

# **Appendix 4-14: Scope of Work for Hydraulic Tracer Study of STA-2, Cell 3**

**EXHIBIT “C”  
STATEMENT OF WORK**

**STA-2, Cell 3 Baseline Tracer Study**

**1.0 INTRODUCTION AND BACKGROUND**

The Everglades is an internationally recognized ecosystem and represents the largest subtropical wetland in the United States. During recent decades, the biotic integrity of the Everglades ecosystem has been affected by alterations of the hydrologic and nutrient regimes resulting from agricultural and urban development. Research has shown that both hydrologic improvements and a reduction in the level of total phosphorus (TP) in the runoff from the Everglades Agricultural Area (EAA) and urban areas is a prerequisite to restoring and protecting the remaining Everglades.

The South Florida Water Management District (DISTRICT) and other parties are aggressively pursuing measures to reduce TP concentrations in EAA runoff. Several measures to reduce TP concentration levels have been implemented and include EAA landowner Best Management Practices (BMPs), and construction and operation of Stormwater Treatment Areas (STAs). These phosphorus control programs have proven very effective at reducing phosphorus concentrations going into the Everglades. To date, the EAA BMPs and downstream STAs have removed over 1,400 tons of phosphorus that would have otherwise entered the Everglades. The Everglades Forever Act (EFA) established a default long-term TP discharge concentration of 10 ppb for water delivered to the Everglades Protection Area (EPA). The DISTRICT is continuing the efforts to optimize and improve the TP removal performance of the STAs through the implementation of the STA enhancements presented in the Conceptual Plan for Achieving Long-term Water Quality Goals (Burns and McDonnell, 2003). Preliminary modeling results presented in the Conceptual Plan have indicated that compartmentalization of some of the STA treatment cells may improve the hydraulics of the wetland by redistributing the water flow, thereby increasing the TP removal performance of the treatment system.

The original performance forecast model for the STAs assumed that these systems operated as plug-flow reactors. However, tracer projects conducted within the STAs indicate that flow patterns depart widely from ideal plug-flow characteristics and that large short-circuits exist. These short-circuits result in a portion of the influent water reaching the outflow of the system before the calculated hydraulic residence time (HRT), thereby reducing the TP removal efficiency of the system. These non-ideal flow patterns typically remain intact until the water is redistributed by structural means, such as an additional levee that partitions the treatment cell into two areas.

The purpose of this Request for Proposals (RFP) is to contract a tracer project to provide a hydraulic baseline for STA-2, Cell 3 to quantify the system’s retention time and flow distribution prior to the construction of an internal levee. Synoptic grab samples of the lithium tracer and phosphorus shall be made at internal locations to further characterize the flow and phosphorus concentrations, and to document any short circuiting. In this RFP, the CONTRACTOR shall

respond with a plan to conduct and summarize the results of a lithium tracer project in STA-2, Cell 3.

## **2.0 OBJECTIVES**

The overall objective of this project is to document the hydraulic retention time (HRT), the distribution of flow and phosphorus concentrations prior to the construction of the levee in STA-2, Cell 3.

## **3.0 LOCATION OF PROJECT**

STA-2 (Figure 1) is located in southern Palm Beach County, adjacent to the southwestern section of Water Conservation Area 2A (WCA-2A). STA-2 is a 6,340 acre treatment wetland, constructed on previously farmed land and consists of three treatment cells. Cell 3 is 2,220 acres in size, and is maintained as an SAV system dominated by Southern Niad and Hydrilla, with an average water depth of 2 feet with navigation hazards such as under water rocks and agricultural ditches. The nominal HRT for Cell 3 is approximately 23 days. Water is pumped from the S-6 structure to the inlet canal and then flows through 5 culverts (G-333 A through E), into Cell 3 and out of Cell 3 through the G-334 outlet structure.

