plan describe the process for arriving at key questions, sub-questions, and the prioritization of those questions. Dozens of District scientists, engineers, and modelers from across the agency with considerable hands-on experience with the STAs examined all the factors affecting STA performance over the years. This included a cell-by-cell examination of each STA as well as the various mechanisms and processes for phosphorus treatment to determine the six overarching key questions, which closely align with the two suggested selection criteria provided by the Everglades Foundation. Additionally, the Consent Orders designated six Technical Representatives (Tech Reps) from the U.S. Environmental Protection Agency, Florida Department of Environmental Protection, U.S. Department of the Interior, U.S. Army Corps of Engineers, and SFWMD as science consultants for the Restoration Strategies effort. The SFWMD has engaged the Tech Reps, federal agency experts, and several of their technical consultants throughout the plan development process with seven workshops, incorporating a majority of their suggestions and comments. In conjunction, the opportunity for public input on the draft Science Plan was provided via open forum at three Long-Term Plan communications meetings and one Water Resources Advisory Commission meeting, and with e-posting of the draft Science Plan (April 2013) on

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	the District's WebBoard for almost two months prior to publishing the current Science Plan (June 2013). These collaborative activities, from August 2012—June 2013, are summarized in Table 1. As described in Section 3.2, the District's Science Plan team evaluated and prioritized the areas of investigation and sub-questions considering testability, feasibility, timeliness, and importance in reaching the Water Quality Based Effluent Limit (WQBEL). A special workshop was conducted with the Tech Reps and federal agency experts and their consultants to review and deliberate on the prioritized list, make refinements and, based on their input, translate eight of the top sub-questions into seven of the proposed, initial studies. Based on their recommendations, two studies were also added as other areas of investigation: STA Water and Phosphorus Budget Improvements and Evaluation of Sampling Methods. The selection process was semi-quantitative and utilized best professional judgment of the Science Plan Team, Tech Reps, and federal agency experts and consultants. As previously noted, several opportunities for public and stakeholder participation and review of the evaluation process, selected sub-questions, and studies were provided at both Long-Term Plan Communication and Water Resources Advisory Commission Meetings as well as during the draft Science Plan public review period.
Timeline, Cost and Budget (Para. 3) While the document details the proposed technical activities and the suggested timeline by phase, we have concerns because the associated costs and budget are missing. This information is particularly important since some of the scientific projects will be conducted by the SFWMD, other projects are already in progress, and others still will be conducted by outside contractors. In order to move forward, the cost estimates of the selected projects need to be assessed and summarized in an appropriate budget that would reflect the parts performed by SFWMD scientists and the ones in progress. Each proposed study should include specific details of the work to be	Final details on planned costs and budget for the nine proposed, initial studies are still under development and undergoing review by the District's Restoration Strategies Steering Group and Executive Management. The Restoration Strategies Regional Water Quality Plan included funding over a 10-year period in which to implement the Science Plan. During the initial development of the study plans, preliminary cost estimates and resource needs were developed. To move into the detailed planning phase of development, the proposed studies must first receive approval from the Restoration Strategies Steering Group. To date, three studies have been reviewed and have received approval to be funded

