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TO: Principals of the Consent Decree

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FINAL DRAFT FOR PRINCIPALS' REVIEW

Progress Report on Remedial Measures to Control Phosphorus Loads to the A.R.M. Loxahatchee National Wildlife Refuge

The TOC met in special session on November 8, 2004 to discuss the circumstances of an August 2004 exceedance of the Interim Phosphorus Levels in the Refuge. This meeting provided an opportunity to review all relevant information on external and internal factors involved in phosphorus levels in the Refuge and potentially having some role in exceedances of the Interim Phosphorus Levels. While TOC representatives can agree on the suite of potential causes of the exceedances, the TOC may not agree on the relative importance of these factors. As a result, the TOC and Settling Parties find it more appropriate and effective to focus on the remedy rather than to continue debating which factors may have been most involved in a particular exceedance.

Following the November 8, 2004, TOC meeting, the Principals of the Consent Decree met and provided guidance to the TOC in a letter dated November 9, 2004. They recognized that TOC had invested substantial effort to arrive at consensus recommendations in response to the 2002/2003 exceedance of the Interim Phosphorus Levels, culminating in a letter agreement dated April 2, 2004. The agreement supports remedial and monitoring measures in response to the 2002/2003 exceedance, based on the detailed TOC recommendations dated July 24, 2003. Most of these measures are contained in the District's Long-Term Plan and in the letter of November 9, 2004, the Principals re-affirmed the suite of actions being taken based on the April 2, 2004, agreement. Absent extenuating circumstances, they indicated that the Settling Parties should allow sufficient time for those measures to be completed before imposing additional remedies.

The Principals requested that the additional measures being put in place by the State beyond those of the April 2, 2004, agreement should be discussed at the November 30, 2004, TOC meeting, along with possible water management

actions to further reduce phosphorus loads and levels. They anticipate recommendations based on these discussions. Further, they request a report on progress to date implementing the April 2, 2004, agreement. In this summary of progress, they expect an update on: 1) actions being taken to control phosphorus loads to the Refuge, 2) enhancing monitoring of the Refuge, and 3) modeling of the Refuge. These are the three general categories of recommendations submitted by the TOC in their letter of July 24, 2003. In addition, the principals anticipate recommendations on additional measures involving water management, these are communicated as a separate section of the document.

Introduction to the Progress Report

The Settling Parties have identified several factors that could potentially cause or contribute to exceedances of the Interim Phosphorus Levels in the Refuge. However, differences of opinion exist as to the relative weight of the various factors in affecting phosphorus levels in the Refuge, generally and in causing the exceedances, specifically. To move constructively forward, a three-prong remedy was devised by the TOC (July 24, 2003) and approved by the Principals (April 2, 2004) to control phosphorus loads to the Refuge and to provide additional information through monitoring and modeling. The following summary uses the three-prong outline and titles of the July 24, 2003, recommendations from the TOC to the Principals while referencing specific activities described in the November 2004 Long-Term Plan.

The following paragraphs and appendices constitute the requested progress report to the Principals. The report was discussed in detail at the January 24, 2005, Special Session of the TOC and approved at the quarterly meeting of the TOC on February 25, 2005.

A. Controlling Phosphorus Loads to the Refuge

Background of the Phosphorus Control Program

The overall remedy considered by the Principals and the TOC to control phosphorus loads to the Refuge (Category A TOC recommendations) is being implemented through Florida's Long-Term Plan for Achieving Water Quality Goals, or Long-Term Plan (LTP). The LTP includes three categories of projects and activities to control phosphorus loads to the Refuge. As reflected in the Principals' April 2, 2004, letter agreement, one category of projects is the existing phosphorus control measures established by the Settlement – the STAs and BMP Program. The LTP contains activities involving the installation of physical improvements to the existing STAs to improve their performance. Updates on specific activities being executed under the Plan and recommended by the TOC are provided below. At the time of the April 2, 2004, agreement of the Settling Parties, improvements to the LTP had been finalized and were being implemented. In formulating their remedy to the Refuge exceedances, the Settling Parties recognized the obvious benefits of using the LTP to assure that appropriate actions were being taken and progress could be tracked and reported.

