Comprehensive Everglades Restoration Plan

Quality Assurance Oversight Team

Quality Assessment Report

for Water Years 2017 - 2018

(May 1, 2016 – April 30, 2018)

Prepared for:

CERP Design Coordination Team

Prepared by:

Quality Assurance Oversight Team

January 2019

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ACRONYMS AND ABBREVIATIONS

ADaPT	Automated Data Processing Tool
BBCW	Biscayne Bay Coastal Wetlands
BTEX	Benzene, toluene, ethylbenzene and xylene
CAPs	Corrective Action Plans
CERP	Comprehensive Everglades Restoration Plan
CGM	CERP Guidance Memorandum
DBHYDRO	Hydrometeorologic, Water Quality, and Hydrogeologic Data Retrieval System
DCT	Design Coordination Team
DOD	Department of Defense
DPM	Decompartmentalization Physical Model
DQO	Data quality objective
DVS	Data Validation and Stewardship
EB	Equipment Blank
ECCC	Environment and Climate Change Canada
EDQW	Environmental Data Quality Workgroup
EFGS	Eurofins Frontier Global Sciences
ESA	Environmental Site Assessment
FAC	Florida Administrative Code
FB	Field blank
FCEB	Field-cleaned Equipment Blank
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual
IDM	Information and Data Management
LDC	Laboratory Data Consultants

MAP	Monitoring and Assessment Plan
MDL	Method Detection Limit
MTBE	Methyl tertiary-butyl ether
NELAP	National Environmental Laboratory Accreditation Program
NH4	Ammonia
NOx	Nitrate-Nitrite
PDT	Project Delivery Team
PE	Performance Evaluation
PEST	Pesticide Monitoring
PI	Process Improvement
PIE	Everglades National Park Inflows East
PLMP	Project-level Monitoring Plan
PM	Project Manager
PrMP	Program Management Plan
PSRP	Picayune Strand Restoration Project
QA/QC	Quality Assurance/Quality Control
QAOT	Quality Assurance Oversight Team
QAR	Quality Assessment Report
QASR	Quality Assurance Systems Requirements
QI	Quality Improvement
RCRA	Resource Conservation and Recovery Act
REC	RECOVER Executive Committee
RECOVER	Restoration Coordination and Verification
SFWMD	South Florida Water Management District
SM	Standard Methods
SO4	Sulfate
SOP	Standard Operating Procedure
SSR	System Status Reports

TAP	TestAmerica Pensacola
TN	Total Nitrogen
TP	Total Phosphate
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WQM	Water Quality Monitoring
WY	Water Year

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EXECUTIVE SUMMARY

The purpose of this Quality Assessment Report (QAR) for the Comprehensive Everglades Restoration Plan (CERP) is to provide CERP leadership with an assessment of the state of data quality for CERP monitoring and analyses activities. This is the eighth QAR prepared by the Quality Assurance Oversight Team (QAOT) and covers the Water Years (WYs) 2017 and 2018, May 1, 2016, through April 30, 2018, or "reporting period." In this report, the QAOT identifies the processes that contribute to identification of quality of data being collected, data quality problems identified, and remedies implemented, reports on the activities of the QAOT, and recommends improvements to the quality system for CERP monitoring activities. This QAR integrates the results of the CERP quality assessment and QAOT activities performed during this reporting period.[1]

The QAOT evaluated the quality assurance/quality control (QA/QC) procedures that could impact CERP data quality by reviewing QA/QC processes, evaluating of field monitoring activities, and assessing laboratory performance. The QAOT updated the Quality Assurance Systems Requirements manual (QASR) chapter 4 (subsection 4.1.1), and reviewed CERP Guidance Memoranda (CGM) 040.02, 041.01 and CGM 042.02 (subsection 4.1.2). One Standard Operating Procedure (SOP) was updated and another created during the reporting period (subsection 4.1.3). The QAOT Facts and Information Sheet was also revised (subsection 4.1.4). There were no water quality Scopes of Work or Monitoring Plans reviewed (subsection 4.2). The WYs 2015-2016 QAR was finalized and approved by the Design Coordination Team (DCT) (subsection 4.3). Project-level data assessments were conducted for six CERP projects (subsection 4.4). The QAOT also conducted three program-level activities: (1) initiated laboratory assessments for four Environmental Site Assessment laboratories (subsection 4.5.1); (2) organized and gave presentations at the 7th QAOT Workshop at the U.S. Army Corps of Engineers (USACE) Jacksonville District office (subsection 4.5.2); and (3) actively partnered with the Florida Department of Environmental Protection (FDEP) when Chapter 62-160, Florida Administrative Code (FAC), the QA Rule, was updated (subsection 4.5.3).

Field audits and/or observations were conducted to assess monitoring activities (subsection 5.1) for three CERP water quality projects. Quality reviews of Hydrology (subsection 5.2) and Biological/Ecological (subsection 5.3) monitoring activities were not performed during this time period. A summary of Restoration Coordination and Verification's (RECOVER) Monitoring and Assessment Plan (MAP) QA/QC is presented (subsection 5.4). This report does not include assessment of quality practices conducted by RECOVER.

The QAOT completed on-site quality assessments during the reporting period for three laboratories contracted to perform chemistry analyses (subsection 6.1). Findings for the chemistry laboratories included method deviations related to calibration and lack of adequate documentation/detail in SOPs. In most cases, corrective actions were undertaken by the laboratories to mitigate the findings. The QAOT did not provide Performance Evaluation (PE) samples to the laboratories assessed. In the summers of 2016 and 2017, inorganic water and sediment (metals only) PE sample sets were provided to laboratories that are or could potentially be used to analyze chemistry samples for CERP (subsection 6.2). Some improvements in performance were observed.

An assessment was conducted of CERP data quality represented by a snapshot of analytical data in SFWMD's Hydrometeorologic, Water Quality, and Hydrogeologic Data Retrieval System (DBHYDRO)

[1] All QAOT reports are available in Documentum or upon request from the QAOT co-chairs.

database (subsection 7.1). An evaluation of analytical chemical and classical water quality data indicated that approximately 13% of the WY 2017 and WY 2018 data snapshot had qualifiers indicating that data quality could be compromised; however, these data are skewed by one project where 64% of the nutrient data were qualified, and 100% of the General Chemistry data were qualified. CERP field test monitoring data quality (subsection 7.2.1), along with CERP field QC data in DBHYRO (subsection 7.2.2) evaluations were added to QAR2018. For 13 hydrologic data types in DBHYDRO, 8.1% of the data were missing, 10% were estimated, and 0.12% were not processed during the reporting period (subsection 7.3). These percentages are slightly higher for percent missing, about average for percent estimated and significantly lower for percent not processed when compared to those reported in WYs 2011-2016. A summary of the 18 active stations with continuous monitoring of water quality for the Picayune Strand Restoration Project (PSRP) is presented (subsection 7.4). The percent of samples with quality related qualifiers slightly increased in WYs 2017-2018 when compared to WYs 2015-2016.

