Assessment of the Quality of May-June 2005 TP Data and the Monitoring Processes for EVPA (LOX) Project

Report to SFWMD Management
D. Ivanoff, Version 9/08/05

1.0 Purpose of this Assessment

This assessment was conducted to further determine the validity of data collected in May and June 2005 for the EVPA Project Refuge (LOX) sites, and also to determine if further action is needed to help ensure that the data generated for this project are of acceptable and verifiable quality.

2.0 Sources of information

a) SFWMD Field Sampling Quality Manual (2005)
b) Frank Nearhoff's Marsh Sampling Protocol (1996)
c) EVPA Sampling SOP (3/2004 revision)
d) Field notes
e) Chain of custody
f) Joe Albers' report
g) Garth Redfield's memorandum
h) D. Ivanoff's data analysis (TP concentration as affected by sampler/date, depth to floc, depth to consolidated sediment, TP vs. TDP and TSS).
i) Dave Struve's LOXA data analysis
j) Dave Struve's Review of EVPA Data, 7/5/05
k) Kristin Larson - verbal communication
l) Previous audit reports: 12/13/04, 8/11/03, 9/9/03
m) Interviews with U.S. Fish and Wildlife Service (USFWS) sampling personnel
n) Nate Ralph's 7/11/05 Field Observations - verbal communication and notes
o) DBHYDRO data
p) Contract No. C-ML040283
q) Consultation with DEP's Quality Assurance Section
r) Meeting with Refuge (M. Harwell, D. Suratt), DEP (R. Frydenborg), COE (O. Ramos-Gines and P. Dubowy)

3.0 Overview of Field Collection Procedure

The objective of field collection is to obtain representative samples from the site to address project objectives. General collection protocols and QA/QC requirements are those specified in the current version of the SFWMD Field Sampling Quality Manual (FSQM) and the EVPA Field Sampling SOP (3/2004 revision). Field activities include preparing for the trip, calibration of field test equipment, actual sample collection and field testing, submittal of samples to the laboratory, and processing of samples in the laboratory.

Collection in the Water Conservation Area (WCA1) marsh is more challenging than other District monitoring projects mainly due to the shallow water conditions, the fact that the site is accessed via helicopter, and the difficulty in obtaining representative samples. Due to these challenges, it is most critical that proper training is given to the field sampling personnel and that competency is evaluated through demonstration of capability prior to allowing any new personnel to conduct the actual sampling. Application of proper techniques is critical.

4.0 Overview of Laboratory Analysis

Upon submission of samples to the laboratory, field information is entered into the LIMS and samples are logged in and given a sequential laboratory ID. Samples are then distributed to the analysts or designated storage refrigerator for sample preparation or analysis.

5.0 Overview of Present Routine Data Verification, Validation, and Assessment Process

(See Glossary for basic description and scope of these processes, according to EPA's protocols.)

5.1 Verification of Field Data and Documentation

Field documentation and field testing data include information about the sample collection; location and depth of sampling; field testing results (pH, specific conductivity, temperature, and Dissolved Oxygen); and other pertinent site and sample observations. Documentation for routine collection includes field header sheet (chain-of-custody form), and field notes. The field sampling personnel (i.e., the Refuge sampling team) are responsible for verifying entries in the field documentation. This is further verified by the District's field Project Manager (PM), who then contacts the field sampling team to resolve any discrepancies. The field PM also reviews comments in the field notes, and enters any comments that could affect data quality into the Laboratory Information Management System (LIMS).

Upon submittal to the laboratory, the District's log-in person enters the field information into LIMS. During this process, the log-in person would note any anomalies in the field header sheets, and notify the field PM and/or the collectors to resolve the issues. LIMS also has system checks to catch common errors. The log-in staff may reject samples at the point of entry if the submittal did not meet the laboratory's sample acceptance criteria. Data entry into LIMS is verified by a second laboratory person, to check for correctness.

5.2 Verification of Laboratory Data and Documentation

The laboratory personnel proceed with sample preparation and analysis. Each analyst is responsible for verifying his/her generated data and documentation. Laboratory supervisors then perform data verification and resolve any issues related to the analytical batch. An SOP for this review is available. Data that do not meet laboratory QA/QC criteria are flagged at this point.

5.3 Data Validation

The data validation process involves looking at the quality of the sampling event, by looking at both field collection and laboratory analysis, based on quality indicators.

Validation starts with systems checks for any data anomalies based on QC indicators (LIMS auto checks) and historical trends (OLECAS).

The District's Laboratory QA officer is responsible for validating data sets from the District laboratory and for taking actions in qualifying data when appropriate. Once data are validated at this level, data are loaded into DBHYDRO. There are also additional systems checks during the loading process that eliminate common data loading errors. (An analysis of the data validation process for the EVPA May and June 2005 sampling events confirmed that the data met the routine QA/QC criteria.)

5.4 Data Quality Assessment

Data users, project managers, or QA staff perform further data quality assessment or data evaluation for reporting purposes. During this process, these data users or project managers would note any data anomalies and request re-verification of results. In some instances, result correction in DBHYDRO may be requested. Some examples of the reasons flags were requested by data users in the past were:

a. historical outlier
b. questionable data
c. heavy amount of particulates in the samples
d. lack of flow or reversed flow for intended flow-proportional samples

Data quality assessment may also be conducted during a laboratory or project audit. Depending on the findings, data may be flagged, depending on whether or not the audit findings were critical and directly impacting the quality of data generated.