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conducted (items) with corresponding costs and budget – as customary in proposal submissions for funding. We also think that for several of the suggested projects, the methodology section would need to be expanded. More details about the type of field experiments/monitoring/data analysis to be conducted should be given.	and move forward in Fiscal Years 2013-2014. The remaining six are awaiting review and authorization. The SFWMD principal investigators have been assigned to all nine projects, and it is anticipated that the work will be completed using both District staff and contractors (consultants, academia, etc.) as appropriate. The current conceptual plans are continuing to evolve into full-scale research plans with more robust technical design. To the extent possible, the design of individual experiments is addressed in the current Science Plan version. However, there are plans to develop more comprehensive experimental designs for the proposed study plans, as needed, and update the Five-Year Work Plan with input from the Tech Reps, federal agency experts, and their technical consultants over the next several months.
<u>Public Participation and Peer Review (Para. 1)</u> The Science Plan was developed with limited public participation. No reason has been given to explain and support this decision. We have continually recommended that this science process should be open because a) it leads to better technical products, and b) it avoids unnecessary controversies later on. Presenting the key questions in three or four public meetings was insufficient public involvement when developing a $55 million project funded with taxpayer dollars. It is contrary to public policy of this state, which is committed to conducting government in the sunshine, and it fails to comport with Judge Gold's demand for openness and involvement of all stakeholders. We hope that stakeholders will be regularly updated on the results of these projects and there will be more openness in deciding about the future project activities.	The Science Plan had extensive review upfront by a team of dozens of scientists, engineers, and modelers, many of whom have 20 years of hands on experience with STAs, respectively. Additionally, there were seven workshops held over the course of six months with the Restoration Strategies Tech Reps, federal agency experts, and their consultants, including Bill Walker and Bob Kadlec, where input into the study plans was provided. Review of the Science Plan, including the Five-Year Work Plan, by Tech Reps and federal agency experts is ongoing. As previously noted, concurrently several opportunities for public input on the draft Science Plan was provided and are expected to continue as this open, iterative process moves forward. Looking ahead, sub-questions not addressed in the initial suite of proposed study plans will be considered as the Science Plan evolves through the adaptive management process. Additional study plans will be developed as needed, with continuous involvement and feedback from the Tech Reps, federal technical experts, and their consultants, as part of the collaborative process outlined in Section 5, Adaptive Management to Reduce Uncertainty. Science Plan implementation

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	will be a standing item on the Long-Term Plan Communication Meeting agendas to continue to offer opportunities for public updates and stakeholder input on related progress and any refinements made to the plan throughout its implementation.
Public Participation and Peer Review (Para. 2) Furthermore, the process of selecting/funding specific projects needs rigorous peer-review. As in any project proposal procedure, the first step would be to peer-review the project selection to ensure that only the most qualified proposals are chosen and carefully prioritized. It seems that the final list of projects was developed and selected by the SFWMD scientists without any peer-review for the prioritization and/or selection of the projects. Quite beneficial external overview, critical examination and "second thought" area invariably contributed through a peer-review procedure commonly practiced (particularly) in science. Peer review brings the opportunity of fresh perspective into projects that might otherwise tend to be developed with the best of intentions but with unduly narrow enthusiasm.	The District has been an agency leader in technical peer review and remains firmly committed to its judicious application. As part of the adaptive management process, peer review will be used on an as-needed basis to provide constructive criticism and guidance when faced with large uncertainties or technical obstacles in information gathering. However, independent peer review must be used when such review can be productive, and there must be stand-alone products and clear needs and objectives for review. It should be noted that the aggressive timeline did not allow the District to use peer review of the Science Plan during the development process. However, the agency intends to use peer review strategically and as needed to improve individual study plans and deal with cutting-edge issues. The regular Long-Term Plan meetings and the annual South Florida Environmental Report will provide ongoing access to decision points and project products as well as document the overall progress of the Science Plan efforts.
Study #1: Use of Soil Amendments to Control P Flux …., soil amendments are generally not considered as viable and long term P control practice. In addition, there are also significant costs associated with application of chemicals accompanied by logistical problems. All considered, we believe that this project should be given a low priority. Alternatively, if the project is to go forward, we suggest that the first month of the first phase should be aimed at assessing the engineering and economic feasibility of this technology in the STAs.	Agree. These points on soil amendments are very useful and any project moving forward must satisfy these and other concerns. Large-scale application of any soil amendment may not be acceptable due to one or more of these concerns. However, as new technologies are continuously evolving in this area, and before this concept is abandoned, there is a need to better understand the feasibility of strategically targeting the use of certain Advanced Treatment Technologies (ATTs) within the FEBs and STAS at certain places, levels, and times, which may be more practical and helpful in further reducing TP levels in the STAs. For example, soil amendments may be utilized in the initial construction to bind the exposed sediments and associated particulate phosphorus to prevent a major flux out of the system and may