The second category of projects and activities is operational refinements and research projects initiated since the October 2003 LTP was drafted to further improve STA performance and reduce phosphorus levels. These are generally set forth in the TOC's July 24, 2003, recommendations, which were approved by the Settling Parties. The Settling Parties recognize that there is a great amount of uncertainty associated with all of the phosphorus control programs set into motion under the Settlement and EFA, and as a result, we must constantly re-evaluate that remedy in an adaptive manner.

The third category of projects and activities is several recent initiatives by the State in conjunction with the Army Corps of Engineers (Corps), a combined effort known as 'Acceler8'. First in relation to P control to the Everglades, the State is committed to building approximately 18,000 additional acres of STAs in the EAA, about a 40% increase from the current size. These projects will substantially improve water quality in the Everglades. Second, the State and the Corps are expediting construction of several CERP projects that will also help improve water quality in the Everglades.

The following paragraphs update progress on projects and activities in the LTP originating from the Settlement Agreement, the October 2003 LTP and the Acceler8 initiative.

A. 1. Continue to develop and implement strategies to operate the STAs within their design range. That should include review of baseline hydrologic data sets used for STA design and updating to reflect current regional water management.

A.1.a. Operate the STAs within their design range

1. Project: Flow-through Operation of STA-1E.

- a. **Purpose:** STA-1W occasionally receives flows from the S-5A, C-51 West and L-8 Basins in excess of its design range. STA-1E is part of the overall Everglades Restoration program and is intended to work in concert with STA-1W. Once STA-1E is in flow-through operation, there will be greater operational flexibility in treating flows from the S-5A, C-51 West and the L-8 Basins, which, it is hoped will allow STA-1W to operate within its design range. The TOC acknowledges that there are differences of opinion among its members as to the degree of flexibility that will be available and the net reduction of P loads to the Refuge from the operation of STAs 1W and 1E in tandem and that matter will be the subject of continuing review.
- b. **Status:** The Corps determined that STA-1E construction was substantially complete in June 2004. Since that time, the District has been implementing vegetation management activities in all cells except Cell 2, which the Corps is maintaining control over as the location of their proposed PSTA demonstration project. The FDEP is in the process of issuing operational permits for STA-1E.

2. **Project: Minimize Lake Okeechobee Regulatory Releases to the Refuge**
 - a. **Purpose:** Regulatory releases from Lake Okeechobee are used to keep the Lake within its regulation schedule. STA-1W was not designed to treat regulatory releases from Lake Okeechobee; hence sending these waters to STA-1W may result in flow and phosphorus loads in excess of the STA design quantities. Minimizing these releases will reduce P loads to the Refuge from this source.
 - b. **Status:** In February 2003, the District terminated the delivery of regulatory releases to STA-1W from Lake Okeechobee, which was above its regulation schedule. STA-3/4, which was designed to treat regulatory releases, is now operational and has been receiving regulatory discharges, as intended. The Miami and North New Rivers canals have both been plugged and hence all Lake Okeechobee regulatory water sent south to STA-3/4 is treated.

3. **Project: Avoid Phosphorus Loading To STA-1W and the Refuge by Conveyance of Water Around the Refuge Instead of Through STA-1W and the Refuge**
 - a. **Purpose:** Water delivered from the Refuge to the Lower East Coast for water supply purposes must be replenished to maintain the Refuge's regulatory schedule. This results in good quality water being released from the Refuge and being replaced with water of lower quality and overloading of STA-1W. This project seeks to minimize the delivery of water supply make-up water to the Lower East Coast (and associated P loads) through STA-1W and the Refuge without compromising downstream water supply needs.
 - b. **Status:** The District and local water supply district have experimented with delivery of water around the Refuge instead of through the Refuge, as a partial solution. A maximum of 500 cfs can be delivered in this manner when conditions in the C-51 West Basin are amenable. Other delivery options are under investigation.