6.0 Assessment Findings

6.1 Contract Compliance

Category	Description of requirement	Findings
Sampling procedure and QA/QC	The agency (USFWS) will adhere to the QA/QC guidelines set forth in the most current District Field Sampling Quality Manual (FSQM).	There was no indication that Refuge personnel deliberately failed to follow any of the FSQM provisions. Based on recent observations, it was evident that there are improvement areas as reflected in this report. Sampling techniques are among the improvement areas.
	The District will monitor adherence to QA protocols by performing audits, reviewing documentation, and analyzing QC check samples.	The District field auditors' last audit of the Refuge sampling team was 12/2004. Findings were corrected and determined to be acceptable, except for the lack of an FSQM. The field PM also communicates to the Refuge any deficiencies on an as-needed basis. District staff met with Refuge management and staff on 8/17/04 also to discuss EVPA issues.
	The agency (USFWS) must review the FSQM on a regular basis to ensure that samples are collected in accordance with this plan.	No documentation to indicate that this is being done. The Refuge field personnel were provided copies of the current District FSQM. During the interviews on 7/11/05 and 7/12/05, all sampling personnel indicated that they have read the applicable sections in this manual.
	Samples must be properly collected and labeled in accordance with Section 5.13 of the FSQM for marsh sampling by helicopter (Note: this is now Chapter 5.15 in the 2004 version). Avoid alligator holes, airboat trails, and other non-representative areas.	Mr. Suratt indicated that he used 2-liter (intermediate) containers at on 5/2/05 and 5/3/05 when total depths, measured before getting into the water, was >20 cm. In LOX7, the initial measurement, before leaving the helicopter, was >20 cm, but when the samples have been collected into 2L, and depth was re-measured, the final total depth was 18 cm. Field notes only indicated the use of 2L containers. Using such large containers in shallow causes disturbance of the floc layer. High levels (>12 mg/L) of total suspended solids (TSS) were found in samples from 4 sites in May and 4 sites in June. Samples from LOX 7 and LOX 11 had 148 and 204 mg/L of TSS, respectively, in May 2005. It was also noted by Nate Ralph (SFWMD), during the 7/11/05 trip, that it was highly probable to disturb the floc layer without being observed by collection personnel due to dense vegetation in sampling area. Touching the blades of this vegetation could stir up the floc layer. Both these scenarios could have occurred during the May or June sampling events. Mr. Smith indicated that he did not know or realize the impact of contacting the vegetation and the use of big containers in shallow depths, until the 7/11/05 trip. Ms. Rinker indicated that she was using hip waders during the June trip. On more than one occasion, she experienced difficulty in wading that required the pilot to ease up the helicopter to get to her. She also indicated that in some of the sites, she had to stretch forward at an angle to retrieve the samples. Sampling depths were not entered in the field header sheets until returning to the laboratory. The field personnel recorded the total depth (depth to floc), divided that by 2 to get the mid depth, and that value was entered on the header sheet. SFWMD clarified that the sampling depth must be entered immediately after collection and before leaving each site.

Category	Description of requirement	Findings
Sampling procedure and QA/QC	Sample processing will be in accordance with the EVPA project standard operating procedure provided by the District.	In cases when there is a large volume of sample collected, samples from two 2-liter bottles are mixed in a bucket and composite aliquots are placed into the individual bottles. Mixing was done by gentle swirling, which may or may not be sufficient when there is a large volume of water and when there is a large amount of particulates. A better mixing mechanism may be necessary to ensure that representative aliquots are retrieved. Comments on the amount of particulates present on the samples were based on observations during the sample processing. There were preservation errors observed during the 7/11/05 sampling. This could have been caused by distractions, since training, interviews, and processing were occurring at the same time. The errors were not on total phosphorus samples.
	The District PM will also be responsible for coordinating activities with the agency (USFWS).	The District PM has done an excellent job in coordinating with the Refuge personnel, but was confused about verbal instructions that SFWMD staff should no longer be training contractors.
	The Agency (USFWS) must not change any sampling procedures without prior written approval from the District PM.	Procedures were not changed. Techniques could vary from person to person, and a better more comprehensive training is critical.
Skills and Training	All persons conducting the sampling must be experienced with the collection of marsh samples by helicopter. The Agency (USFWS) must ensure that all personnel are adequately trained before performing any work on this project.	There was no available documentation to indicate that adequate training had been provided. R. Smith and D. Suratt both indicated that they had a checklist with them, but it had not been filled out by the trainer(s). S. Rinker was not familiar with the training checklist. D. Suratt had accompanied B. Arrington for the April sampling and participated in actual collection during the first day in April. R. Smith participated in a special training done by B. Arrington, and also accompanied him in a regular sampling trip.
	The District will provide training for the Agency (USFWS) for sample collection and processing.	The following sample collectors were not trained by a District trainer on the actual field collection process: Robert Smith, Serena Rinker, and Donato Suratt. These personnel were trained by K. Larson and Mr. Arrington on sample processing in the laboratory. K. Larson indicated that SFWMD field staff were instructed that they are no longer to train contractors.

6.2 Compliance to Chapter 62-160, F.A.C. and DEP SOP FA3300 (DEP 01/001, 2004)

The USFWS needs to have its own FSQM. Although there is no direct connection between the lack of an FSQM and the quality of the sampling process and the data collected, it is critical that the USFWS have its own FSQM to guide its own sampling activities. This is a state of Florida requirement (Ch. 62-160, F.A.C.), and was noted as one of the findings in the December 2004 field audit by SFWMD. The preparation of the FSQM may be done in partnership with District personnel. USFWS personnel have already been working with SFWMD on this issue.