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	not be needed thereafter. The scope of the planned project also includes review of other soil management techniques (e.g., limerock capping and tilling) in addition to soil amendments. This study is proposed to be conducted in three phases, in which the first phase (Phase I) is a desktop analysis. After data summary, literature review, and assessment of feasibility is complete, a stop/go decision will be made whether to initiate Phase II.
<u>Study #2: Evaluation of P Removal Efficacy of Water Lily and Sawgrass in a Low Nutrient Environment</u> … Even though we generally support this type of study, it is hard to understand the reasoning of the SFWMD scientists in selecting this project…. ... The results of this study after more than three years are, at best, not conclusive and would indicate the apparent preference for using only water lilies to reach low P levels… ….we need more details on the design of experiments to be conducted in Phase 1. As it is reported in the text, the mesocosms study would be extended for one year to evaluate water lily efficiency to reduce P levels in SAV cells. The first questions that would need to be answered are: Will other types of vegetation be tested? Will water lily efficiency to reduce P levels in SAV cells be tested in the mesocosm study? What is the P dynamic model and what would it be used for? We would recommend that the Phase 1 study be conducted under close supervision of SFWMD staff, and we think that a stop/go step should be enforced before initiating Phase II.	There is potential in looking closely at different vegetation types, particularly when they may alter the STA environment in such a way as to improve TP retention and water column phosphorus (P) levels. This study is important as it directly relates to improved P performance under current STA outflow conditions. The essential goal of the study is to compare the P removal of several native Everglades plant communities and test the critical hypothesis that they are able to further remove P to a lower level than the current SAV cells. The hypothesis, or the proof of the concept, was based on an understanding of the STA outflow characteristics and the ecology and biology of these plants. It is well understood that the STA outflow consists of extremely low soluble reactive phosphorus (SRP) as well as the more refractory forms of dissolved organic P (DOP) and particulate P (PP). Plants assimilate SRP directly from water column or soil, but not DOP and PP. Phosphorus enzymes do transform DOP and PP into forms available for plant uptake. Plants adapted to a low SRP but high DOP and PP environment possess these P transforming enzymes. Published studies suggest that plant communities distributed in both the historical and current reference Everglades system, including sawgrass and water lily, are adapted to a very low P environment. Moreover, these plants have developed life history characteristics and plant structures that benefit P retention, including high tissue P relative to external habitat, slow turnover and decomposition rates, and large belowground organs. If the results from the proof-of-concept study are positive, then the native vegetation communities studied may be applied as alternative vegetation types in

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	conjunction with SAV cells to maximize P treatment performance. The three-year, proof-of-concept study is located at STA-1W Research Facility. There are six vegetation treatments consisting of cattail, sawgrass, and waterlily monocultures, a mixture of waterlily and spikerush, an SAV with *Najas guadalupensis* and *Chara* sp., and a control with soil (no vegetation was added). Each of the six treatments is replicated three times, resulting in a total of 18 replicates. The phosphorus dynamic model will be developed and tested using the data obtained from the mesocosm study. The model will capture P pathways and storages in each of the vegetation treatment and help to evaluate the P retention mechanisms. The study has been designed and implemented at the District under the close supervision of agency scientists since its inception three years ago in terms of sampling scheduling, methodology, sample analysis, and experimental maintenance.
<u>Study #3 –Development of Operational Guidance for FEB and STA</u> 1) This project would need to address the A-1 FEB case in particular. The FEB has been modeled to reach a P removal efficiency of about 35%. The operation of this FEB would need to be developed and optimized not only to provide a steady flow to the STAs but also to provide a high P removal performance. SFWMD would need to consider adding several new monitoring stations in this FEB to follow and optimize the P removal performance in the three FEB cells.	This study will, over its duration, address all FEBs but will start with the A-1 FEB. The expected outcome of the study includes the assessment of FEB operations to achieve desirable flow characteristics or state for the STAs, but will also incorporate findings of other ongoing Science Plan studies on internal processes to verify projected P removal performance of the FEB. A draft hydrologic and water quality monitoring plan for the A-1 FEB has been submitted to the FDEP as part of the Everglades Forever Act (EFA) permit application for inflow and outflow stations. Recommendations for additional long-term monitoring to assess FEB performance and assist with developing FEB operational plans will be forthcoming and is expected to be included in future updates of the Science Plan.