4. **Project: Develop and Implement an Operational Tool to Ensure STAs are Operated within their Design Range**
 - a. **Purpose:** The STAs were designed to treat a specific range of flows and phosphorus loads. This project is intended to avoid or minimize the likelihood of overloading the STAs.
 - b. **Status:** The District developed an operational tool (charts and tables) to track actual vs. design range for flow and phosphorus. This tool is used in weekly meetings with Operations staff to ensure continued operation within the design range.

5. Project: G-341 Divide Structure

a. **Purpose:** The Ocean Canal, which extends from the West Palm Beach Canal to the Hillsboro Canal, is currently an open connection. This allows water that is intended to go to STA-2 to go to STA-1W. This structure will prohibit that water and phosphorus loads from going to STA-1W, and contributing to its overload.

b. **Status:** Construction is underway on the divide structure in the Ocean Canal to replace the S-5AX Structure. Completion expected by the end of 2005.

6. Project: Temporary Deviation from Refuge Regulation Schedule to Reduce Excess Phosphorus Loads to STA-1W and the Refuge

a. **Purpose:** Temporarily deviating from the Regulation Schedule will help to minimize overloading STA-1W and water supply make-up water impacts to the Refuge under specific stage conditions. These impacts are associated with the current Regulation Schedule.

b. **Status:** On January 6, 2005, the District requested a temporary deviation for the Regulation Schedule of the Refuge from the USACOE, Jacksonville. The District asked for the removal of the condition requiring water supply releases be balanced by deliveries when the Refuge stage is less than one foot above the stage of Lake Okeechobee. By removing this condition, water supply deliveries from the Lake would not be required at high stages. Removing this requirement will decrease the potential for the penetration of canal water into the interior areas of the Refuge. This is one step in the direction of decreasing water quality impacts to the Refuge through changes in regional water management.

A.1.b. Review and update the baseline data set used for STA design.

1. Project: Review and Update Baseline Data Set Used for STA Design.

a. **Purpose:** The STA designs in the Settlement Agreement assumed future flows would match the flows that occurred during the 10-yr base period (1979-88). This project evaluates those assumptions and more recent data to update the anticipated flows and loads to the STAs for subsequent evaluation of potential regional modifications to optimize STA performance.

b. **Status:** Actual flows to STA1-W, excluding Lake Okeechobee releases, match those of the base period; however, they are significantly higher than the 2002 flow estimates used in the LTP. Of particular concern are flows from the upstream basins that contribute to STA-1W, which may be up to twice the anticipated amounts until future CERP projects are in place (e.g., the L-8 diversion project), as was assumed in STA-1W planning. The District's simulation model was re-calibrated using updated information. A review of the actual and anticipated flows and loads is underway at this time, with a target to complete this analysis by September 2005.

2. Project: EAA Regional Feasibility Study

- a. **Purpose:** One major objective is to determine an optimal re-allocation of flows and loads to the STAs that will minimize overloading to any individual STA. One task is to identify the necessary revisions to the operational regime and/or physical improvements to the conveyance system to implement the optimal re-distribution of flows and loads.
- b. **Status:** The District has initiated a regional feasibility study for the EAA that will utilize the updated data sets. The feasibility study should be completed in the summer of 2005. (See further discussion of the regional feasibility study below.) This will be an issue that will be discussed at the May 2005 TOC meeting.

A.2. Review the Long-Term Plan to determine whether additional measures are appropriate for optimizing phosphorus reduction. Implement such measures as necessary to achieve the long-term levels.

In general, the STA enhancements contained in the LTP include the following features:

- Conversion of emergent vegetation to submerged aquatic vegetation, which has been demonstrated to generally reduce phosphorus to lower levels than emergent vegetation.
- Construction of physical features to create more uniform flow of water within an STA, thereby allowing greater opportunity for the plants to remove phosphorus.
- Operational refinements of the STAs, including: (1) lowering operating depths; and (2) balancing flows/loads among the cells within an STA. Both of these measures have been shown to reduce p levels in discharge.
- Investigation of additional measures to improve STA performance, including the use of Periphyton-based Stormwater Treatment Areas (PSTA).