## **4.0 RESULTS FROM PREVIOUS PROJECTS**

No previous tracer studies have been conducted within STA-2. However, prior to this project, the DISTRICT and Florida Department of Environmental Protection (FDEP) have conducted four separate tracer projects in three full-scale treatment cells located within STA-1W. The DISTRICT reports and data can be found on the internet at [http://www.sfwmd.gov/org/erd/ecp/etweb/main\\_template/attrep\\_a.htm](http://www.sfwmd.gov/org/erd/ecp/etweb/main_template/attrep_a.htm). Copies of the FDEP project are available by contacting Taufiqul Aziz from FDEP at (850) 245-8415.

## **5.0 SCOPE OF WORK**

This project shall consist of five (5) tasks that will be performed over a 44 week period. These include a Project Work Plan, Kickoff Meeting, Tracer Project, Draft and Final Report, and a Technical Review Meeting to present the results. The lithium tracer solution will be evenly distributed into Cell 3 through the five (5) G-333 culverts. Monitoring efforts will begin just prior to release of the tracer.

## **6.0 WORK BREAKDOWN STRUCTURE**

The CONTRACTOR shall present the draft Project Work Plan during the project kickoff meeting. All sample collection, implementation, laboratory analysis, materials, equipment including autosamplers and airboats and all other goods or services in conjunction with this project shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall be responsible for the storage, handling or disposal of any chemicals, residues, process byproducts, etc., involved with this project. The DISTRICT will provide access to the project site at all times and the CONTRACTOR shall facilitate site inspection. The CONTRACTOR shall remove all equipment and restore the project site(s) to the original condition at the conclusion of the Tracer project.

### **TASK 1: PROJECT PLAN**

#### ***A. Draft Project Work Plan***

The CONTRACTOR shall prepare and submit a letter report detailing the draft Project Work Plan providing a detailed layout of objectives, individual tasks (implementation, collection, evaluation, etc.), deliverables and all other pertinent information required to complete each phase and task of this project.

The Project Work Plan shall include, but not necessarily be limited to, the following:

- List of the project team members and their assigned roles and responsibilities.
- Internal and external communications protocols to be followed for the duration of the project.
- Schedule for performing the authorized tasks.
- Procedures for working with designated DISTRICT staff as project points of contact.
- Details of the Tracer Project Plan will include the generation of the technical data needed to provide a baseline prior to the construction of the levee to redistribute flow within STA-2, Cell 3.
- Site Safety will primarily focus on highlighting safety issues associated with remote water facilities. Protocols for sampling, sample handling and shipment, site security and other applicable plan features will be described, in addition to information regarding emergency medical services and/or other emergency support.
- Sampling and Analysis Plan (SAP)
- Data validation, analysis and reporting

As part of the Work Plan, the CONTRACTOR shall develop and follow a Sampling and Analysis Plan (SAP) that shall be submitted to the DISTRICT and will follow any applicable FDEP SOPs (001/01) during sample collection, including, but not limited to, field documentation, field quality control, field sampling, and field cleaning. All laboratory analysis

must be performed by a laboratory certified by the Florida Department of Health under the National Environmental Laboratory Accreditation Program (NELAP) for Orthophosphorus (or Soluble Reactive Phosphorus-SRP), total phosphorus (TP), total dissolved phosphorus (TDP) and lithium (Li) analysis in environmental samples. For lithium analysis, the laboratory must routinely achieve a minimum detection limit of 20 ppb or better, with documented accuracy and precision between 80 and 200 ppb. For the phosphorus analyses, the laboratory must routinely achieve a minimum detection limit of 4 ppb, with documented accuracy and precision between 10 and 50 ppb. The laboratory must meet an accuracy target of 90-100% and a lab precision target of no more than  $\pm 10\%$  for all parameters.

### ***B. Final Project Work Plan***

The final DISTRICT approved Project Work Plan shall incorporate elements discussed and decided in the Kickoff Meeting (Task 2), the site visit (Task 3) and written comments provided by the DISTRICT Project Manager. This plan will estimate the time to begin sampling, time intervals between samples, duration of sampling, and will be submitted to the DISTRICT to be reviewed with the Project Manager prior to the start of Task 3b. The Final Project Work Plan shall become a binding document when the DISTRICT's Project Manager has agreed to the Plan in writing. The CONTRACTOR shall proceed with the performance of this contract in accordance with the approved Project Work Plan and the requirements of this Statement of Work. In the event of any conflict between the Statement of Work and Project Work Plan, this Statement of Work will take precedence.