Study #3 –Development of Operational Guidance for FEB and STA 2) This project would also need to consider the Everglades ecosystem downstream. Indeed, the STA and FEB operational optimization should also take into consideration improving Everglades ecosystem hydropatterns – the timing and flow of surface water to the Everglades. Optimizing STAs flow discharge to improve the natural timing and pattern of inundation through the ecological communities in the Everglades is needed at this stage.	The project will not address downstream issues directly, as Everglades research and restoration is not within the scope of the Science Plan; however, advances in addressing water quality issues will benefit Everglades marshes. Based on preliminary regional modeling performed for the A-1 FEB in support of the U.S. Army Corps of Engineer's Environmental Impact Statement, the A-1 FEB is not anticipated to substantially affect Everglades hydropatterns. This study will, however, consider in the development of FEB/STA operational protocols and other agency operational objectives including flood protection, environmental, and water supply deliveries.
Study #3 –Development of Operational Guidance for FEB and STA 3) We have serious concerns about the SFWMD's decision to develop a new model from scratch to guide operational plans. This is an extremely time consuming step, particularly when peer-reviewing the model is a necessary step to confirm it validity. There is no reason to abandon the existing DMSTA model, which has taken significant time and resources to develop and has served so well. The DMSTA model is being widely used by the scientific community across the agencies, attesting no only to its good performance, but also to its ease of use, ruggedness, and reliability. The RSM model platform is currently used solely by the SFWMD scientists. Will the new RSM-based model be so much more reliable and accurate to support this decision? The deployment of such a specialized model exclusively by a select SFWMD group eliminates any comparative studies and highly desirable peer participation.	The objective of this study is not to build a new model though it is understood that may be one of the outcomes based on the findings of the study. The District intends to leverage any existing tool that is sufficient to address the projects needs, and models such as the SFWMM, DMSTA, RSM, iModel, and TUFLOW have been identified as part of the initial suite of tools. It is expected that a suite of tools will evolve out of this work that takes advantage of the strengths and features of the existing models and addresses their known limitations. It is also anticipated that through this study or other Science Plan studies, refinement of some of the existing models, including DMSTA, will likely occur. Models will be used at the appropriate scale, complexity, and rigor to support development of operating protocols that allow a balancing of the various operational objectives and outcomes in a manner that can inform timely decision making. The tools used will not be limited to any existing model nor will useful tools be abandoned that could help accomplish the intended role for models in this study.
Study #4: Evaluation of P Sources, Forms and Flux As reported in the main Science Plan Document, the key parameters that would likely affect STA performance are the hydraulic and phosphorus loading rates as well as the inflow P concentrations. SFWMD scientists seem to have avoided dealing with P in the STA inflow. Historical data indicated that the inflow TP is comprised largely of soluble reactive P and particulate P. Enhancing the removal of particulate phosphorus	High P concentrations and loading influence STA performance, particularly at the front end of the treatment flow-ways. Programs such as BMPs and sub-regional controls that reduce inflow loads are considered in the mix of management options, and will continue to be researched and refined in the District's BMP program. However, many years of STA performance data demonstrates definitively that internal processes are critical to STA outflow TP levels. These previous analyses show that at the

at the STA inflow should be investigated and included as part of this Study #4. Another cost-effective alternative to reduce P flowing into the STAs and to enhance the STAs performance would be to implement additional on-farm source controls or Best Management Practices – this is another obvious project that was completely left out by the SFWMD scientists. Moreover, the SFWMD scientists also neglected to: -incorporate the sub-regional source control strategies of this study plan -investigate the different alternatives for these sub-regional source control strategies, or -develop operational guidance for these sub-regional source control projects to enhance the FEBs and STAs performance	lower end of the treatment train, where the concentration and load have already been reduced significantly, inflow TP concentration and loading do not have any significant correlation with outflow TP concentration, suggesting that other factors (e.g., internal flux) might be the key influencing factors. Both studies #4 and #5 aim to identify those key factors.
<u>Study #5: Investigation of STA-3/4 PSTA Technology Performance</u> The outflow P concentrations from the PSTA cell in STA 3/4 have been very promising, and we would recommend to continue this project and to accurately assess the PSTA performance through a water quality and quantity budget analysis. As reported by the SFWMD for the first four water years of operation, the PSTA cell achieved an average annual FWM TP concentration of 10 ppb. If this alternative technology was in implemented in lower reaches of the STAs, it would guarantee the attainability of the WQBEL. We believe that at this stage the SFWMD should also include an additional investigation to assess the engineering and economic feasibility of the PSTA scale UP.	Agreed. To date, the STA-3/4 PSTA cell has shown solid performance in terms of producing low TP concentration at the outflow. The scientific investigation is continuing to more accurately assess performance, e.g., concentration reduction, load reduction, settling rate, changes in P species. This study is intended to determine the key factors that result in achieving such low level TP and in sustaining that level of performance. If the results of this study warrant further investigation, then a feasibility and engineering evaluation would likely be initiated.
<u>Study #6: Influence of Canal Conveyance</u> The influence of canal conveyance study, as currently developed, is assessing the changes in TP concentrations in the inflow water between the primary outflow point and the treatment flow-ways (e.g. changes in pump station S6 and STA-2 flow-way control structures). We would recommend broadening the scope of this investigation to also include the Everglades Agricultural Area canal system (lower reach), which contains sediments that could be entrained and which currently contribute to the deterioration of water quality at downstream sites. This study could provide a better	In some cases, studies of STA inflow canals capture the lower reaches of the agricultural canal system (e.g., the STA-5 inflow canal); however in others, the lower reaches of the agricultural canals are already covered under the District's BMP Research Program. The Science Plan does not include BMP projects but instead focuses on STA research that can further help in achieving the WQBEL. As part of the Restoration Strategies Water Quality Planning effort, the District proposes to build upon the success of the existing BMP Regulatory Program by focusing on areas and projects with the greatest potential to further improve water quality. The District's goal is to design water