There were no alternative procedures approved by the QAOT in this reporting period (Section 8), and deviations (other than those documented from the field and laboratory assessments) from the Quality Assurance System Requirements (QASR) were not identified (Section 9).

The QAOT continued communication and outreach efforts (subsection 10.1) and collaboration with other CERP entities (subsection 10.2). Three initiatives identified in previous QARs were completed during the reporting period (subsection 10.3).

QA is a continuous process improvement cycle of plan, do, check, and act. The QAOT addressed five recommendations identified during previous reports which are summarized in Section 10. Three recommendations for improvement were identified by the QAOT during this reporting period (Section 11) and will be part of the planning and action focus during the next QAR reporting period. These recommendations include determining if the QAOT can provide QA support to RECOVER, evaluating data quality objectives (DQOs) to assess the relevance of percent qualifiers for various parameters, and evaluate the need to include biological metadata in future QARs.

1 INTRODUCTION

Since passage of the Water Resource Development Act in 2000, the mission of the Comprehensive Everglades Restoration Plan (CERP) has been to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. CERP Guidance Memorandum (CGM) 0 41.01 (South Florida Water Management District [SFWMD] and U.S. Army Corps of Engineers [USACE], 2010), establishes the Quality Assurance Oversight Team (QAOT) and its responsibility for *providing guidance on and evaluation of the implementation of CERP Quality Systems through the Quality Assurance Systems Requirements* (*QASR*) *and CGMs. The QAOT develops and provides guidance on procedures, quality assurance/quality control (*QA/QC*) requirements and data verification and validation for CERP monitoring activities. The QAOT* serves as *the forum through which consistency is achieved regarding data quality and QA/QC processes among the various entities involved with hydrological, meteorological, water quality, and biological monitoring activities for CERP*. CGM 041.01 further specifies that the lead QAOT agencies will produce a *QA report on CERP monitoring activities on a biennial basis, evaluating whether the QASR is being implemented by CERP projects and programs and/or their contractors.* This QAR has been prepared to meet that mandate.

The Office of Management and Budget was required to provide guidance for quality, objectivity, integrity, and utility of information disseminated by Federal agencies as a result of the Information Quality Act passed in 2001 (U.S. Congress 2001). The Government Performance Results Modernization Act of 2010 (U.S. Congress 2011) requires agency performance plans and reports that describe how the agency ensures the reliability of the data used to measure progress toward performance goals, including how performance measures are verified and validated and if there are any limitations in the data that prevent attainment of the required level of accuracy.

It is critical that environmental monitoring and assessment data generated for the restoration of the Everglades as part of CERP provide a reliable and defensible basis upon which to formulate appropriate planning decisions. Use of data with unknown, unequal, or untraceable quality could result in decision errors or legal challenges. Therefore, to maximize the integrity of the data, programmatic data quality will be achieved by systematically incorporating QA/QC measures into every aspect of data collection. This is a requirement that applies to project and program level monitoring activities and analyses conducted as part of the CERP.

The CERP's QASR manual defines protocols and procedures for environmental data gathering and defines quality systems to ensure data quality. The QASR establishes fundamental QA/QC procedures that, if implemented, will ensure data generated for CERP are "of acceptable and verifiable quality, generated in a consistent manner to allow sharing and utilization of data" (CERP Monitoring Program, 2004). The QASR manual incorporates, by reference, the Florida Department of Environmental Protection (FDEP) QA Rule Chapter 62-160 FAC and FDEP SOP-001/01. The QASR requirements are applicable to all data that will be used for CERP purposes.

The purpose of this report is to provide CERP management with an assessment of the state of data quality for CERP. The goals of the QAR are to document processes that contribute to data quality, identify data quality problems and best management practices, report on the activities of the QAOT, and recommend improvements to the quality systems for CERP monitoring. As such, when specific data quality issues are discussed in this report, it is intended to identify opportunities for continuous process improvement.

As directed by the CERP Design Coordination Team (DCT), the QAR is a biennial report which integrates into one document the results of CERP quality assessment and QAOT activities performed during each reporting period.[2] This document provides an assessment of CERP data quality and QAOT activities for the period between May 1, 2016 and April 30, 2018 based on WY 2017 and WY 2018, hereafter referred to as the reporting period. This is the eighth QAR developed by the QAOT.

[2] All QAOT reports are available in Documentum or upon request from the QAOT co-chairs.

2 SCOPE AND APPLICATION

The scope of this QAR is to describe the quality of data generated for CERP during the reporting period of May 1, 2016 through April 30, 2018, evaluate the effectiveness of quality practices, and make recommendation to CERP leadership where improvements are needed to ensure the data collected within CERP project and program-level activities are known and withstand legal challenges and support decisions. The report focuses on CERP environmental monitoring activities from: (1) Restoration Coordination and Verification (RECOVER) system-wide monitoring efforts (i.e., Monitoring and Assessment Plan [MAP]); (2) project-level operational monitoring; and (3) permit-driven regulatory monitoring. The QAOT employed a variety of methods to evaluate the QA/QC procedures implemented for CERP that potentially impact data quality.

This report assesses quality directly through reviews of field and laboratory data quality indicators, results of Performance Evaluation (PE) sample analyses, assessments of monitoring and analytical procedures, and reviews of field and laboratory audits. Indirect assessments of data quality were accomplished by reviewing monitoring plans, standard operating procedures (SOPs), data, and/or project reports.

3 LIST OF KEY PARTICIPANTS AND ORGANIZATIONS

The preparation of this report was supported by the major contributions of QAOT members who provided audit reports, data, contact names, guidance, oversight, and comments. **Table 3-1** lists the people who contributed text to this document, including those who provided supporting documentation and review comments.

Table 3-1. Contributors to the WY 2017 - 2018 QAOT Quality Assessment Report.

Name of Participant	Organization
Paul Julian	FDEP
Nia Wellendorf	FDEP
Cindy Lee Westergard	HSW Engineering, Inc. (SFWMD contractor)
Ming Chen	SFWMD
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Marie Huber	USACE

4 CURRENT QA/QC PROCESSES

This section summarizes QAOT activities conducted to improve or assess current QA/QC processes implemented across CERP. These processes, defined in the QASR and QAOT SOPs, constitute the CERP quality system. Whenever possible, the QAOT is pro-active and focused on preventive actions. During the reporting period, the QAOT focused efforts on the following processes:

- Providing acceptable QA/QC requirements to Principal Investigators using QAOT documents – subsection 4.1 (QASR chapter 4 was updated, initiated review of CGMs 040.02 and 041.01, updated one and authored one QAOT SOP, and revised the QAOT Facts and Information Sheet).
- Approving 2015-2016 QAR documented QAOT activities during the previous reporting period – subsection 4.3.
- Assessing the CERP quality system for six CERP projects – subsection 4.4 and **Table 4-1**.
- Initiating three activities to improve the quality of data (initiated project specific laboratory assessments, hosted a QAOT workshop in Jacksonville, and worked with FDEP on the QA Rule applicability to SFWMD projects) – subsection 4.5.