The LTP was reviewed and the following modifications were made:

1. Project: Review LTP and Revise to Optimize Phosphorus Reduction

- a. **Purpose:** To improve operational flexibility to optimize phosphorus reduction.
- b. **Status:** The District added a water control structure and remotely operated gates to the plan of enhancements to STA-1W. The construction contract for the STA-1W enhancement was awarded in the fall of 2004 and work is underway. The target completion is December 2006. The result of these refinements to the LTP should be increased operational flexibility to move water among the treatment cells within STA-1W to balance the flows/loads.

2. Project: Revise Operations of STAs

- a. **Purpose:** To modify the operational depths in the STAs to optimize phosphorus reduction.
- b. **Status:** The District has reduced the average operating depth within STA-1W, and other operational measures are being investigated.

A.3. Refine operational strategies to reduce short-term loads to and from the STAs.

By reducing short-term phosphorus loads to the STAs, there will be better performance of the STAs – the result of a more even inflow and more opportunity for the plants to remove phosphorus. It is also expected that reducing short-term loads from the STAs (and therefore to the Refuge) will also result in less penetration into the interior marsh of the Refuge.

1. Project: Use Smaller Pumps Prior to the Larger Ones

- a. **Purpose:** To reduce short-term loads by using lower average flow rates from STA-1W to the Refuge.
- b. **Status:** This is the standard operating protocol. The standard practice for the STA-1W outflow pump stations (G-251 and G-310) is to use the smaller (75 and 100 cfs) electric pumps first instead of the large diesel pumps (470 and 950 cfs).

2. Project: Revise Operation of STA-1W Outflow Pumps from 8-hr on/16-hour off to 24-hour on

- a. **Purpose:** To reduce short-term loads by using lower average flow rates from STA-1W to the Refuge.
- b. **Status:** In the summer of 2004, the District began implementing 24-hr pumping of the STA-1W outflow pumps instead of the prior practice of pumping for 8-hr, then shutting down for 16 hours. This increases operating costs to the District, but is expected to reduce phosphorus penetration into the interior marsh. The expanded monitoring of the Refuge may provide evidence of effectiveness.

3. Project: Revise Operation of STA-1W Inflow Pumps from 8-hr on/16-hour off to 24-hour on

- a. **Purpose:** To reduce short-term loads to, and improve performance of, STA-1W by using lower average inflow rates.
- b. **Status:** The District is investigating a similar continuous pumping protocol for the S-5A (inflow) pump station. Extensive coordination with the upstream landowners will be required regarding timing of agricultural pumping, and an initial meeting with an industry representative has taken place.

4. Project: Increase Conveyance Capacity of L-40 Canal Downstream of STA-1E.

- a. **Purpose:** Outflow from STA-1E can overflow the receiving L-40 canal into the Refuge interior. This project is intended to minimize this effect by increasing canal conveyance capacity.
- b. **Status:** As part of the STA-1E construction, the Corps has agreed to increase the conveyance capacity of the L-40 canal downstream of STA-1E. This should reduce the hydraulic penetration of STA-1E discharges into the interior marsh of the Refuge. Performance measures are currently being developed to assess the effectiveness of this project.

A.4. Review of regional water management decisions affecting STA operations and performance.

1. Project: Review of Regional Water Management Decisions Affecting STA Operations and Performance

- a. **Purpose:** To identify regional decisions that may be adversely affecting STA operations and performance.
- b. **Status:** There is a plan in place to review and revise the Lake Okeechobee Regulation Schedule that will include an evaluation of the effects on water conservation areas of changes to that schedule. Susan Sylvester of the Corps is leading the effort to review the Lake Okeechobee and WCA regulation schedules at the request of the TOC. An update will be provided to the TOC in the near future.

Recent Initiatives

At its November 30, 2004, meeting the TOC discussed several additional measures being undertaken, which are intended to further decrease phosphorus loads to the Everglades, including the Refuge, beyond those measures considered in the July 24, 2003, TOC recommendations.