understanding of additional changes (e.g. dredging) that could further reduce the amount of P and particulate P reaching the STAs and the FEBs.	quality improvement projects at strategic on-site locations through sub-regional source control projects in series with the on-site BMPs to further reduce TP loads to the STAs. The East Beach Water Control District has volunteered to participate in a three-year cooperative agreement with the SFWMD on a sub-regional canal cleaning implementation and demonstration project within the S-5A sub-basin. This interest is based on promising preliminary results of the University of Florida Institute of Food and Agricultural Sciences' research on a comprehensive canal management program at a research plot level. This type of demonstration has not been evaluated on a sub-regional scale. This project includes evaluation of data associated with existing water quality, floating aquatic vegetation, and canal sediment conditions under current practices, in contrast with feasible comprehensive canal management practices. The activities funded by this project are above and beyond existing BMP plan regulatory requirements.
<u>Study #7: Deep Water Pulsing on Cattail Sustainability</u> The second project examining the water level pulsing effect on cattail should also include the development of specific operational guidance for FEBs/STAs during storm and hurricane events. Along with examining additional changes to managing sediments in upstream canals, the SFWMD should investigate an adequate operational procedure during storm events (water distribution between STAs, etc.). For more than two months after Tropical Storm Isaac, the P flowing into STA-1W was reaching 350 ppb, and bypassing STA-1W and STA1E was the only alternative selected by the SFWMD.	The results of the proposed cattail study will provide scientific evidence for improving STA operations during storm events. As cattails are anticipated to establish in the shallow FEBs, the findings from the proposed study will be applicable as input to FEB operational guidance. A separate study (Study #3) focuses on integrated FEB and STA operations, which will evaluate alternative operational strategies for various conditions expected during high rainfall events, dry hydrologic conditions, and other periods that have potential impacts to STA performance.

Study #8: STA Water Budget Improvement This is an extremely important study that needs to be conducted as soon as possible. It should be given the highest priority. Increasing the number of water quality and quantity monitoring stations in the STAs and FEBs is essential in order to conduct this study and to close the current STAs' water and phosphorus budgets. Enhanced monitoring and seepage management suggested as possibilities in Phase II should be given a high priority. Rigorous statistical and data analysis should be also part of this endeavor.	This study has already begun as a high priority effort for the agency in recognition of its importance. Building upon this recognition and since the initial Water Budget study plan was presented, the study has been expanded to include work on improving STA phosphorus budget, loading rate, and settling rate calculations. In order to ensure successful STA operations and an optimized monitoring network, monitoring will continue to be reviewed. In addition, monitoring and data collection will be added as needed to support specific, short-term monitoring requirements of individual projects.
Last Paragraph In order to proceed efficiently in this endeavor , we would finally suggest to 1) identify a SFWMD principal investigator (PI) who would lead the work on each of the projects, and 2) select and engage an appropriate external and independent Co-PI would also follow the work progress to ensure appropriate accountability.	An SFWMD Principal Investigator has been assigned to each of the nine studies. An adaptive management and implementation process will be followed using periodic project specific workshops with the Restoration Strategies Tech Reps, federal agency experts, and their consultants. It is anticipated that the Science Plan progress and results will be reported and discussed at routine Long-Term Plan Communications Meetings as well as documented in the annual South Florida Environmental Report. The District encourages external stakeholders to take advantage of the public Long-Term Plan Communications meetings to engage and follow the work progress of the Science Plan studies and the Restoration Strategies construction projects. Therefore, an external Co-PI will not be necessary.