#### **Task 1 Deliverables:**

- 1.1 Within three (3) weeks of the contract execution date, the CONTRACTOR shall submit one electronic copy (CD-Rom – MS Word 2002) and five (5) hard copies of the draft Project Work Plan and any other materials to be used during presentations at the initial project meeting.
- 1.2 At week six (6), the CONTRACTOR shall submit the final Project Work Plan to the DISTRICT. The Plan shall outline any DISTRICT consolidated recommendations or revisions to the final draft of the Project Work Plan, which shall be incorporated by the CONTRACTOR into the final work product.

#### **TASK 2: KICKOFF MEETING**

The CONTRACTOR and subcontractors shall attend a project Kickoff Meeting with DISTRICT representatives. At a minimum the CONTRACTOR team should include the project manager, the field leader, and the field coordinator. The project team shall present a concise overview of the work plan, including:

- Project schedule

- Rationale and objectives of this project.
- The tracer methodology.
- SRP, TDP, TP and Lithium analytical methods, method detection limits, precision and accuracy targets, QA/QC and data verification.
- Sampling schedule including when staff will be onsite
- Deliverables, costs estimates and timelines for all tasks.

The CONTRACTOR shall record pertinent recommendations and concerns provided by the DISTRICT during the meeting, and incorporate these into the Work Plan. The DISTRICT will provide the CONTRACTOR with the available flow data from the beginning of operation at the Kickoff Meeting.

**Task 2 Deliverables:**

- 2.1 Within five (5) weeks of the contract execution date , the CONTRACTOR shall attend a Kickoff Meeting to present and discuss the draft Project Work Plan in Task 1 above.

**TASK 3: STA-2 CELL 3 TRACER PROJECT**

STA-2 (Figure 1) currently receives nutrient-rich water from the EAA and other sources for phosphorus removal before being discharged into WCA-2. The STA-2 inflow has moderate nutrient concentrations (~29 to 45 ppb TP) and low nutrient concentrations at its outflow (~17 ppb TP). The proposed Cell 3 levee is intended to result in improved hydraulics through increased compartmentalization. In a prior study, water quality, sediment and vegetation were collected at 47 internal locations within STA-2, Cell 3. To determine the sampling locations, the cell was divided into a grid unit measuring 1,333 feet by 1,333 feet. This resulted in 47 grid units, with the sampling location at the center point of each grid unit (Figure 2). Using the District coordinates and a GPS unit capable of sub-meter accuracy, the CONTRACTOR shall locate these sites to collect the internal water samples for the synoptic study.

***A. STA 2- Site Visit***

Prior to entry, the CONTRACTOR shall plan a tracer project using an inert chemical, lithium chloride, to quantify the area and degree of hydrologic short-circuiting. The CONTRACTOR’s personnel will make at least one site visit to the interior of STA-2 before implementing the tracer project. Airboats will be required to access these locations. The CONTRACTOR’s staff shall accompany DISTRICT staff to learn the locations of the water hazards in STA-2. The CONTRACTOR shall incorporate information gained on this site visit into the final work plan.

***B. STA- Tracer Project***

The CONTRACTOR shall provide all labor and material resources needed to perform the tracer project. Since this is time dependent monitoring and re-sampling is not possible, the CONTRACTOR shall be responsible for timely review of all laboratory analysis and shall

schedule re-work of any questionable results as needed. The acceptance of this deliverable will be gauged on obtaining satisfactory samples for at least of 95% of the scheduled samples and that 95% of all samples submitted for analysis meets all QA/QC objectives. The DISTRICT will attempt to provide a constant hydraulic loading to Cell 3 prior to and during the tracer project. This may be limited by the ability of the DISTRICT's Operations and Maintenance Department to maintain constant flow should a peak storm event arise. The DISTRICT Project Manager will coordinate with the STA operations control staff to minimize flow changes and will provide the flow data to the contractor during the tracer study. The final detailed experimental design will be documented in the project work plan, but for budgeting purposes, the sampling will be similar in effort and scope to what has been outlined below.

