Quality Assessment Report for Water Quality Monitoring

April – June 2025

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INTRODUCTION

This report is an assessment of the South Florida Water Management District (SFWMD) field sampling and laboratory analysis for total phosphorus (TP) in surface water, primarily for the projects and their associated stations as shown in **Table 1** from April 1, 2025, through June 30, 2025. The analysis reflects the status of the data at the time of download and does not account for changes made to the data after May 15, 2025.

Table 1. Projects and associated stations.

Project Name	Project ID	Stations
Everglades National Park Inflows North	PIN	S12A, S12B, S12C, S12D, S333, S333N, S355A, S355B, and S356-334
Everglades National Park Inflows East	PIE	G737, S332DX, S18C, and S328
Everglades Protection Area	EVPA	LOX3, LOX4, LOX5, LOX6, LOX7, LOX8, LOX9, LOX10, LOX11, LOX12, LOX13, LOX14, LOX15, and LOX16

The Water Quality Monitoring Section (WQM) *Field Quality Manual* (SFWMD-FIELD-QM-001) and *Field Sampling Manual* (SFWMD-FIELD-FSM-001) provided the quality system requirements, and the field sampling procedures were followed in field sample collection from April 1, 2025, to June 30, 2025. The Analytical Services Section's *Chemistry Laboratory Quality Manual* (SFWMD-LAB-QM-001) provides the guidance and requirements for preparing and analyzing laboratory samples, as well as data verification and validation. The *Field Sampling Quality Assessment* and *Laboratory Analysis Quality Assessment* sections in this report provide a comprehensive evaluation and validation of the TP results for surface water samples collected from the locations and timeframe described above.

To prepare this report, a Microsoft Excel workbook named "qa_report_apr_jun_2025_data.xlsx" was also created, containing all TP results obtained from DBHYDRO, SFWMD's corporate environmental database, for all sampling events. This includes grab samples collected for the projects/stations listed above during the period specified in this report. The Excel workbook will be referred to as the Reference Data Set (RDS) throughout this report and both of the documents are available on the Everglades Technical Oversight Committee (TOC) website (https://www.sfwmd.gov/our-work/toc). TP analyses were completed at the SFWMD Analytical Services Chemistry Laboratory (Florida Department of Health Identification # E46077).

If available, TP sample results for biannual laboratory proficiency testing as required by the National Environmental Laboratory Accreditation Program (NELAP) or results from other laboratory performance evaluation studies completed during the period specified in this report will also be included.

FIELD SAMPLING QUALITY ASSESSMENT

SAMPLE COLLECTION

All samples were collected by Water Quality Monitoring (WQM) staff. A total of 39 sampling events were conducted that included collection of samples for the projects/locations and timeframe described in the *Introduction* to this report. A complete list of the laboratory work orders obtained from the Laboratory Information Management System (LIMS) for these sampling events is shown in **Table 2**. The table details the work order identifiers, work order numbers, project codes, and sample collection dates.

Table 2. Sampling events for the reporting period.

Work Order Identifier	Work Order	Project [a]	Date Collected
P157502	94753	EVPA	04/01/2025
P155892	93945	PIE	04/01/2025
P155752	93879	PIN	04/01/2025
P155828	93913	PIE	04/01/2025
P157504	94754	EVPA	04/02/2025
P155765	93886	PIN	04/08/2025
P157592	94797	PIE	04/08/2025
P155917	93958	PIE	04/15/2025
P155777	93892	PIN	04/16/2025
P155790	93899	PIN	04/22/2025
P157593	94798	PIE	04/23/2025
P155778	93893	PIN	04/29/2025
P157611	94805	PIE	04/29/2025
P158314	95152	PIN	05/06/2025
P157572	94786	PIE	05/07/2025
P157594	94799	PIE	05/07/2025
P158337	95172	EVPA	05/07/2025
P158339	95173	EVPA	05/08/2025
P157612	94806	PIE	05/13/2025
P157556	94778	PIE	05/13/2025
P158326	95164	PIN	05/13/2025
P157573	94787	PIE	05/20/2025
P157595	94800	PIE	05/20/2025
P158315	95153	PIN	05/20/2025
P157613	94807	PIE	05/27/2025
P158327	95165	PIN	05/27/2025
P157596	94801	PIE	06/03/2025
P158316	95154	PIN	06/04/2025
P158926	95462	EVPA	06/04/2025
P158928	95463	EVPA	06/05/2025
P157614	94808	PIE	06/10/2025
P158328	95166	PIN	06/10/2025
P157558	94780	PIE	06/11/2025
P157575	94789	PIE	06/17/2025
P157597	94802	PIE	06/17/2025
P158318	95156	PIN	06/17/2025
P157559	94781	PIE	06/24/2025
P157615	94809	PIE	06/25/2025
P158329	95167	PIN	06/25/2025