From: dmandch@aol.com [mailto:dmandch@aol.com]
Sent: Wednesday, May 22, 2013 2:02 PM
To: Gerry, Lawrence
Subject: Sierra Club Loxahatchee Group Comments on Draft Science Plan

Larry,

Thank you for all the work you and your team have been doing. We appreciate your efforts.

Here are some brief comments:

1). The source of the water coming into the STAs is important. Source controls and BMPs for basin users need to be part of the process. The quality of water entering the system has a significant impact upon your ability to meet the QBL.

We do not believe that you can separate the source controls from the clean up process. If you meet the QBL with a certain level of phosphorous entering the system and then the source water were to degrade you could then fail to meet the QBL later on in the process. Source reductions play such a critical role in meeting water quality standards. Input estimates must be part of the process along with basin water quality programs with ever increasing requirements as technology improves.

2) We encourage the maximum amount of natural sheet flow for water quality treatment. We are happy to see the use of saw grass and lilies to polish water. Sheet flow was the original water quality treatment provided by nature we recommend that you continue to rely in part on natural sheet flow for water quality.

3) We are concerned about water depth as it can drown plants. We agree with your analysis that pulse flows reduce this problem and that water should be entered in pulses (please let me know if this interpretation of the presentation is correct.)

4) Limestone caping appears to be a good strategy in sequestering phosphorous. The question will remain about the amount of phophorous coming from undergroud sources. Will this capped phosphours reappear in underground water tables?

5) We remain concerned about other chemicals from agriculuture and treatment causing pollution downstream. In particular pesticides, mercury, lead, and Roundup (glyphosate). These chemicals and their side effects can not be ignored as we move to create clean water.

6) We want to encourage your group to focus on the long term impacts on improving water flows to Everglades National Park. Meeting the QBL is part of this process, but the long term needs of the park mean significant amounts of water will need to be treated and sent south. The speed of treatment is equally important. How fast can water be treated and released? How much water can be treated? What happens to this process during drought and what happens during Hurricans and Tropical Storms?

7) How will phosphorous be removed long term from the STAs? Where will is go? These questions still have not been fully answered.

Thank you again for all your efforts,
Drew Martin
Conservation Chair, Loxahatchee Group, Sierra Club

SFWMD Responses to Sierra Club Comments on the Draft Science Plan for the Everglades Stormwater Treatment Areas (April 2013)

PUBLIC COMMENT	SFWMD RESPONSE
1. The source of water coming into the STAs is important. Source Controls and BMPs for basins users need to be part of the process. The quality of water entering the system has a significant impact upon your ability to meet the QBL. We do not believe you can separate the source controls from the clean up process. If you meet the QBL with a certain level of phosphorus entering the system and then the source water were to degrade you could then fail to meet the QBL later on in the process. Source reductions play such a critical role in meeting water quality standards. Input estimates must be part of the process along with basin water quality programs with ever increasing requirements as technology improves	As the South Florida Water Management District (SFWMD or District) already has a program in place that focuses on and conducts research on source controls and Best Management Practices (BMPs) through the Everglades Regulation Bureau, the District is focusing on understanding, optimizing and enhancing the phosphorus treatment performance of the STAs and Flow Equalization Basins (FEBs) in the Science Plan. It is important to note that there is close coordination and information sharing between the areas of the District that implement the BMP research program and the STA science and research activities. The Restoration Strategies Regional Water Quality Plan proposes to build upon the success of the existing BMP Regulatory Program by focusing on areas and projects with the greatest potential to further improve water quality. The District's goal is to design projects to increase retention/detention of total phosphorus (TP), above what is currently required at the basin-ID level, in strategic on-site locations, or through sub-regional source control projects (S-5A drainage basin) in conjunction with the onsite BMPs to further reduce TP loads to the STAs.
2. We encourage the maximum amount of natural sheet flow for water quality treatment. We are happy to see the use of saw grass and lilies to polish water. Sheet flow was the original water quality treatment provided by nature we recommend that you continue to rely in part on natural sheet flow for water quality.	In the Five-Year Work Plan (Appendix C), there is a proposed Science Plan study focused on optimizing flow regimes into the STAs in conjunction with the operation of the FEBs. District staff is optimistic that the results of this study will provide useful information that can guide future operation of the STAs and FEBs. Regarding the water lily and sawgrass study, this proof-of-concept study is being conducted to determine the actual benefits of encouraging these types of vegetation in existing submerged aquatic vegetation (SAV) cells.