6.3 Adherence to SFWMD Field Sampling Quality Manual and EVPA SOP

The Refuge personnel indicated that they follow the SOP and District FSQM. There was no indication that any of the sampling personnel were deliberately not following any of the SOP or FSQM provisions.

6.4 General Quality Practices

Sampling technique is very critical for this project and any other projects where water depth is very shallow and the site is packed with vegetation. Bumping vegetation leaves, wading, bottle suction, and sampler movement can cause resuspension of floc into the water column. Some of these conditions were observed by N. Ralph (SFWMD) when he joined the 7/11/05 sampling trip.

Sampling from the helicopter float is an option given to the discretion of a sampler, and is usually done when the water is too deep for wading. On 5/3/05, samples from LOX6, LOX16, LOX15, and LOX12 sites were collected from the helicopter float, with total depths at 0.18, 0.63, 0.61, and 0.61 m, respectively. On the June 2005 event, samples from S5AD, LOX15, and LOX12 were taken from the float, with total depths between 0.66 and >1m. The samplers indicated that they use their judgment to determine when to wade or when to sample off the float. This is not a contradiction of the SOP or FSQM provision; however, sampling off the float, especially when water depths are this shallow, can disturb the floc layer and yield questionable data. Sampling off the float when the water depth is <0.2 m, as was done at LOX6, should not have been done.

Documentation of field observations must be completed prior to leaving each site. On the 7/11/05 trip, the sampling depth column on the header sheet was left blank. Mr. Smith indicated that they usually divide the total depth in half and fill the sampling depth column in the laboratory. This was pointed out during the 7/11/05 briefing with the Refuge staff.

During the 7/11/05 sample processing, observation on the amount of floc or particulate in the sample was done upon filling the sample bottles. Mr. Smith indicated that was how they have been doing this.

6.5 Data Verification, Validation and Assessment

Data were verified and validated by District personnel according to routine procedures. Based on data quality indicators, the quality of data passed and data were submitted to DBHYDRO. However, since both the TSS and TP values were outliers, these data were included in the May and June OLECAS (Online Environmental Chemist Alert System) reports. OLECAS is an automated query tool that looks for outlier values. The purpose of the OLECAS is to alert staff on outlier results, so that they could investigate or re-work the affected samples. Laboratory supervisors, the laboratory QA officer, data validation staff, and field project managers were receiving the OLECAS reports. Beginning 7/13/05, primary data users from the Water Quality Assessment Division and other project managers were added to the list. There was no written procedure for OLECAS implementation, nor any document that specifies the use and responsibilities. The WQM director indicated that the field project managers do not routinely use OLECAS to determine any need for resampling. In the case of May and June 2005 EVPA data, no one took any action to further investigate or communicate the anomalous results.

The high TP results were noticed during the data assessment phase during the last week of June in preparation for the TOC meeting in July 2005. Upon notification by the WQ Assessment Division director, investigation of the sampling and laboratory analysis processes was initiated.

6.6 Quality of May and June 2005 Sampling Events

a. Amount of Particulates in the Samples

Based on the available facts and an analysis of the field notes, and results for TP, total dissolved P (TDP) and TSS, it is evident that the high TP in the samples was due to the high content of solids in the some of the samples collected. The objective of water sampling for this project is to obtain representative samples. The facts indicate that the water samples collected were not representative. Whether the high level of TSS was due to sampler error, helicopter impact, or other factors is not certain at this time. The samplers assigned on these two events were inexperienced and, according to field documentation, had not previously worked as the primary collectors. A primary collector, for the purpose of this report, is the person in charge of actually collecting the water samples.

In May and June 2005, TSS results far exceeded the average TSS concentration in the area over the recent 2.5 year period. The TSS concentration exceeded 3 times the standard deviation for 4 sites in May (LOX7, LOX11, LOX8, LOX14), and 4 sites in June (LOX7, LOX8, LOX9, LOX11). There were no TSS data for May LOX4, LOX6 and June LOX3, LOX5 to make the same determination for these sites.

TSS data along with TP, TDP, and depth of sampling for May and June samples are presented in Table 1.

Analysis of Total Suspended Solids (TSS) data from all sampled LOX sites from January 2003 to June 2005:

Max	**27 mg/L**
Mean	**4 mg/L**
SD	**3.8**
3*SD	**11.5**
n	**276**
Number of TSS ≤ 3 mg/L	**237**
Upper Control Limit (UCL=Mean + (3*SD))	**15.5 mg/L**
Outliers (not included in above calculations)	
Lox12, 6/14/04	92 mg/L
Lox7, 5/2/05	148 mg/L
Lox11, 5/3/05	204 mg/L

Eighteen out of 279 observations from January 2003 to June 2005 (including the 3 outliers) exceeded the upper control limit. For May and June sampling, there were 8 samples with TSS>15.5; some sites did not have TSS data. This constitutes 40 percent of all samples collected during these two months, with 2 sites exceeding 100 mg/L.

Example analyses of TSS concentration over historical period of record and corresponding TP levels for some of the sites (LOX 7, 11, 8 and 13) are presented in Figures 1-4. These figures indicates the strong correlation between increased levels of TSS and TP concentration in collected samples.