a. EVPA – Everglades Protection Area; PIE – Everglades National Park Inflows East; and PIN – Everglades National Park Inflows North.

During the 39 sampling events described in **Table 2**, a total of 40 grab sample records for the projects/locations described in the *Introduction* indicate that a sample was not collected in most cases due to dry conditions, gates closed and/or the site being no flow or too shallow to collect. The grab sample identifiers and reasons these samples were rejected or not collected are shown in **Table 3**.

Table 3. Grab samples rejected or not collected during the reporting period.

Work Order Identifier	Project [a]	Sample Identifier	Station	Date	Reason Sample Was Rejected or Not Collected [b]
94753002	EVPA	P157502-2	LOX5	04/01/2025	Ponding conditions, Helicopter didn't land.
94753003	EVPA	P157502-3	LOX10	04/01/2025	Too shallow to collect.
93913005	PIE	P155828-5	G737	04/01/2025	Gates closed. No flow.
94754005	EVPA	P157504-5	LOX3	04/02/2025	Ponding conditions, Helicopter didn't land.
94784004	PIE	P157570-4	G737	04/08/2025	Gates closed. No flow.
94784009	PIE	P157570-9	S18C	04/08/2025	Gates closed. No flow.
93932005	PIE	P155865-5	G737	04/15/2025	Gates closed. No flow.
93932009	PIE	P155865-9	S18C	04/15/2025	Gates closed. No flow.
94785005	PIE	P157571-5	G737	04/22/2025	Gates closed. No flow.
94785009	PIE	P157571-9	S18C	04/22/2025	Gates closed. No flow.
94777005	PIE	P157555-5	G737	04/29/2025	Gates closed. No flow.
94777009	PIE	P157555-9	S18C	04/29/2025	Gates closed. No flow.
94786005	PIE	P157572-5	G737	05/06/2025	Gates closed. No flow.
95172002	EVPA	P158337-2	LOX5	05/07/2025	Dry conditions, Helicopter didn't land.
95172003	EVPA	P158337-3	LOX10	05/07/2025	Dry conditions, Helicopter didn't land.
95172004	EVPA	P158337-4	LOX9	05/07/2025	Dry conditions, Helicopter didn't land.
95172005	EVPA	P158337-5	LOX8	05/07/2025	Dry conditions, Helicopter didn't land.
95172006	EVPA	P158337-6	LOX7	05/07/2025	Dry conditions, Helicopter didn't land.
95172007	EVPA	P158337-7	LOX11	05/07/2025	Too shallow to collect.
95172011	EVPA	P158337-11	LOX6	05/07/2025	Too shallow to collect.
95173005	EVPA	P158339-5	LOX3	05/08/2025	Dry conditions, Abandoned kayak.
95173004	EVPA	P158339-4	LOX4	05/08/2025	Dry conditions, Helicopter didn't land.
95173009	EVPA	P158339-9	LOX13	05/08/2025	Ponding conditions, Oily sheen on surface.
94778005	PIE	P157556-5	G737	05/13/2025	Gates closed. No flow.
94787005	PIE	P157573-5	G737	05/20/2025	Gates closed. No flow.
94779005	PIE	P157557-5	G737	05/27/2025	Gates closed. No flow.
94779009	PIE	P157557-9	S18C	05/27/2025	Gates closed. No flow.
94788005	PIE	P157574-5	G737	06/03/2025	Gates closed. No flow.
94788009	PIE	P157574-9	S18C	06/03/2025	Gates closed. No flow.
95462002	EVPA	P158926-2	LOX5	06/04/2025	Dry conditions, Helicopter didn't land.
95462003	EVPA	P158926-3	LOX10	06/04/2025	Ponding conditions, Helicopter didn't land.
95462004	EVPA	P158926-4	LOX9	06/04/2025	Ponding conditions, Helicopter didn't land.
95462005	EVPA	P158926-5	LOX8	06/04/2025	Dry conditions, Helicopter didn't land.
95462006	EVPA	P158926-6	LOX7	06/04/2025	Dry conditions, Helicopter didn't land.
95462007	EVPA	P158926-7	LOX11	06/04/2025	Ponding conditions, Helicopter didn't land.
95462011	EVPA	P158926-11	LOX6	06/04/2025	Too shallow to collect.
95463004	EVPA	P158928-4	LOX4	06/05/2025	Dry conditions, Helicopter didn't land.
95463005	EVPA	P158928-5	LOX3	06/05/2025	Dry conditions, Helicopter didn't land.
95463009	EVPA	P158928-9	LOX13	06/05/2025	Ponding conditions, Helicopter didn't land.
94781005	PIE	P157559-5	G737	06/24/2025	Gates closed. No flow.