SFWMD Responses to Sierra Club Comments on the Draft Science Plan for the Everglades Stormwater Treatment Areas (April 2013)

PUBLIC COMMENT	SFWMD RESPONSE
3. We are concerned about water depth as it can drown plants. We agree with you analysis that pulse flows reduce this problem and that water should be entered in pulses (please let me know if this interpretation of the presentation is correct.)	Seasonal water level fluctuation within a reasonable range of water depths (e.g., not too deep for too long) does not always impact cattail communities in the STAs and in fact may be beneficial in allowing new growth. To clarify, a proposed Science Plan study is focusing on determining the effects of deep water level pulsing (extreme condition, e.g., 3 ft deep or deeper for up to one week, that may occur during or following storm and hurricane events) on cattail sustainability.
4. Limestone capping appears to be a good strategy in sequestering phosphorus. The question will remain about the amount of phosphorus coming from underground sources. Will this capped phosphorus re-appear	The intent of limerock (limestone) capping is to reduce the amount of groundwater phosphorus that will diffuse up into the water column by covering the high-phosphorus sediments in the STAs with a thick layer of low-phosphorus material, i.e., limerock. Also, phosphorus cycling in a wetland is highly complex. Phosphorus that is stored in the sediment or attached to calcareous surfaces could potentially be released depending on the condition of the substrate. For example, a drop in pH to an acidic condition could result in desorption of phosphorus that is sorbed on calcitic surfaces. There is very limited field data to determine the ability of limestone to trap groundwater phosphorus and minimize the upward flux to the water column in the STAs. The stability of trapped phosphorus will be evaluated under this study.
5. We remain concerned about other chemicals from agriculture and treatment causing pollution downstream. In particular pesticides, mercury, lead and Roundup (glyphosate). These chemicals and their side effects cannot be ignored as we move to create clean water.	As mentioned previously, the focus of the Science Plan is on understanding, optimizing, and enhancing the <u>phosphorus</u> treatment performance of the STAs and the FEBs. The District routinely monitors for herbicides, pesticides, metals, and mercury. These constituents have not been found in concentrations high enough to be of concern in the STAs. While the SFWMD has not conducted any independent studies, the literature suggests that glyphosate not absorbed by targeted or non-targeted plants will bind strongly with soil particles. It is also readily broken down by soil microbes. Furthermore, the SFWMD does not use the surfactants that have been linked to impacts to

SFWMD Responses to Sierra Club Comments on the Draft Science Plan for the Everglades Stormwater Treatment Areas (April 2013)

PUBLIC COMMENT	SFWMD RESPONSE
	amphibians and other organisms.
6. We want to encourage your group to focus on the long term impacts on improving water flows to Everglades National Park. Meeting the QBL is part of this process, but the long term needs of the park mean significant amounts of water will need to be treated and sent south. The speed of treatment is equally important. How fast can water be treated and released? How much water can be treated? What happens to this process during drought and what happens during Hurricanes and Tropical Storms?	The Science Plan and Restoration Strategies Projects are intended to significantly improve the quality of water delivered to the Water Conservation Areas (WCAs) and Everglades National Park. However, the volume of water delivered from STA tributary basins and Lake Okeechobee to the WCAs will not increase as a result of the implementation of Restoration Strategies. The Central Everglades Planning Project (CEPP) and other Comprehensive Everglades Restoration Plan (CERP) projects are the proper forums for means and methods of increasing the volume of water delivered to the Everglades. The inclusion of FEBs in the Restoration Strategies Water Quality Plan is anticipated to improve the system response to both dry hydrologic conditions and high rainfall events.
7. How will phosphorus be removed long term from the STAs? Where will it go? These questions still have not been fully answered.	The STAs retain phosphorus through several mechanisms including plant nutrient uptake and litter decay, settling and sorption, co-precipitation with minerals, sedimentation, and microbial uptake. The incorporation of phosphorus into the formation of new soil structures is essentially permanent.