Based on observed sampling problems, the potential mixing of porewater with surface water and its influence on the level of analytes cannot be ruled out as well.

b. Field QC

There were also incidences of six (6) high values for field-cleaned equipment blanks associated with the May and June 2005 LOXA (expanded WCA1) sampling trips conducted by the same sampling team. The high equipment Blanks were for TP, Alkaline Phosphatase Activity, Orthophosphate, NOx, Ammonia, Silica, Total Dissolved P, and Sodium. The blank value for TP was 0.061 mg/L; it was re-analyzed by the District laboratory for confirmation (0.060 mg/L). The high blank values may really be an indication of contamination or a result of sample mix-up, but in either case, is an indication of sampling error. All samples associated with this trip were flagged with a "V" qualifier.

c. Laboratory QC

All laboratory QC procedures, including accuracy checks, method blanks, and precision checks were reviewed and were found to have passed laboratory criteria, an indication that the quality of laboratory analysis was acceptable.

7.0 Corrective Actions and Rationale:

a) Flag all data for May and June 2005 sampling events with a "?" qualifier

Add a comment: sampling quality is questionable based on sampling assessment findings.

b) Provide training and Demonstration of Capability (DOC) by field sampling personnel
Re-training of Refuge personnel was initiated on 7/11/05 and 7/12/05 during the July sampling events. DOC will be certified by SFWMD upon evaluation of the field documentation and sample results from these two trips. Any future changes in sampling personnel must be communicated to the field PM. The field PM must ensure that training is completed and documented and that DOC is evaluated prior to the sampler being allowed to conduct actual sampling for this project. DOC must also be re-evaluated and re-certified once a year.

As recommended by the Technical Oversight Committee (TOC), a workshop on field sampling will be held to address recent findings, sampling procedures, techniques, and quality issues. This workshop is scheduled for September 26, 2005.

c) Conduct TSS analysis whenever possible
Whenever water depth permits collection of a larger volume of sample (in addition to the quantity needed for total phosphorus [TP] analysis), TSS should be analyzed from the same grab sample as that used for TP. TSS data can be a useful screening indicator of the quality of water sample collected.

d) Develop and implement an SOP for OLECAS report review
This SOP should include responsibilities at all levels, and may be included in the Data Validation SOP. This SOP should address the corrective actions to be done when anomalies are observed.

e) Review and enhance data verification and validation procedures
This would apply to all projects. The process should be reviewed, gaps identified, automation increased, and SOP revised.

f) Finalize the EVPA Project Monitoring Plan
There is presently a DRAFT but no approved monitoring plan for the EVPA project. The present sampling SOP can be expanded to include the elements of a monitoring plan. A monitoring plan is critical in identifying and communicating the details, goals and objectives, and protocols to project participants. This plan should be prepared by a team comprised of SFWMD and Refuge personnel, then presented to the TOC for review.

The Monitoring Plan should include:

i. Project description
ii. Project scope and purpose
iii. Project organization and key responsibilities
iv. Data quality objectives: data use, data and reporting requirements, expected data and data quality
v. Data quality indicators
vi. Field activities: Sampling design, location, collection methods, field testing and calibration, and quality control requirements

vii. Laboratory activities: Laboratory methods, quality control requirements
viii. Data processing, QA/QC, and validation
ix. Data management
x. Data evaluation, assessment, and reporting

g) Finalize and implement an SOP for Field Project Management
This SOP must state the responsibilities, the procedures followed, and the communication mechanisms for the different field sampling and project management roles.

h) Develop and implement an SOP for Data Assessment
This SOP must state the responsibilities, the procedures followed, and the communication mechanisms for the different data assessment roles. Alternatively, this procedure can be discussed in the Monitoring Plan.