a. EVPA – Everglades Protection Area; and PIE – Everglades National Park Inflows East.
b. These abbreviated notes do not necessarily convey all the details from the sample comments that can be seen in DBHYDRO.

FIELD QUALITY CONTROL

Field quality control (QC) samples were collected during each sampling event in accordance with the procedures outlined in the *Field Sampling Manual*. These QC samples were used to evaluate the integrity of the sample collection process and were associated with all environmental samples collected during the corresponding sampling day.

If any field QC sample failed to meet the criteria established by the Florida Department of Environmental Protection (FDEP) Quality Assurance Rule (Chapter 62-160, Florida Administrative Code [F.A.C.]), appropriate data qualifiers were applied to the affected sample results to indicate potential limitations in data quality.

Field QC samples may include replicate samples (RSs), field quality control blanks, field-generated equipment blanks (EBs), field-cleaned equipment blanks (FCEBs), and field blanks (FBs). It should be noted that the sampling events listed in Table 2 may include field QC samples collected at locations not specified in **Table 1**.

Grab samples collected at the locations listed in **Table 1** were not assigned a Project Manager Review (PMR). However, six samples (referenced in **Table 4**) received "J" qualifiers, indicating estimated values. These qualifiers were applied because the laboratory analysis was performed on samples collected from a disconnected pool of water using a field protocol that did not conform to the requirements outlined in the Florida Department of Environmental Protection (FDEP) Quality Assurance Rule (Chapter 62-160, Florida Administrative Code [F.A.C.]).

Table 4. Results with qualifiers and remark codes during the reporting period for the 39 sample events listed in Table 2.

Work Identifier	Project [a]	Sample Identifier	Station	Collection Date	Qualifier or Remark Code / Reason
93945010	PIE	P155892-10	S328	04/01/2025	J: Estimated value because of improper laboratory or field protocols.
93958007	PIE	P155917-7	S328	04/15/2025	J: Estimated value because of improper laboratory or field protocols.
94805007	PIE	P157611-7	S328	04/29/2025	J: Estimated value because of improper laboratory or field protocols.
94806007	PIE	P157612-7	S328	05/13/2025	J: Estimated value because of improper laboratory or field protocols.
94807007	PIE	P157613-7	S328	05/27/2025	J: Estimated value because of improper laboratory or field protocols.
94809007	PIE	P157615-7	S328	06/24/2025	J: Estimated value because of improper laboratory or field protocols.

a. PIE – Everglades National Park Inflows East.

FIELD AUDITS

SFWMD did not conduct any field audits on TOC-related projects during the second quarter of 2025.

FIELD PROCEDURE UPDATES

No major procedural updates related to TP sample collection were made during the period specified in this report.

LABORATORY ANALYSIS QUALITY ASSESSMENT

SAMPLE ANALYSES

SFWMD Analytical Services Chemistry Laboratory staff conducted 256 TP analyses for the grab samples collected during the 39 sampling events listed in **Table 2** and detailed in RDS. Of those 256 TP results, 151 were for grab samples collected from projects/locations listed in **Table 1** (excluding field quality control samples). For reference, a complete set of all 256 grab TP results can be found in the RDS described in **Table 1** with the sample identifiers, sampling locations, collection dates, etc.