4.1 QAOT Document Updates

4.1.1 Review of the QASR Manual

During the reporting period, Chapter 4 (Chemical Analysis) of the manual was updated to include an additional reference to Chemical Data Quality Management for Environmental Restoration Activities (USACE Engineer Regulation 200-1-7, 28 Nov 2014). Reference to the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards was removed and replaced by "applicable NELAC standards." Three paragraphs regarding certification, certification unavailability, and certification for research purposes were added to clarify how these situations are handled by both the project and the laboratory. QASR Chapter 4.0 was updated in November 2017.

4.1.2 CERP Guidance Memoranda (CGM)

During the reporting period, CGM 040.02 (Project Level Monitoring and Assessment) and CGM 041.01 (Agency Responsibility and Coordination for Quality Assurance, Quality Control and Data Validation for CERP Monitoring Activities) were reviewed with a decision made to revise in FY19. CGM 042.02 (Screening Process for Mercury and Other Toxicants) was revised during this reporting period. Changes to CGM 042 were based on observations in mercury and toxicant monitoring over the past 11 years. Changes included transitioning from 3 phases to 2 phases, reducing project monitoring from 9 years to 5 years, reducing surface water monitoring from 3 years to 1 year, revising the schedule for fish tissue monitoring, and eliminating monitoring for toxicants that are not contaminants of concern. FDEP and USACE concurred with the proposed changes. CGM 042.02 was approved in September 2018.

4.1.3 QAOT Standard Operating Procedures

During the reporting period, the QAOT revised one SOP and created another one of its six SOPs.

SOP-005 (Administering and Reporting Analytical Performance Evaluation Studies of Inorganic Analytes) was revised to add specifications to parameters, participating laboratories, and project managers and

environmental technical leads' responsibilities. The SOP title was revised to indicate that this SOP addresses PE studies of inorganic analytes. The QAOT approved the revision to SOP-005 on April 7, 2017.

SOP-006 (Conducting Laboratory Assessments) was created. The purpose of this new SOP is to document the process followed by the QAOT in performing laboratory assessments for facilities that conduct, or may conduct, analysis of samples for CERP projects. This process includes performing a remote desk assessment of the laboratory's documentation for the methods identified by the point of contact requesting the assessment, verifying documented processes are being implemented by performing an on-site evaluation of the laboratory, and reviewing the laboratory's PE sample results. The duties and responsibilities of the project managers, QAOT, assessor, and laboratory are clearly identified. The eight-step procedure section describes in detail the execution of the process. The QAOT approved the revisions to SOP-006 on August 21, 2017.

4.1.4 Revision of the QAOT Facts and Information Sheet

The QAOT Facts and Information Sheet was updated in September 2017. The sections regarding Requirements, Guidance, Frequently Asked Questions, and points-of-contact were updated to reflect the current status of the QAOT. The latest revision can be found at https://evergladesrestoration.gov/qaot.

4.2 Monitoring Plan/Scope of Work Reviews

During this reporting period there were no monitoring plans or scopes of work reviewed.

4.3 Quality Assessment Report for WY 2015-2016

The 2015-2016 QAR (QAR2016) presented CERP data quality and project performance; QAOT guidance documents, audits and outreach; and recommendations for future data quality improvements during WYs 2015 and 2016. The time period for QAR2016 was between May 1, 2014, and April 30, 2016. QAR2016 was approved by the DCT on April 10, 2017.

4.4 CERP Project Assessment Summary

The QAOT assessed the quality of CERP monitoring plans and project level data collected by performing project-specific field/laboratory assessments (Section 5 and Section 6) and reviewing CERP data quality (Section 7). **Table 4-1** provides a summary of CERP projects assessed by the QAOT during the reporting period.

Table 4-1. CERP Projects Assessed by the QAOT during the Reporting Period.

Project	QA/QC Processes (Section 4)	Field/Lab Assessments (Sections 5/6)	Data (Section 7)
Biscayne Bay Coastal Wetlands (BBCW)	-	X	X
C-111 Spreader Canal[a]	-	-	X
Decompartmentalization Physical Model (DPM)	-	-	X
Everglades National Park Inflows East (PIE)	-	X	X
Pesticides Monitoring (PEST)	-	X	X
Picayune Strand Restoration Project (PSRP)	-	-	X

[a]*A subset of C-111 Spreader Canal data was reviewed; the PIE and PEST monitoring plans include monitoring stations for the C-111 Spreader Canal project.*

4.5 QAOT Initiatives

4.5.1 Laboratory Assessments for Selected Environmental Site Assessment (ESA) Projects

The sub-contracted external laboratories utilized in these Projects included Test America Laboratories/Tampa, Test America Laboratories/Pensacola, Pace Analytical Laboratories, Florida Spectrum Environmental Services, Inc., and Jupiter Environmental Laboratories, Inc. The collective sampling results were evaluated in the context of overall data quality specific to the Environmental Risk Assessment Services. Media sampled included soil, sediments, ground water and surface water. The collective sampling parameters included Resource Conservation and Recovery Act (RCRA) Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver), Copper, Organochlorine Pesticides, Chlorinated Herbicides, Organophosphorus Pesticides, Total Organic Carbon, and the Kerosene Analytical Group compounds (which included benzene, toluene, ethylbenzene and xylene [BTEX]/methyl tertiary-butyl ether [MTBE], Total Petroleum Hydrocarbons, and Polycyclic Aromatic Hydrocarbons).

A cursory manual review of the cumulative data (>500 data points) by the project team indicates that there was general adherence to the Laboratory Quality Assurance Requirements and the Standard Procedures for Laboratories Providing Analytical Services, as identified in the Environmental Risk Assessment Services Contracts. Duplicate samples, split samples, and equipment blanks were routinely collected in order to validate the field and laboratory procedures, and to ensure that the collected data was representative of site conditions. Typically, there was good correlation between the primary samples and the duplicate samples, as well as between the primary samples and the spilt samples that were analyzed by the secondary laboratory. The Automated Data Processing Tool (ADaPT) data validation program was utilized by SFWMD to validate the laboratory data. In general, the collective data validation efforts indicated that the significant majority of the produced data were considered appropriate for use. The exceptions noted (exceptions were primarily associated with detection limits, laboratory control samples outside acceptance limits, false negative analyses slightly outside of holding time, and matrix interference) and rejected data (<1% of the reported data) was not of a significant degree that the conclusions of any specific investigation were impacted. Based upon the review of these Projects, the overall quality of laboratory data generated by sub-contracted external

laboratories via the Environmental Risk Assessment Services Contracts appears to be acceptable for the timeframe encompassed by Water Years 2017-2018.