Table 1. TP, TDP, and TSS data

Station	Sampler	Date	TP, mg/L	TDP, mg/L	TSS, mg/L	Observations on Particulates in the sample[†]	Total depth, m	Depth to Consolidated Sediment, m	Sampled fr H Float? [††]
Lox3	Arrington-USFWS	2/7/2005	NS	NS	NS	NS	0.01	0.10	
Lox4	Arrington-USFWS	2/7/2005	0.026	0.006	12	**very heavy large**	0.24	0.27	
Lox5	Arrington-USFWS	2/7/2005	NS	NS	NS	NS	0.04	0.15	
Lox6	Arrington-USFWS	2/7/2005	0.006	*0.004*	<3	light	0.33	0.33	
Lox7	Arrington-USFWS	2/7/2005	0.012	NS	NS	light	0.17	0.30	
Lox8	Arrington-USFWS	2/7/2005	0.009	0.007	<3	light	0.25	0.35	
Lox9	Arrington-USFWS	2/7/2005	NS	NS	NS	NS	0.05	0.15	
Lox10	Arrington-USFWS	2/7/2005	0.014	NS	NS	medium	0.13	0.19	
Lox11	Arrington-USFWS	2/7/2005	0.01	*0.005*	6	**heavy**	0.26	0.54	Y
Lox12	Arrington-USFWS	2/7/2005	0.006	*0.004*	<3	light	0.67	0.75	Y
Lox13	Arrington-USFWS	2/7/2005	0.009	*0.006*	<3	moderate	0.48	0.48	
Lox14	Arrington-USFWS	2/7/2005	0.007	*0.007*	<3	moderate	0.56	0.57	Y
Lox15	Arrington-USFWS	2/7/2005	0.007	*0.005*	<3	light	0.62	0.96	Y
Lox16	Arrington-USFWS	2/7/2005	0.008	*0.005*	<3	moderate	0.63	0.73	Y
FCEB	Arrington-USFWS	2/7/2005	<0.002	*0.003*	<3	NA	NA	NA	NA
Lox3	Arrington-USFWS/Atkins-SFWMD	3/7/2005	NS	NS	NS	NS	0.05	0.07	
Lox4	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.009	NS	NS	light	0.16	0.25	
Lox5	Arrington-USFWS/Atkins-SFWMD	3/7/2005	NS	NS	NS	NS	0.06	0.14	
Lox6	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.011	NS	NS	light	0.19	0.29	
Lox7	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.02	NS	NS	**heavy small**	0.14	0.24	
Lox8	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.015	0.007	10	**heavy small**	0.25	0.36	
Lox9	Arrington-USFWS/Atkins-SFWMD	3/7/2005	NS	NS	NS	NS	0.07	0.12	
Lox10	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.018	NS	NS	medium	0.16	0.25	
Lox11	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.026	0.007	11	**heavy small**	0.27	0.37	
Lox12	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.018	0.004	14	--	0.50	0.66	
Lox13	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.009	0.004	11	**heavy small**	0.25	0.44	
Lox14	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.011	0.005	11	**heavy small**	0.42	0.55	
Lox15	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.01	0.006	<3	**heavy**	0.49	0.69	
Lox16	Arrington-USFWS/Atkins-SFWMD	3/7/2005	0.01	0.005	3	moderate	0.40	0.62	
FCEB	Arrington-USFWS/Atkins-SFWMD	3/7/2005	<0.002	0.002	3	NA	NA	NA	NA
Lox3	Arrington-USFWS	4/4/2005	NS	NS	NS	NS	0.04	0.10	
Lox4	Arrington-USFWS	4/4/2005	0.012	0.006	<3	light	0.28	0.31	
Lox5	Arrington-USFWS	4/4/2005	NS	NS	NS	NS	0.06	0.11	
Lox6	Arrington-USFWS	4/5/2005	0.006	0.005	<3	light	0.36	0.48	
Lox7	Arrington-USFWS	4/4/2005	0.01	0.006	<3	moderate	0.21	0.33	
Lox8	Arrington-USFWS	4/4/2005	0.01	0.005	<3	moderate	0.29	0.36	
Lox9	Arrington-USFWS	4/4/2005	NS	NS	NS	NS	0.09	0.15	
Lox10	Arrington-USFWS	4/4/2005	0.009	NS	NS	light	0.10	0.18	
Lox11	Arrington-USFWS	4/5/2005	0.009	0.005	<3	moderate	0.21	0.36	
Lox12	Arrington-USFWS	4/5/2005	0.004	0.006	<3	moderate	0.50	0.70	Y
Lox13	Arrington-USFWS	4/5/2005	0.009	0.008	<3	moderate	0.43	0.52	Y
Lox14	Arrington-USFWS	4/5/2005	0.008	0.005	<3	NO	0.53	0.57	Y
Lox15	Arrington-USFWS	4/5/2005	0.004	0.006	<3	light	0.60	0.83	Y
Lox16	Arrington-USFWS	4/5/2005	0.008	0.005	<3	moderate	0.80	0.54	Y
FCEB	Arrington-USFWS	4/5/2005	<0.002	0.002	<3	NA	NA	NA	NA

Table 1. TP, TDP, and TSS data (continued)