LABORATORY QUALITY CONTROL

TP analyses are routinely conducted in the SFWMD Analytical Services Chemistry Laboratory in analytical batches of approximately 100 samples. To assess the quality of the sample results produced during the analyses of these batches, various types of laboratory control samples are included according to the requirements described in the *Chemistry Laboratory Quality Manual* (SFWMD-LAB-QM-001). The results of these laboratory quality control samples are associated with the analyses conducted in each batch, and qualifiers are added to the data as required by the FDEP *Quality Assurance Rule* (Chapter 62-160, F.A.C.), which is based on the specifications found in the *Chemistry Laboratory Quality Manual* (SFWMD-LAB-QM-001). The types of laboratory quality control samples typically run in a batch include samples with certified concentrations (laboratory control samples), matrix spikes, precision checks (duplicates or matrix spike duplicates), and method blanks. Since the laboratory exhibited no quality control failures for batches associated with the RDS, none of the laboratory operation related qualifiers were added for the 151 TP results of samples collected from projects/locations listed in **Table 1**.

METHOD DETECTION LIMIT AND PRACTICAL QUANTITATION LIMIT

The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined by the laboratory on an annual basis using the procedure described in the Code of Federal Regulations (CFR), 40 CFR 136, Appendix B. The practical quantitation limit (PQL) is the minimum concentration of an analyte that can be measured with a high degree of confidence that the analyte is present at or above that concentration. However, there is not any universally accepted (or required) method for determining the PQL. In the case of TP analyses, the SFWMD Analytical Services Chemistry Laboratory PQL (0.004 mg/L) is set to the concentration of the lowest standard used for calibration, which is a typical approach among analytical laboratories. Any TP results that are below the MDL (0.002 mg/L) are assigned a "U" qualifier indicating that there is high confidence that the analyte is not present. The reported TP values between the MDL (0.002 mg/L) and the PQL (0.004 mg/L) are assigned an "I" qualifier, indicating that the results are at concentrations that cannot be accurately quantified. Of the 151 TP results reported, no results were below the MDL, and only one sample had a concentration between the MDL (0.002 mg/L) and the PQL (0.004 mg/L).

ESTIMATION OF ANALYTICAL MEASUREMENT UNCERTAINTY

All measurements are subject to uncertainty and a measured value is only complete if a statement of the associated uncertainty accompanies it. The definition of uncertainty (of measurement) can be found in

the *International Vocabulary of Basic and General Standard Terms in Metrology*: "A parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (JCGM 1993). The uncertainty has a probabilistic basis and reflects incomplete knowledge of the quantity. The SFWMD Analytical Services Chemistry Laboratory provides uncertainty estimates using the nested hierarchical methodology by Ingersoll (2001) in combination with a mathematical model found in Eurachem/CITAC (2012). This quality control-based nested approach uses the statistical quality control data attributed to laboratory measurement activities and does not include uncertainty attributed to field sampling activities. The estimated uncertainty is calculated using the following equation:

$$\mathbf{U(x)} = \sqrt{\boldsymbol{S_o^2} + (\boldsymbol{S_1^2 x^2})}$$

U(x) is the combined standard uncertainty in the result x at the 95% confidence interval (CI).
$\mathbf{S_0}$ is a constant contribution to the overall uncertainty derived from the procedure to determine the MDL.
$\mathbf{S_1}$ is a proportionality constant derived from nested hierarchical methodology by Ingersoll (2001).

During this reporting period, the uncertainty constants are $\mathbf{S_0}$ = 0.002 and $\mathbf{S_1}$ = 0.068. Estimated uncertainties are calculated automatically by LIMS using the equation and constants shown above and are provided with all TP results. The percentage measurement uncertainty (95% CI) is 100% at MDL, nearly 30% at PQL, and remains relatively constant at higher concentrations.

PROFICIENCY TESTING AND PERFORMANCE EVALUATION

The SFWMD Analytical Services Chemistry Laboratory participates in a variety of studies to evaluate the proficiency of the laboratory's quality system. During the second quarter of 2025, the laboratory received TP results for the Phenova #WP0425 proficiency testing study. The reported results were evaluated as "acceptable" with a calculated Z-score of 0.417. The laboratory also participated in the WEPAL-QUASIMEME AQ1 and AQ2 nutrients in seawater and nutrients in estuarian and low salinity open water performance evaluation study Round 2025.1 but had not received the results of the study.