Sampling will be conducted for a maximum of 3 hydraulic retention times (HRT), which is estimated to be a sufficient time to capture the majority of the lithium at the culvert and to allow for the development of an acceptable response curve. The nominal HRT through this system has been calculated to be approximately 23 days. The actual sampling time and schedule shall be determined by the District and Contractor during the Kick Off Meeting. Sampling at the G-334 outflow structure will be conducted with time-proportional autosamplers for the length of the study. Twice weekly during the Tracer Study the CONTRACTOR shall measure flow and sample the five inflow culverts for lithium, total phosphorus, soluble reactive phosphorus and total dissolved phosphorus. The samples from the 5 culverts shall be combined as one composite sample for submittal to the laboratory. It is estimated that sampling frequency at the outflow structure will be every four (4) hours for the first HRT of collection, then every eight (8) hours for the next HRT and for the remainder of the project every 12 hours, resulting in the collection of 253 discrete water samples.

Using DISTRICT flow data and flow measurements obtained by the CONTRACTOR at the inflow culverts 3 to 4 days prior to dye injection, the CONTRACTOR shall present a final volume of lithium to be injected into each of the 5 inflow culverts. For budgeting purposes, it has been estimated that 3850 gallons of lithium shall be needed, which translates to fourteen 55 gallon barrels to be injected at each inflow culvert. The CONTRACTOR shall have a minimum of five (5) personnel assigned to the task of tracer injection to ensure that there is at least one (1) person assigned to each culvert during the actual dye injection. To prevent any equipment problems, the CONTRACTOR shall have duplicates of all mechanical equipment available. This includes, but is not limited to, autosamplers, batteries, pumps and airboats. To minimize other problems the CONTRACTOR shall perform a dry run of all tracer injection methods at least 48 hours prior to the actual tracer injection.

The CONTRACTOR shall submit these outflow samples for analysis in two batches. The first batch consisting of 20 percent of the total samples (approximately 50 samples) shall be sent for analysis and the results graphed as a time series graph and then submitted to the DISTRICT for review with the CONTRACTOR to determine whether or not further lithium analysis is needed. The analysis of a second batch of approximately five (5) additional samples may be needed to fill in the time series and to ensure good characterization of the retention time and distribution of flow within the cell. The DISTRICT will respond within one (1) week to confirm which additional samples are to be analyzed.

In addition to the automated sampling at the outflow structure, 48 internal samples will be taken at DISTRICT specified locations for lithium, total phosphorus, total dissolved phosphorus, soluble reactive phosphorus and vegetation presence / absence. The laboratory completing the phosphorus analysis must have participated in the Florida Department of Environmental Protection's Everglades Round Robin studies for phosphorus analysis, or similar studies, and have acceptable ratings. Airboats will be required to access these locations. To most efficiently characterize the movement of tracer, sampling will commence at time zero and shall encompass all of the sampling locations. As time progresses, sampling will focus less on the inflow and more towards the outflow and later, mostly in the outflow region. For cost estimating purposes, it is estimated that 1,000 discrete water samples will be collected and analyzed in addition to the lithium samples collected at the outflow structure (G-334). The final sampling design will be detailed during the Kickoff Meeting and shall be documented in the Project Work Plan.

### **Task 3 Deliverables:**

- 3.1 At Week five (5), the CONTRACTOR shall conduct a site visit to STA-2, Cell 3. Any changes to the draft Project Work Plan based on the site visit shall be documented in the final Project Work Plan.
- 3.2 At Week twenty-six (26), the CONTRACTOR shall submit one electronic copy of a Raw Data Report in the required data format (see Attachment A) from the first 20 percent of samples analyzed with field notes, laboratory QC reports including calibration data, method blanks, matrix spikes, duplicates, continuing calibration verification, and a case narrative describing the overall quality of the data and any non-conformances, and the timeseries graphs.