1. Project: Acceler8

- a. **Purpose:** Multi-purpose; four Acceler8 projects are intended to provide three direct benefits to the Everglades, including the Refuge:
 - The primary and most direct benefit will be a reduction in phosphorus entering the Everglades.
 - A second benefit will be improved timing and distribution of water to the Everglades – more closely reproducing the historic flow patterns.
 - iii. A third benefit is the additional operational flexibility provided by more storage and treatment areas.
- b. **Status:**
 - i. **Expansion of the STAs.** Design is underway for an 18,000-acre expansion of the STAs. Approximately 9,000 acres will be adjacent to STA-2, which could then receive a portion of the flows and loads that are currently entering the Refuge

through STA-1W. Another approximately 9,000 acres of expanded treatment area will be located between STA-5 and STA-6. Construction of both expansions is currently scheduled for completion by December 31, 2008, with full flow-through operations expected within 18 months after construction.

- ii. **Diversion of Acme Basin B Discharges.** Currently, discharges from Wellington Acme Basin B go untreated directly to the Refuge. As part of Acceler8, these discharges will be terminated, and the water directed to STA-1E for treatment. Construction is currently scheduled for completion by September 2007.
- iii. **EAA Regional Feasibility Study** – As described in section A.1.b.#2 above, one objective of this project is to balance the flows and loads among the STAs. This will potentially include enlarging canals to allow this interbasin transfer from the east to the west where these new treatment areas are located. There is one scope item that will look at enlarging the treatment area serving the Refuge if the additional 18,000 acres are not a sufficient treatment area to meet the long-term water quality goals. The study is currently scheduled for completion by the summer of 2005. This will be on the TOC Agenda for the May 2005 meeting.
- iv. **Everglades Agricultural Area Reservoir – Phase 1 with Bolles and Cross Canals Improvement.** This project will construct any necessary refinements to the existing canal system to be used to convey water from STA-1W to the expanded STA adjacent to STA-2. Further, the additional storage to be provided in the reservoir will increase operational flexibility in the EAA canal network, which could lead to optimized performance of the STAs. This is currently scheduled for completion by December 2009.

B. Enhancing Monitoring of the Refuge

B.1. Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.

Status: An expanded water quality monitoring network (a combination of transects and individual sites) has been designed and established. With the rise in water levels, complete monthly sampling began in September 2004. Final data for monthly samples continue to be publicly posted on DBHYDRO by the SFWMD.

The monitoring transects are also being equipped with water conductivity data loggers to collect conductivity and temperature data. This information can then be used to more fully understand the relationship between water management and water quality, and refine operations, when possible, to minimize canal water intrusion into the interior marsh. Four of these transects

have been instrumented, and, in cooperation with the USGS, we plan to deploy additional instruments within the next few months.

C. Modeling of the Refuge

C.1. Develop a water quality / hydraulic model for the Refuge with a phosphorus cycling component, and C.3. Develop and track a simple phosphorus mass-balance for the Refuge.

Status: A contract has been established with Dr. Ehab Meselhe (University of Louisiana – Lafayette) for the development of these modeling tools for the Refuge. The first phase of this effort involves a model selection process. The first phase of Dr. Meselhe's model selection project is nearing conclusion with the meeting of the External Technical Panel on 28 January, 2005. For additional information, the reader is referred to the November 2004 Progress Report on the TOC website.

Separately, a contract has been established with Dr. Vince Neary (Tennessee Technological University) to establish an External Technical Panel to provide review of the model selection process and the development of the modeling tool(s) over time. Technical Panel members have been identified. The initial panel meeting is scheduled for January 28, 2005.

C.2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.

Status: A canal monitoring contract has been established with Dr. Samira Daroub (UF – IFAS) to conduct canal hydrographic surveys and synoptic water quality surveys. The sediment survey component began at the end of 2004. The canal water quality survey component will begin in early 2005.

Future Report to Principals

In the November 9, 2004, letter to the TOC, the Principals asked the TOC to analyze current water management practices and water quality compliance, as well as opportunities to alter water management to improve water quality while maintaining water quantity benefits. The TOC has developed an initial list of possible opportunities and will discuss and analyze these opportunities in future deliberations. A report to the Principals will be developed and delivered under separate cover by June 2005.