As evidenced by the QAOT 2017 and 2018 Performance Evaluation (PE) Studies (see **Table 6-5**), potential performance issues were identified for multiple sub-contracted external laboratories currently utilized by the Environmental Risk Assessment Services Contractors. These include Jupiter Environmental Laboratories, Pace Analytical Laboratories, SGS Accutest Southeast, and Test America Laboratories/Tampa. Each of these laboratories have agreed to participate in the 2018 PE Study, as well as the preceding on-site laboratory assessment. These measures are intended to confirm that corrective actions to address the previously noted potential performance issues were appropriate, and that other relevant aspects of the laboratory's quality system are acceptable to the QAOT. The project staff utilizing the Environmental Risk Assessment Services Contracts will continue to monitor the results of the 2018 PE Study upon completion, particularly as it relates to the performance of sub-contracted external laboratories. In addition, the results of the 2018 PE Study will be communicated to the primary Environmental Risk Assessment Services Contractors pursuant to the revised QAOT Standard Operating Procedure (May 2018 Revision). This information will be evaluated to clarify the status of the sub-contracted laboratories with respect to eligibility for continued utilization via the Environmental Risk Assessment Services Contracts.

4.5.2 Outreach: 7th QAOT Workshop at USACE Jacksonville District – February 2018

The QAOT hosted a workshop at the USACE Jacksonville District on February 15, 2018 to inform Project Managers, Technical Leads, and those directly associated with CERP on how QAOT involvement can enhance overall success of their project. Goals of the workshop included:

- Communication:
    1. CERP QA/QC requirements.
    2. Purpose of QA (and consequences if not employed).
    3. Provide examples of existing issues with collecting, analyzing, and storing data.
    4. Knowledge-sharing and networking.
- Seek QA "buy in" from Project Managers:
    1. Illustrate need for QA.
    2. Understand long-term CERP goals for data validity.
    3. Encourage ownership of project and program objectives.

The workshop included teleconference capability for those unable to participate in person. Nineteen (19) participants attended this workshop, including those attendees that participated via the webinar. The workshop consisted of the following presentations:

- The QAOT and How We Can Assist You
- The QAOT and Project Delivery Team/Recover Team Responsibilities for Quality Assurance of Monitoring Activities
- The QAOT Review and Audit Processes
- Monitoring Plans and Scopes of Work Review Process
- 2016 Quality Assessment Report to the Design Coordination Team - Findings

Workshop evaluations completed by the attendees, along with verbal feedback, were positive. Copies of the presentations were sent to those who requested them.

4.5.3 Outreach: Environmental Monitoring and Data Quality Workshop – April 2018

The USACE QAOT co-chair accepted an invitation from the Department of Defense (DOD) Environmental Data Quality Workgroup (EDQW) to present the plenary lecture at the annual Environmental Monitoring and Data Quality (EMDQ) workshop in Orlando, FL on April 10, 2018. The presentation focused on the history of the Everglades, CERP goals and vision, RECOVER Monitor and Assessment Plan, CERP project monitoring, and the role of the QAOT with regards to CERP. With representatives from Army, Navy, Air Force, and Defense Logistics Agency, EDQW's primary mission is to develop and recommend DOD policy pertaining to environmental sampling, laboratory testing operations, and data quality. Approximately 220 representatives from DOD, contractors and laboratories were in attendance.

4.5.4 QA Rule Applicability to the South Florida Water Management District's Technical Projects

During this reporting period, FDEP updated the QA Rule in Chapter 62-160, FAC and presented to one of the QAOT meetings. The SFWMD QAOT members were tasked to collect examples of projects that need to be clarified and considered by FDEP as to the applicability of QA Rule to District projects. A conference call was held between SFWMD and FDEP on December 7, 2017 to get better guidance as to the applicability of various aspects of the QA Rule. The notes derived from this meeting concluded that FDEP guidance will be incorporated into a tiered approach document to provide appropriate QA/QC information to project managers in the District to apply on various new technical projects going forward.

- QA Rule applies to three situations generating data, according the FDEP:
    - All projects with monitoring specified in permits or other actions issued by FDEP.
    - All projects that are funded by FDEP including pass-through funds.
    - Projects providing data that FDEP may use for future regulatory action.
- Contractual compliance with the QA Rule requires:
    - For contracts, the appropriate QA language should be written into the contract and/or scope of work (SOW), and the District would use standard contractual processes if the scope isn't adhered to.
    - Work plans should have sufficient level of detail to indicate what general QC practices are being applied and to ensure repeatability and comparability. Academic scientists may not be used to having regulators reviewing their work, and it may take some time to flesh out and document the QA details.
- QA in research projects via permits will vary case-by-case depending on several factors:
    - If "data use by FDEP or the Department" is indicated for a project, then QA Rule applies to make sure the data are defensible and reproducible.
    - If data are for "future usage" by FDEP or "connection with" a regulatory requirement, QA Rule may apply on a case-by-case basis.

- If QA Rule applies, FDEP can require review of project SOWs and work plans to ensure adherence to it. Because of the work load practicalities, it is desired to limit the amount of review to be conducted by FDEP. Use of the FDEP QA template for research plans can assist researchers.
- Except as provided in subsection 62-160-300 (2) through (8), FAC, of the QA Rule, all laboratories generating environmental data for submission to FDEP or for use in FDEP-regulated or FDEP sponsored activities must be certified by the Florida Department of Health Environmental Laboratory Certification Program. Laboratory certification by the Florida Department of Health is not required for laboratory tests conducted for research projects when FDEP has reviewed and concluded that the organization's SOPs provide sufficient QA requirements for FDEP purposes.
- The QA Rule does not mention ADaPT data software. The ADaPT requirements are coordinated through FDEP's Division of Waste Management. Note that the QA Rule does authorize FDEP to require electronic data formats such as ADaPT.

5 EVALUATION OF FIELD MONITORING

This section summarizes QAOT activities to assess the quality of CERP field monitoring. Assessment input for field data quality may consist of field audits of water quality monitoring, hydrometeorologic monitoring, and ecological field observations.

Five field audits relevant to three projects were performed with no deficiencies noted indicating past audits had a positive effect on the sampling processes

Quality reviews of Hydrology and Biological/Ecological monitoring activities were not performed or reported during this time period on specific CERP projects, and

The RECOVER Monitoring and Assessment Plan QA/QC roles and responsibilities needed to successfully accomplish its mission were summarized.

5.1 Water Quality Monitoring Field Activities

Field audits are conducted on trips that include CERP related stations or they may be conducted on trips and stations that are not CERP related but where the sampling methods and sample collection groups are the same as those collecting samples for CERP projects. For example, pesticide samples are collected for the PSRP project, but that specific project was not audited for that collection method. Audits for the District project PEST have been included as a surrogate because the samples are collected by the same sampling group using the same collection methods. Audits were conducted in accordance with the most recent effective version of the Water Quality Monitoring (WQM) SOP for Conducting Field Sampling Audits (SFWMD-FIELD-SOP-012).

Audit Criteria:
Deficiency:
Method, process or product that does not meet the specifications in the listed quality system requirements.

Quality Improvement (QI):
A QI is defined as a deficiency that results in the qualification of data or a deficiency may or could have affected the quality of a sample directly and/or field data collected. This includes the representativeness of a sample or any Quality Control samples collected. QIs must be addressed in the written response.