### **TASK 4: PROJECT REPORTING**

#### **Draft and Final Letter Reports**

The CONTRACTOR shall submit to the DISTRICT a draft letter report for Task 3. This report shall include, but not be limited to, (a) an executive summary, (b) an introduction, including all tasks performed; (c) a methods section, including a description of the sampling methodology and all data analyses performed including all calculations related to the initial concentration of lithium projected (d) a results section, including the raw data placed in a table format in MS Excel® with time in the first column and the sites in the subsequent columns, timeseries graphs and maps depicting the concentration of lithium and the various phosphorus parameters measured over time and space at all locations, and a analysis of residence time distribution (RTD), through the calculation of the zeroth and normalized first moments and any major problems encountered and corrective actions taken; (e) appendices, including the raw data as received by the laboratory (see Attachment A) and QA/QC results including calibration data,

method blanks, matrix spikes, duplicates, continuing calibration verification, and a case narrative describing the overall quality of the data and any non-conformances.

The DISTRICT Project Manager and technical staff will review the draft Report and provide written comments to the CONTRACTOR's Project Manager within five (5) days. The CONTRACTOR shall incorporate the DISTRICT revisions based on the comments received and resubmit the reports to the DISTRICT in a final version. All data, field and laboratory notes, computer programs, spreadsheets and any other electronic files generated during the course of this contract shall be and remain as the sole property of the DISTRICT.

**Task 4 Deliverables:**

- 4.1 By week thirty-six (36), the CONTRACTOR shall submit the Draft Letter Report for DISTRICT review. This report will include an appendix and an electronic copy with all raw data and supporting field and QA/AC information for all samples analyzed.
- 4.2 Within forty (40) days of receipt of the DISTRICT's written recommendations for the Letter Report, the CONTRACTOR shall incorporate all DISTRICT revisions and submit one (1) electronic copy and five (5) hard copies of the final version to the DISTRICT.

**TASK 5: TECHNICAL REVIEW MEETING**

Key members of the CONTRACTOR's project team will attend a Technical Review Meeting at the DISTRICT headquarters in West Palm Beach to present the results and conclusions of this project. The CONTRACTOR team shall present the methodology, results and findings in a formal presentation.

**Task 5 Deliverables:**

- 5.1. At Week forty-two (42), the CONTRACTOR shall submit one (1) electronic draft copy of the presentation to the DISTRICT for DISTRICT review.
- 5.2 At Week forty-four (44), the CONTRACTOR shall attend a Technical Review Meeting to present the Tracer Project Results.

**EXHIBIT “D”**  
**SUMMARY PAYMENT AND DELIVERABLE SCHEDULE**

- A summary payment and deliverable schedule for each task associated with this project is set forth below.
- All deliverables shall be submitted to the DISTRICT’s Project Manager unless otherwise stated in Exhibit “C” of this contract. All deliverables submitted hereunder are subject to review by the District and FDEP. However, the DISTRICT shall maintain full responsibility and ultimate authority for providing all project direction to the CONTRACTOR, including final approval of all project deliverables.
- Due dates for all deliverables are based on the number of weeks following the date of contract execution. Payment shall be made following receipt and acceptance by the DISTRICT of all project deliverables in accordance with the schedule set forth below.
- The CONTRACTOR agrees to provide the DISTRICT all deliverables, data and information pursuant to this agreement in a four-digit date format (Year 2000 compliant). Acceptability of all work will be based on the judgment of the DISTRICT that the work is technically credible, accurate, precise and timely and in compliance with all other aspects of the contract.

TASK	DELIVERABLES	DUE DATE	COST
1			
1.1	Draft Project Work Plan	Week 3	---
1.2	Final Project Work Plan	Week 6	\$ 11,848.35
2			
2.1	Kickoff Meeting	Week 5	\$ 3,009.02
3			
3.1	Site Visit (includes Tracer deployment and culvert flow measurements)	Week 6	\$ 21,453.52
	Tracer Delivery	Week 8	\$ 72,499.02
3.2	Raw Data Report	Week 26	\$ 127,876.00
4			
4.1	Draft Letter Report	Week 36	---
4.2	Final Letter Report	Week 40	\$ 21,334.53
5			
5.1	Draft copy of all Presentation materials	Week 42	---
5.2	Presentation to DISTRICT Staff at the Technical Review Meeting	Week 44	\$ 3175.02

<b>Total Contract Amount</b>	<b>\$287,714.82</b>
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