LABORATORY AUDITS

During this reporting period the laboratory finalized its annual internal audit report. There were six corrective actions, two observations, and one recommendation identified. These findings have been entered into the laboratory's corrective action log and are in the process of being addressed. No deficiency was relevant to the laboratory's TP analytical procedure and did not affect the quality of the TP sample data.

PROCEDURE UPDATES

The TP sample preparation (Standard Method 4500-P B (5)-2011, Persulfate Digestion Method) and analytical procedure (Standard Method 4500-P H-2011, Automated Ascorbic Acid Reduction Method) did not change during this reporting period.

REFERENCES

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FDEP. 2018. *Quality Assurance*. Chapter 62-160, Florida Administrative Code. Florida Department of Environmental Protection, Tallahassee, FL. Effective April 16, 2018.

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JCGM. 1993. *International Vocabulary of Basic and General Standard Terms in Metrology*. Joint Committee on Guides for Metrology, Geneva, Switzerland. ISBN 92-67-10175-1.

SFWMD. *Chemistry Laboratory Quality Manual*. SFWMD-LAB-QM-001, most current, effective version. South Florida Water Management District, West Palm Beach, FL.

SFWMD. Field Quality Manual. SFWMD-FIELD-QM-001, most current, effective version. South Florida Water Management District, West Palm Beach, FL.

SFWMD. Field Sampling Manual. SFWMD-FIELD-FSM-001, most current, effective version. South Florida Water Management District, West Palm Beach, FL.

SFWMD. Standard Operating Procedure for the Determination of Total and Dissolved Phosphorus. SFWMD-LAB-SOP-3140, most current, effective version. South Florida Water Management District, West Palm Beach, FL.

GLOSSARY

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations.

Confidence Interval (CI): A range of values so defined that there is a specified probability that the value of a parameter lies within it.

Equipment Blank (EB): Field quality control sample prepared using sampling equipment that has been brought to the site or processing area precleaned and is collected before the equipment has been used. The results of these blanks are used to monitor the on-site sampling environment, sampling equipment decontamination, sample container cleaning, suitability of sample preservatives and analyte-free water, sample transport and storage conditions, and laboratory process.

Field Blank (FB): FBs are collected by pouring analyte-free water directly into the sample container, preserved, and kept open for the same approximate time and interval as required for collection and/or processing of the routine sample. The results of this blank are used to monitor the on-site sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, sample transport and storage conditions, and laboratory process.

Field Cleaned Equipment Blank (FCEB): Field quality control sample prepared using sampling equipment that has been cleaned in the field or in the processing area. The results of this blank are used to monitor the on-site sampling environment, sampling equipment field decontamination, sample container cleaning, suitability of sample preservatives and analyte-free water, sample transport and storage conditions, and laboratory process.

Measurand: Particular quantity subject to measurement.

Method Detection Limit (MDL): The smallest concentration of an analyte of interest that can be measured and reported with 99% confidence that the concentration is greater than zero. The MDLs are determined from the analysis of a sample in a given matrix, using accepted sampling and analytical preparation procedures, containing the analyte at a specified level. The MDL is determined by the protocol defined in the Code of Federal Regulations (CFR) Section 40 CFR, Part 136, Appendix B, as established by the United States Environmental Protection Agency.

Practical Quantitation Limit (PQL): The smallest concentration of an analyte of interest that can be quantitatively reported with a specific degree of confidence. The PQL is verified for each matrix, technology, and analyte. The validity of the PQL is verified by analysis of a quality control sample containing the analyte of concern.

Precision: The agreement or closeness between two or more results is an indication that the measurement system is operating consistently and is a quantifiable indication of variations introduced by the analytical systems over a given time and field sampling period.

Replicate Sample (RS): An RS is collected by repeating (simultaneously or in rapid succession) the entire sample acquisition technique that was used to obtain the routine sample. A single RS set (e.g., one sample and two RSs) is collected per quarter, per project, at the same station, for the longest parameter list. RS data are compared to routine sample data to evaluate sampling precision.

Uncertainty: The range of values within which the true value is estimated to lie. It is a best estimate of possible inaccuracy due to both random and systematic error.

Z-Score: A measure of the deviation of the result (Xi) from the assigned value (X) for that determinant (calculated as $z = (Xi - X)/\sigma$, where σ is a standard deviation) (Eurachem/CITAC 2012).