Process Improvement (PI):
A PI is defined as a deficiency that does not result in the qualification of data or affect the quality of a sample and/or field data. This may include deficiencies where the auditor was not confident if the auditee understood the requirement because the requirement was not sufficiently clear, and the audit resulted in clarification of the requirement. PIs must be addressed in the written response.

5.1.1 SFWMD WQM Field Audit Summary

A sum of five field audits relevant to three District projects (BBCW, PIE, PEST) were conducted by District's WQM QA Supervisor during WYs 2017 and 2018, on behalf of QAOT. Specific findings and status of corrective action item implementations are summarized as follows.

Audit Date: 9/12/16
Group: Field Operation Sampling Logistics Unit #4421
Project: PIE
Finding Summary:

- QI - Incomplete implementation of sample segregation during sample processing. Intent of procedure is to limit possible contamination during processing. No direct impact on sample or data quality. No data were qualified.
- PI - Improper collection of field blank (FB) sample which overestimated the potential impact of construction activities on sample during processing.
- PI - Analysis codes for FB did not match that of the sample collected at the same station. This was corrected prior to analysis.
- PI - Training forms had not been completed. This was corrected after the audit.
- PI - Sonde maintenance records identified the sonde did not have maintenance at the schedule specified in the Field Sampling Quality Manual (FSQM). It was identified that the FSQM requirement was based on a different instrument type and needed to be adjusted. The instrument type also needed further evaluation prior to establishing a new maintenance schedule. No data were qualified based on this process improvement.

Audit Date: 2/8/17
Group: Field Operation Sampling Logistics Unit #4424
Project: PEST
Finding Summary:

- QI – The plastic bottle used to contain the total organic carbon (TOC) sample was not rinsed prior to collection of the field-cleaned equipment blank (FCEB). This could result in the overestimation of the possible contamination being assessed with this blank type. No data were qualified as a result of this QI.
- PI – The auditors observed two analyte-free water carboys being used during the field trip however only one was documented in the field notes.

Audit Date: 1/22/18
Group: Field Operation Sampling Logistics Unit #4421
Project: BBCW
Finding Summary:

- QI – Samples were adequately thermally preserved, but the samples were not completely submerged in ice at the end of the trip
- QI – The syringe was rinsed after the regular three rinses for the normal cleaning process.
- PI – The ethics training was not documented on the training form for the auditees. This was corrected by WQM QA.

Audit Date: 1/24/18
Group: Field Operation Sampling Logistics Unit #4424
Project: PEST
Finding Summary:
No deficiencies in sample collection procedures were noted during this audit.

Audit Date:1/30/18
Group: Field Operation Sampling Logistics Unit #4421
Project: PIE
Finding Summary:
No deficiencies in sample collection procedures were noted during this audit.

5.2 Hydrology Monitoring Activities

Quality reviews of Hydrology monitoring activities were not performed or reported during this time period on specific CERP projects.

5.3 Biological/Ecological Monitoring Activities

Quality reviews of Biological/Ecological monitoring activities were not performed or reported during this time period due to remote locations of the projects.

5.4 REstoration COordination VERification (RECOVER) Monitoring and Assessment Plan (MAP) QA/QC

Background: RECOVER is an interagency and interdisciplinary scientific and technical team. RECOVER was developed to be the system-wide scientific oversight team of the CERP. RECOVER is responsible for linking science and the tools of science to a set of system-wide planning, evaluation and assessment tasks. RECOVER's role is to organize and apply scientific and technical information in ways that are most effective in supporting CERP objectives, and to ensure that CERP system-wide goals and purposes are achieved. RECOVER's objectives are to (1) evaluate and assess CERP performance; (2) refine and improve the design and operation of the plan during implementation; and (3) ensure that a system-wide perspective is maintained.

RECOVER is responsible for carrying out the tasks necessary to successfully accomplish its missions through the processes of evaluation, assessment, and planning at both the program and project levels. At the program level, RECOVER maintains a system-wide focus as it evaluates and assesses the CERP performance, develops refinements and improvements in the design and operations of the plan, and reviews the effects that other projects may have on the performance of the CERP. RECOVER works with the PDTs to relate system-wide goals and objectives to project design and performance and incorporate information obtained during project plan formulation into the CERP and its evaluation. RECOVER is the primary means to link achievements at the project level to the overall success of the CERP in meeting the goals and objectives as stated in the plan. RECOVER will continue to function throughout the entire duration of the restoration process, continuously seeking ways to improve the plan as responses measured by a system-wide monitoring program are used to direct the adaptive management process. One of the main documents that guides this process is the MAP.

The MAP: Implementation of the MAP requires rigorous QA/QC. The RECOVER Executive Committee (REC) oversees the implementation of QA/QC protocols for the MAP in coordination with the QAOT. The MAP follows the established QA/QC Program, as outlined in the QASR manual, which is designed to meet the following requirements:

- Withstand scientific review and legal scrutiny.
- Be used to develop and support scientific and technical consensus.

- Be fully integrated into CERP.
- Standardize procedures - ensure the consistency and comparability of data using SOPs across agencies or organizations. There were no additions or changes to ongoing monitoring components during the reporting period. Any changes are reviewed at both the principal investigator/regional coordinator level and then discussed, reviewed and approved by the RECOVER executive team.
- Provide data quality criteria - provide guidance to those involved in the CERP monitoring activities to establish accuracy, precision and other quality criteria (method detection limits, uncertainty, for example) for each data type. There were no changes to data quality criteria during the reporting period.
- Provide a degree of confidence - provide for the efficient and effective analysis of data collected by the various organizations in South Florida and provide users of these data with known degree of confidence level and uncertainty that the data were collected with similar data quality standards across agencies. RECOVER developed performance measures during the reporting period that provided a degree of confidence with regard to data collected from the program.
- Data quality is ensured by the fact that the PI's we hire are the very best experts in their field - RECOVER regional coordinators develop protocols and procedures in cooperation with those experts and any modifications along the way are also discussed. This is then reviewed by the REC which is made up of representatives from the main CERP agencies and are the most senior RECOVER members in those agencies. All deliverables come back through both the contract managers and the regional coordinators for review and approval. There are status reports, quarterly and yearly reports as well as presentations by those scientists to RECOVER and at conferences such as Greater Everglades Ecosystem Restoration and the National Conference on Ecosystem Restoration. The data analysis and findings are then wrapped up once every five years in a System Status Report (SSR).
- Provide guidance for new monitoring - provide guidance on accuracy and precision requirements to agencies and organizations involved with establishing new monitoring. RECOVER and QAOT coordinate project-level monitoring plan (PLMP) reviews and share comments and findings.