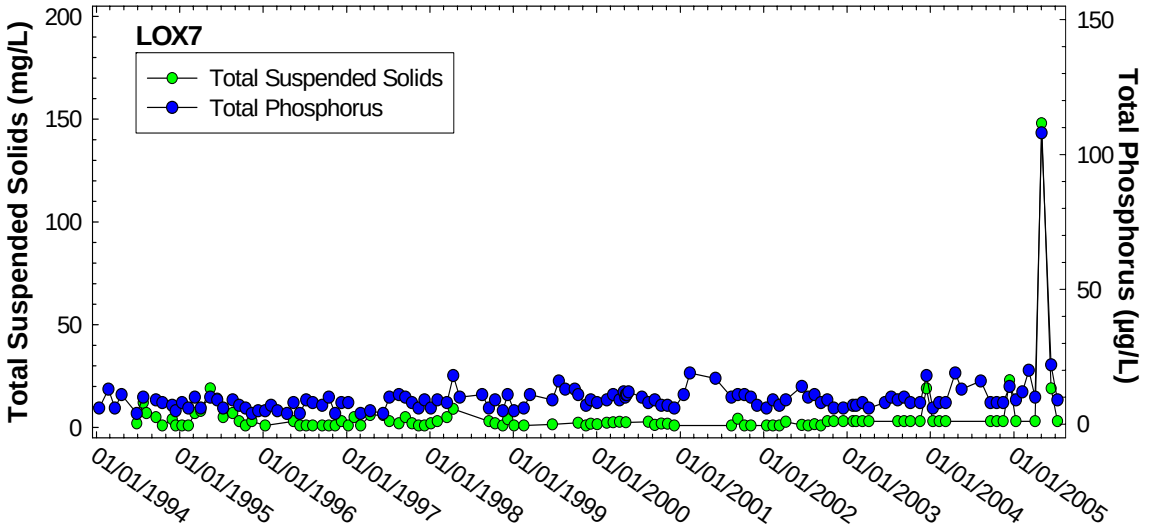
Station	Sampler	Date	TP, mg/L	TDP, mg/L	TSS, mg/L	Observations on Amount of Particulates in the sample†	Total depth, m	Depth to Consolidated Sediment, m	Sampled fr H. Float? ††
Lox3	Suratt-ENP	5/2/2005	NS	NS	NS	NS	<0.1	NO	
Lox4	Suratt- ENP	5/2/2005	**0.043**	NS	NS	**heavy**	0.13	0.16	
Lox5	Suratt-ENP	5/2/2005	NS	NS	NS	NS	<0.1	NO	
Lox6	Suratt- ENP	5/3/2005	0.049	NS	NS	light	0.18	0.21	Y
Lox7	Suratt-ENP	5/2/2005	**0.108**	**0.028**	**148**	**heavy**	0.19	0.22	
Lox8	Suratt- ENP	5/2/2005	**0.046**	*0.007*	**23**	**heavy**	0.36	0.38	
Lox9	Suratt-ENP	5/2/2005	NS	NS	NS	NA	0.09	NO	
Lox10	Suratt- ENP	5/2/2005	NS	NS	NS	NA	0.05	NO	
Lox11	Suratt-ENP	5/3/2005	**0.069**	0.007	**204**	**heavy**	0.27	0.31	
Lox12	Suratt- ENP	5/3/2005	0.009	0.005	<3	NO	0.61	0.62	
Lox13	Suratt-ENP	5/3/2005	0.015	0.007	11	light	0.32	0.39	Y
Lox14	Suratt- ENP	5/3/2005	**0.018**	0.004	**19**	**heavy settled**	0.37	0.43	
Lox15	Suratt-ENP	5/3/2005	0.009	0.005	<3	low	0.61	0.66	Y
Lox16	Suratt- ENP	5/3/2005	0.012	0.006	<3	light	0.63	0.66	Y
FCEB	Suratt-ENP	5/3/2005	<0.002	*0.004*	<3	NA	NA	NA	NA
Lox3	Rinker-USFWS	6/13/2005	0.023	NS	NS	medium floc	0.17	0.21	
Lox4	Rinker-USFWS	6/13/2005	0.016	0.011	<3	medium floc	0.32	0.36	
Lox5	Rinker-USFWS	6/13/2005	0.026	NS	NS	medium floc	0.18	0.21	
Lox6	Rinker-USFWS	6/14/2005	0.014	0.006	9	medium floc	0.32	0.36	
Lox7	Rinker-USFWS	6/13/2005	**0.022**	0.009	**19**	**heavy floc**	0.36	0.37	
Lox8	Rinker-USFWS	6/13/2005	**0.018**	**0.008**	**12**	**medium floc**	0.32	0.34	
Lox9	Rinker-USFWS	6/13/2005	**0.027**	**0.009**	**25**	**medium floc**	0.22	0.27	
Lox10	Rinker-USFWS	6/13/2005	0.027	0.006	6	medium floc	0.24	0.26	
Lox11	Rinker-USFWS	6/14/2005	**0.037**	0.007	**51**	**heavy floc**	0.41	0.43	
Lox12	Rinker-USFWS	6/13/2005	0.007	0.005	<3	no floc	0.77	0.8	Y
Lox13	Rinker-USFWS	6/14/2005	0.009	0.004	11	medium floc	0.41	0.45	
Lox14	Rinker-USFWS	6/14/2005	0.014	0.005	8	medium floc	0.51	0.54	
Lox15	Rinker-USFWS	6/13/2005	0.007	0.005	<3	light floc	0.66	0.72	Y
Lox16	Rinker-USFWS	6/14/2005	**0.038**	0.011	6	**very heavy floc**	0.53	0.63	
FCEB	Rinker-USFWS	6/13/2005	<0.002	<0.002	<3	NA	NA	NA	NA

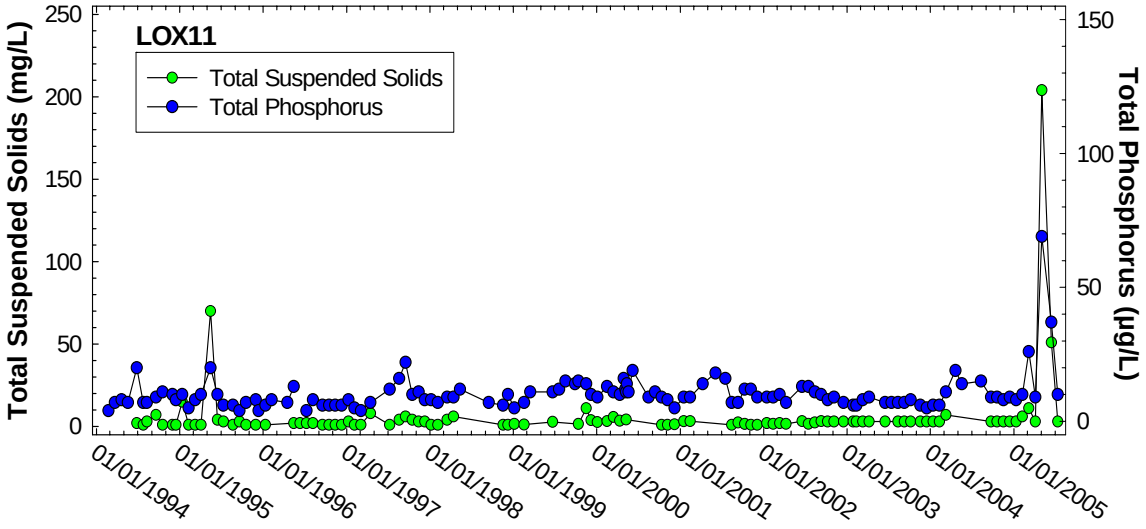
† Based on what was noted on the field notes; according to what was observed in the bucket or bottles during sample processing.