The QASR lays out the protocols and procedures for environmental data gathering activities for the implementation of CERP and is periodically updated and refined to strengthen the QA/QC program for CERP. The QASR manual covers the details of the QA/QC program required during the implementation of the MAP, including establishing or defining the data quality objectives, SOPs for various QA/QC activities, data quality assessment criteria, and data handling procedures, and describes some of the expected data types and associated elements and standards necessary to produce quality data that are consistent and comparable. No additions to the QASR were made during the reporting period.

The Applied Science Strategy: RECOVER is responsible for the coordination and application of an Applied Science Strategy during CERP implementation. This strategy outlines a process for organizing current scientific understanding of wetland and estuarine ecosystems into interrelated components that can effectively support restoration efforts. The major components of the Applied Science Strategy are the development of regional and total system conceptual ecological models, identification of performance measures and restoration targets, development and implementation of a system-wide monitoring program, and development of an assessment strategy.

This guidance recommends that the following issues be included and addressed explicitly in all MAP assessments:

- A clear and unambiguous statement of goals and objectives that includes explicit statements of the target population of interest and the environmental variables to be monitored.
- A description of how inferences are to be made about the target population from the sampling design, what types of data will be used and how representative the sampling sites are.
- Random sampling is required for design- or probability- based inferences about the entire target population; however, complete random sampling, where each location has an equal probability of being included in the sample, is the simplest but the least powerful for a given sampling effort.
- Stratification and other more general forms of multi-stage sampling are useful for leveraging ancillary data to provide more powerful estimates of variability but random sampling within strata or sampling units is still required.
- If causation is important (e.g., linking the causal pathways from the conceptual ecological model), the monitoring design should incorporate supplemental experimental work to address specific hypotheses about causation.
- It is crucial that the sampling design be able to accommodate change as objectives change over time. However, finely-tuned designs, while being the most powerful to detect specific a priori responses, greatly reduce the ability of the design to capture unforeseen responses and limit the ability to subsequently restructure the monitoring program in response to modified objectives or resource levels. These considerations are particularly important to successfully implementing the adaptive management strategy which is critical to CERP.

The RECOVER sampling design, ecological monitoring SOPs, RECOVER reviews (at multiple levels including public reviews), and adoption of data for use in performance measures and tools for continued application and review of data quality, demonstrate the quality of MAP data collection and assessment. As part of RECOVER's five-year plan (2017-2021) the process of reviewing the science program, incorporating new knowledge into the conceptual ecological models developed early in the program and updating performance measures. This effort will continue in the coming years and includes a vulnerability analysis and may eventually lead to a MAP revision as needed.

Also, during this reporting period, the RECOVER team started to develop its sixth in a series of System Status Reports, the 2019 SSR will be undergoing an exhaustive review procedure and will be published as a final web document in January of 2019.

6 LABORATORY ASSESSMENTS

This section summarizes QAOT activities to assess the quality of laboratories that may generate data for CERP under existing SOWs or contracts with the SFWMD or USACE. Subsection 6.1 summarizes laboratory assessments performed during the reporting period.

Three laboratory assessments relevant to CERP projects were performed with documentation issues (SOPs not up to date or not detailed enough, and incomplete records for preparation and analytical processes) observed.

Two Performance Evaluations studies were performed to monitor laboratory performance. There was a slight slippage from the Very Good/Good categories to the Fair/Poor categories which prompted the initiation of laboratory assessments for four laboratories (see subsection 4.5.1 of this report).

The QAOT completed assessments of three contract laboratories performing organic and/or inorganic chemical sample analyses during the reporting period. The purpose of a laboratory assessment is to evaluate, at the bench-level, a laboratory's analytical proficiency and to ensure that it meets the QA/QC requirements defined in USEPA methods specified in the project's documents. The primary focus of the QAOT assessment program is to provide a mechanism to verify, document, and improve, the analytical procedures used by the laboratory that generate measurement data. The desired outcome is to enhance assurance that laboratories are producing defensible data for CERP samples by following the analytical methods requested for the project.

The assessment process consisted of three components used to evaluate laboratory performance:

- Remote Desk Assessment
- On-Site Assessment
- PE Samples

The remote desk assessment includes a review of the laboratory's documentation (SOPs, Quality Manual, control charts, method detection limits, standard data package, and previous National Environmental Laboratory Accreditation Program [NELAP] PE sample results). The on-site assessment entails in-depth review of analytical procedures used by the laboratory with emphasis on the review of bench-level data including detailed discussion with the analysts. The PE samples are provided by commercial vendors (purchased by the QAOT) and the laboratories' results are compared to the vendors quality control limits generated by NELAP protocols. Previous QAOT and the most recent NELAP audit reports and laboratory responses were reviewed to identify findings applicable to the methods under review. During the audit, the auditor verified implementation of any previous audit-based corrective actions pertaining to the methods being assessed.

For both the remote and on-site assessments, the findings are characterized as:

- Observations: No impact on data quality (e.g., typographical errors in SOPs).
- Recommendations: Deviations from method requirements that could impact data quality (e.g., not calibrating volumetric glassware).
- Deficiencies: Deviations from method requirements that will impact data quality (e.g., analyte response factors not evaluated properly resulting in not reporting analytes at low levels [false negatives]).

6.1 Laboratory Assessment Summaries

The following sections summarize the assessments for three laboratories evaluated during the reporting period. Note that not all findings are listed in the following summary section.

6.1.1 Eurofins Frontier Global Services, Inc., Bothell, WA

Eurofins Frontier Global Services, Inc., of Bothell, WA was assessed for the following USEPA methods: Total mercury by 1631, methylmercury by 1630, and arsenic/copper by 1638 (modified). The draft Desk Assessment Report was sent to the laboratory on August 16, 2016 and the on-site assessment was conducted on September 7, 2016. The Final Report was issued on November 18, 2016. Findings and corrective actions are presented in **Table 6-1**.

Table 6-1. Findings and Corrective Action for Eurofins Frontier Global Services.

Assessment		Finding	Corrective Action
Desk	1	Definition for Demonstration of Capability for preparation technician or analyst were not defined in the SOP. (1631)	Definition was added to the revised SOP.
	2	The Peer Review Checklist used to verify that analytical run sequences were properly performed were not completely filled out. (1630/1631)	Staff will be retrained on completing and reviewing the Peer Review Checklist.
		An incorrect method was referenced in the preparation SOP. (1630)	SOP was updated to reference the correct method.
On-Site	1	The total refluxing time for sample digestions was not recorded. (1631)	"Time In/Time Out" columns were changed to "Reflex Start/Reflex End."
	2	Laboratory could not demonstrate that carryover was not occurring for the metals. (1638)	Laboratory performed a study in December 2016 that showed carryover was not occurring.
PE Sample	1	QAOT supplied PE samples were not provided to the laboratory.	None.

6.1.2 South Florida Water Management District Chemistry Laboratory, West Palm Beach, FL

The South Florida Water Management District Chemistry Laboratory of West Palm Beach, FL was assessed for the following USEPA methods: Total Suspended Solids by Standard Method (SM) 2540D, Total Phosphorus by SM 4500PF, Total Nitrogen by SM4500-NC, Ammonia Nitrogen by SM 4500 NH3H and Nitrite + Nitrate Nitrogen (SM 4500 NO3F). The draft Desk Assessment Report was sent to the laboratory on April 14, 2017 and the on-site assessment was conducted on May 4, 2017. The Final Report was issued on

July 13, 2017. Findings and corrective actions are presented in **Table 6-2**.