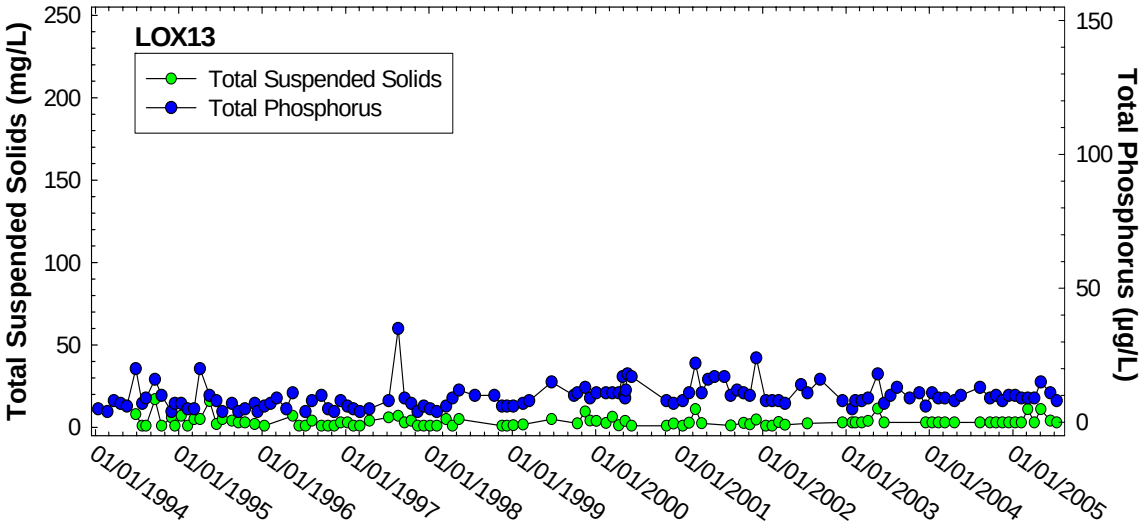
†† Based on what was noted on the field notes.

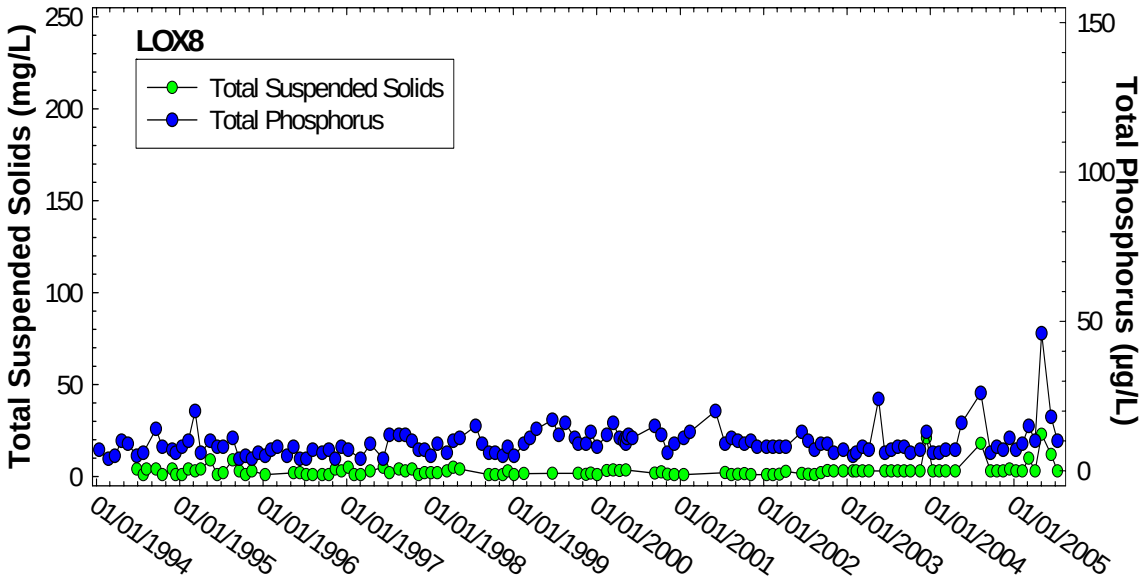
NS=no sample, no analysis; NO=not observed; NA=not applicable

Figures 1-4. Period of record TSS vs. TP in selected LOX stations






LOX13
Total Suspended Solids
Total Phosphorus
Total Suspended Solids (mg/L)
Total Phosphorus (µg/L)
250
200
150
100
50
0
150
100
50
0
01/01/1994
01/01/1995
01/01/1996
01/01/1997
01/01/1998
01/01/1999
01/01/2000
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005


LOX8
Total Suspended Solids
Total Phosphorus
Total Suspended Solids (mg/L)
Total Phosphorus (µg/L)
250
200
150
100
50
0
150
100
50
0
01/01/1994
01/01/1995
01/01/1996
01/01/1997
01/01/1998
01/01/1999
01/01/2000
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005

Appendix A
GLOSSARY

Sources: EPA QA/G8 (EPA 2002), EPA QA/G9 (EPA, 2000b), and FDEP Field Sampling SOP (DEP 01/001, 2004)

Accuracy. The agreement between the actual obtained result and the expected result. QC check samples having known or "true" value are used to test for the accuracy of a measurement system.

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. The goal is to ensure and document that the data are what they purport to be, i.e., the reported results reflect what was actually done. Data verification applies to both field and laboratory activities.