Table 6-2. Findings and Corrective Action for South Florida Water Management District Chemistry Laboratory.

Assessment		Finding	Corrective Action
Desk	1	The time for sample filters place in/taken out of the oven was not recorded. (2540D)	The SOP and log book will be updated to record the times.
	2	Laboratory is not placing sample filters into a desiccator when cooling. (2540D)	Noted.
	3	Temperature that samples are autoclaved at was not recorded. (4500-NC)	Will start recording the temperature.
	4	Digestion check standard compound different than what is stated in the method. (4500-NC)	Update SOP to reflect the use of a different compound.
On-Site	1	Balance tolerance limits were not listed in the log book for easy reference for the analyst. (2540D)	Limits were added to the log book on May 15.
	2	Instrument maintenance log book documented 'what' maintenance was performed, but not the reason 'why'. (4500 NO3F)	Lab will record the reason 'why' to be used as a training tool for new analysts.
PE Sample	1	QAOT supplied PE samples were not provided to the laboratory.	None.

6.1.3 TestAmerica Pensacola, Pensacola, FL

The TestAmerica Pensacola Chemistry Laboratory of Pensacola, FL was assessed for the following USEPA methods: Organochlorine Pesticides (8081B) and Mercury (7471B). The laboratory analyzed fish tissue samples for the Picayune Strand Restoration Project. The draft Desk Assessment Report was sent to the laboratory on July 27, 2017 and the on-site assessment was conducted on August 30, 2017. The Final Report was issued on Sept 28, 2017. Findings and corrective actions are presented in **Table 6-3**.

Table 6-3. Findings and Corrective Action for TestAmerica Pensacola.

Assessment		Finding	Corrective Action
Desk	1	SOPs did not contain details on fish tissue sample preparation and analysis (7471B/8081B).	SOPs were updated to include the steps required for both preparation and analysis.
	2	Method Detection Limit study was performed on solids, not fish tissue (8081B).	Lab will purchase acceptable tissue matrix and perform the study prior to analysis of future samples and will prepare and analyze a low-level matrix spike sample for each unique type of fish per batch.
	3	Acceptable limits for matrix spike recoveries were wider than what is stated in the method (7471B).	Lab adopted the method limits.
	4	SOP contained equations for external standard quantitation technique; lab uses internal standard quantitation technique (8081B).	SOP was updated to document internal standard quantitation equations.
On-Site	1	One refrigerator log sheet was out of date (Quality Systems).	Temperatures will be recorded on a spreadsheet and submitted to Quality Assurance Officer for documentation on a daily basis.
	2	Balance and syringe acceptance criteria were documented; however, the source of the criteria could not be determined (Quality Systems).	Laboratory adopted the DOD Quality Systems Manual Requirements for balance and syringe acceptance criteria.
PE Sample	1	QAOT supplied PE samples were not provided to the laboratory.	None.

6.2 Performance Evaluation of Inorganic Analytes

During the reporting period, inorganic PE samples were administered to laboratories under contract with the SFWMD or the USACE that could potentially perform chemistry analysis to support CERP. The purpose of these PE studies is to assess laboratory performance on single blind samples. Two PE studies were conducted during the reporting period. Environment and Climate Change Canada (ECCC) was the PE sample provider for both studies, which were conducted during the summers of 2016 and 2017 (WYs 2017 and 2018, respectively). Typically, more than 30 laboratories participate in these studies, making submitted data statistically robust. Five of seven analyte classes offered by ECCC were selected by the QAOT for the studies: major ions and nutrients, trace elements, total phosphorus, and low-level mercury in water; and trace elements in sediment. The sample concentrations ranged from low to high and were consistent with values

commonly found in natural environments in Canada. ECCC scored laboratory performance for each analyte class as Very Good, Good, Fair, or Poor based on an equal weighting of the laboratory's analytical results Z-scores and number of biased parameters for each target analyte.

The QAOT selected 11 laboratories to participate in the WY 2017 inorganic PE study conducted in June 2016 and selected nine laboratories to participate in the WY 2018 inorganic PE study conducted in June 2017. In both years, the SFWMD chemistry laboratory ordered the same PE study samples separately and was included as an additional QAOT-evaluated laboratory for each of the two studies (**Table 6-4**). **Table 6-5** summarizes the results of the PE studies conducted in WYs 2017 and 2018. The full PE reports are posted on the QAOT home page: http://www.evergladesrestoration.gov/content/qaot.html. Overall performance for the five years of ECCC studies is summarized in **Table 6-6**.

In general, there has been sustained good performance (e.g., total phosphorus and low-level mercury) and improvement in performance (**Table 6-5** and **Table 6-6**), but with some analytical classes continuing to present challenges (e.g., trace elements in water and, for some laboratories, elements in sediment). It is difficult to make a direct comparison of performance over the past five years as laboratories often reported more analytes than requested by the QAOT (thus impacting overall performance statements issued by ECCC). However, since WY 2018, uploading of study results to ECCC is carefully monitored to restrict it to only analytes of interest to the QAOT; this will allow direct comparison of performance scores among sponsored laboratories. For both WY 2017 and WY 2018, the QAOT requested that each QAOT-sponsored laboratory report one or more of 28 analytes in one or more of the five analyte classes.

For the WY 2017 study, the 12 QAOT-evaluated laboratories provided analytical data for a combined total of 27 analyte classes that were scored by ECCC. Of these 27 analyte classes, 25% were Very Good, 17% were Good, 38% were Fair, and 21% were Poor. For the WY 2018 study, the ten QAOT-evaluated laboratories provided analytical data for a combined total of 32 analyte classes that were scored by ECCC. Of these 32 analyte classes, 37% were Very Good, 4% were Good, 26% were Fair, and 33% were Poor.

ECCC emphasizes that scoring and performance ratings are intended to provide participating laboratories with indicators of their performance when compared to other laboratories in the same field. They are not intended to convey any concept of pass or fail. Also, the scoring and performance ratings by themselves can be misleading as they are based on percentages of passing Z scores or unbiased results for each analyte class, with some analyte classes comprising several analytes (e.g., major ions and nutrients or trace metals) and others comprising only a single analyte (e.g., total phosphorus or low-level mercury). Details are provided in the full reports (HSW Engineering, 2016; HSW Engineering 2017) located on the QAOT home page.

Table 6-4. Summary of Laboratory Assessment Activities during the Reporting Period.