Data Validation is an analyte and sample-specific process that extends the evaluation of data beyond the method, procedural, or contractual compliance, to determine the analytical quality of a specific data set. Data validation criteria are based upon the measurement quality objectives developed during the project planning stage, and usually documented within a Quality Assurance Project Plan or monitoring plan. Data validation includes a determination, where possible, of the reasons for any failure to meet method, procedural, or contractual requirements, and an evaluation of the impact of such failure to meet method, procedural, or contractual requirements, and an evaluation of the impact of such failure on the overall data set. Data validation applies to both field and laboratory activities.

Data quality assessment is the scientific and statistical evaluation of data to determine if data obtained from environmental data operations are of the right type, quality, and quantity to support their intended use. This is the stage of environmental monitoring program in which the following question is answered: "Can the collected data be used for their intended purpose in environmental decision-making?" While the precursor to this are the outcome of data verification and validation processes, data quality assessment to this context is usually a responsibility of the data users. Data users are more knowledgeable about the full range of goals and constraints that shape the data user's actions and perspective than either the data verifiers or validators.

Equipment blank (EB). A general terminology used for analyte-free water that is processed on-site through all sampling equipment used in routine sample processing. May be an assessment of effectiveness of laboratory decontamination (LCEB) or on-site (field) decontamination (FCEB). EB values are indicative of the effectiveness of the decontamination process.

Field Cleaned Equipment Blank (FCEB). Analyte-free water that is processed on-site, after the first sampling site, through all sampling equipment used in routine sample processing. EB values are indicative of the effectiveness of the decontamination process.

Field testing.

Header sheet.

Interviews with Refuge Sampling Personnel (by Delia Ivanoff)

Donatto Surratt (collector on record for May 2005 sampling event), Interview date: 7/12/05

Training received	Joined an experienced Refuge sampler (B. Arrington) in April 2005 sampling. Mr. Suratt indicated that he collected several of the samples collection on one day of the 2-day sampling event in April; field notes indicate that actual collection was done by B. Arrington on both days. Mr. Suratt indicated that he had been trained on sample processing since February 2005, and feels confident about his expertise on processing.
Why was sampling done from the float vs. wading to the sampling spot? How far from the helicopter did you wade out (for sites where you did), and in what direction?	The decision on whether to wade or sample from the float is a judgment call. When water is too deep to wade, they sample from the float. They wade away from where waves are visible.
Did you observe resuspension of sediment during sample retrieval and, if you did, what did you do?	In some of the sites, water was already dark even before sample retrieval. He kept filling the sample bottle, discarding and resampling until he could get the right sample. For the LOX7 site, which he sampled in May, he used 2-liter bottles since the water depth, as measured prior to leaving the helicopter, was >20 cm. Final total depth measured at this site was 18 cm. All other shallow sites were sampled with smaller bottles. Field notes did not indicate the use of smaller bottles.
Were the in-situ measurements done in the same spot where the bottles were filled? If yes, what was the sequence?	No, the sample was collected in another spot, away from where in-situ testing was done.
Was the sample retrieved from where the depth was actually measured?	Initial depth measurements were done from the helicopter. Second depth measurements were done from where the samples were collected; these were the depth values recorded on the header sheet.
Have you read the District's FSQM? What revision?	Yes, current.
Was there enough mixing of samples prior to taking aliquots (when processing in the lab)?	(Not observed.) Mr. Suratt indicated that he was confident of his skill level on sample processing, as he had been doing this since February 2005.

Serena Rinker (collector on record for June 2005 sampling event) and Robert Smith (collection team member for May and June sampling event), Interview date: 7/11/05

Training received	Mr. Smith joined B. Arrington on two events and was given hands-on training by B. Arrington at an impoundment within the Refuge. S. Rinker collected the samples in June 2005; there was no written documentation to indicate that she was trained on actual collection prior to this event. Mr. Smith accompanied S. Rinker on this event, and also performed in-situ measurements and note-taking. K. Larson (SFWMD) indicated that she recalled having trained R. Smith, and maybe S. Rinker on ***sample processing***. None of this training was documented, although Mr.Smith indicated that he keeps his own training checklist. None of these were available to me during this assessment; copies have been requested through the SFWMD Field Project Manager.
Why was sampling done from the float vs. wading to the sampling spot? How far from the helicopter did you wade out (for sites where you did), and in what direction?	When unable to wade, due to field conditions, they sample from the helicopter float. They wade away from the disturbance area and find an open area. The estimated distance is at least 10 m away from the helicopter.
Did you observe Resuspension of sediment during sample retrieval and, if you did, what did you do?	Discard if not acceptable and re-sample.
Were the in-situ measurements done in the same spot where the bottles were filled? If yes, what was the sequence?	No, away in a different spot.
Was the sample retrieved from where the depth was actually measured?	No, away in a different spot.
Have you read the District's FSQM? What revision?	Yes, current.
Was there enough mixing of samples prior to taking aliquots (when processing in the lab)?	Samples were swirled each time prior to taking aliquots.

Interview with the Helicopter Pilot, 8/10/05

Alex Brostek – pilot for May 2 and June 13 sampling events

Mr. Brostek said that he thought Robert Smith (Refuge) had just started around the May time period. The sampling teams in both May and June events were generally not sampling in the same manner as SFWMD sampling personnel or Bruce/Camille (former Refuge employees). They (Robert and teammates in May and June trips) seemed more aggressive and determined to get the samples, compared to previous sampling teams at these sites. The other samplers would not sample when water was too shallow, but the new (Refuge) samplers were not deterred by shallow water.

Mr. Brostek remembered when Serena Rinker got stuck a couple of times and had to ease up the helicopter to rescue her.