Laboratory	Organic Parameters Assessment	Inorganics Parameters Assessment	PE Sample Studies#
ALS Environmental, Inc. Jacksonville, FL	-	-	x
Brooks Applied Laboratories Bothell, WA	-	-	x
DB Environmental Labs, Inc. Rockledge, FL	-	-	x
Eurofins Frontier Global Sciences, Bothell, WA	-	x	x
Florida DEP Central Laboratory Tallahassee, FL	-	-	x
Florida Spectrum, Ft. Lauderdale, FL	-	-	x
Jupiter Laboratories Jupiter, FL	-	-	x
Pace Analytical Services – Florida, Ormond Beach, FL	-	-	x
Southeast Environmental Research Center, Florida International University Miami, FL	-	-	x
South Florida Water Management District Laboratory West Palm Beach, FL	-	x	x
SGS Accutest Southeast Orlando, FL	-	-	x
TestAmerica Laboratories, Inc. Pensacola, FL	-	-	x
TestAmerica Laboratories, Inc. Tampa, FL	x	x	x

#PE studies include participation in the WY 2017 and/or WY 2018 ECCC PE Study.

Table 6-5. Summary of Laboratory Performance Ratings for WYs 2017/2018 PE Studies. [a, b]

Laboratory	Major Ions and Nutrients		Trace Elements		Total Phosphorus		Trace Elements in Sediment	
	2017	*2018*	*2017*	*2018*	*2017*	*2018*	*2017*	*2018*
ALS Environmental, Jacksonville, FL	-	-	Fair	Fair	-	-	Very Good	Very Good
Brooks Applied Laboratories Bothell, WA (Mercury in water only)	-	-	-	Very Good	-	-	-	-
DB Environmental Labs, Inc. Rockledge, FL	-	Very Good	-	-	Very Good	Very Good	-	-
Eurofins Frontier Global Services, Bothell, WA (Mercury in water only)	-	-	Very Good	Very Good	-	-	-	-
Florida DEP Central Laboratory, Tallahassee, FL	-	-	Fair	-	-	-	Good	-
Florida Spectrum Environmental Services, Ft. Lauderdale, FL	Fair	Poor	-	-	Poor	Very Good	Very Good	Fair
Jupiter Laboratories Jupiter, FL	-	-	Poor	Poor	-	-	Good	Very Good
Pace Analytical Laboratories, Ormond Beach, FL	Fair	Poor	Fair	Poor	-	-	Poor	Poor
Southeast Environmental Research Center, Florida International University Miami, FL	Good	Good	-	-	Very Good	Very Good	-	-
South Florida Water Management District Laboratory West Palm Beach, FL	Fair	Fair	Fair	Very Good	Very Good	Very Good	-	-
SGS Accutest Southeast, Orlando, FL	-	-	Poor	Poor	-	-	Fair	Very Good
TestAmerica Laboratories, Inc. Pensacola, FL	-	-	Good	Fair	-	-	Fair	Very Good
TestAmerica Laboratories, Inc. Tampa, FL	-	Fair	Poor	Fair	-	Poor	Poor	Poor

[a] Very Good represents the uppermost rating; Good represents a possible inaccuracy in reporting due to a random error in the analytical sequence; Fair represents analysis that fails in a significant percentage of the results provided; and Poor represents a provider that fails in almost all parameters.

[b] "-" indicates that this parameter was not analyzed by the laboratory.

Table 6-6. Summary of Overall Laboratory Categorization for the Five Years of Using Environment and Climate Change Canada PE Samples. [a]

Rating	Water Year 2014 (%)	Water Year 2015 (%)	Water Year 2016 (%)	Water Year 2017 (%)	Water Year 2018 (%)
Very Good	31	40	33	25	37
Good	17	24	25	17	4
Fair	28	28	38	38	26
Poor	24	8	4	21	33

[a] Supplemental results voluntarily submitted by one or more of the laboratories by an alternate technology or analytical method are not included. The data for Water Years 2014, 2015, and 2016 has been updated to reflect this.

7 QUALITY OF DATA

The QAOT conducted two types of assessments to gauge the quality of data generated for CERP. The QAOT conducted a review of data qualifiers assigned during data validation to assess data quality issues related to unacceptable QC results. The QAOT also conducted a review of several data reports to assess the quality system under which the data were collected. Although these assessments were not comprehensive, they provide a measure of data quality status.

The QAOT compiled analytical laboratory data for CERP projects in the SFWMD DBHYDRO database and conducted a review of data qualifiers assigned during data validation to ascertain potential data quality issues. Although these assessments were not comprehensive, and overall data quality cannot be determined by evaluation of qualifiers independent from other factors, these assessments can provide a measure of data quality status. The District projects included in this evaluation are Decompartmentalization Physical Model (DPM), Biscayne Bay Coastal Wetlands (BBCW), Picayune Strand Restoration Project (PSRP) and selected stations from Everglades National Park Inflows East (PIE) and Pesticide Monitoring (PEST).[3]

- CERP Chemistry Laboratory Data in SFWMD Database: More than 97% of the chemistry laboratory water quality records were not assigned qualifiers related to quality of the measurement.
- CERP Field Test Monitoring Data Quality and Field QC Data in SFWMD Database: 97% of the field test monitoring data were not assigned qualifiers related to quality of the measurement.
- Hydrology Data Quality: Hydrology data quality saw an increase in percent missing in flow data. This increase is a temporary artifact from a change in data management procedures. In future reports it is expected the percent estimated will increase and the percent missing will be significantly reduced. All other parameters, with the exception of a small sample size of wind gust data, saw no significant changes in quality.

Continuous Water Quality Monitoring Data for Picayune Strand Restoration Project: More than 92% of the WQ data were not assigned qualifiers related to quality of the measurement.

7.1 CERP Chemistry Laboratory Data in SFWMD Database

The CERP monitoring data for Water Years 2017 and 2018 were downloaded from the SFWMD's corporate database DBHYDRO on June 21, 2018.[4] A total of 8,572 chemistry laboratory data records[5] were generated

[3] Data for District project PIE includes five stations (AJC1, FPDAH1, S177, S200, and S332DX) and PEST includes one station (S177). All data for station FPDAH1 were No Bottles and not included in calculations. All data for District projects PIE and PEST presented in this report are associated with the CERP C-111 Spreader Canal Phase 1 (Western Features) project.

[4] The analysis contained herein reflects the status of the data at the time the data were downloaded and does not account for changes made to the data after June 21, 2018.

[5] Data set only includes laboratory sample results. Field data, biological metadata and No Bottle records (sampling attempted but no sample collected) were not included in this section.

from 1,199 samples for 19 stations for these five District projects. District project PIE (4,181 records), which includes CERP C-111 Spreader Canal Phase 1 (Western Features) project, was the largest data set, followed by BBCW (2,195 records), PSRP (1,019 records), PEST (also part of CERP C-111 Spreader Canal Phase 1 project) (781 records), and DPM (396 records). Approximately 75% of the data points were analyzed for standard environmental samples and 25% were for field quality control (QC) samples (**Figure 7-1**). Field blanks (deionized water matrix) made up 84% of the field QCs and the other 16% were either field duplicate or replicate samples. Laboratory QC (laboratory duplicates and spikes, etc.) are not included in the database.

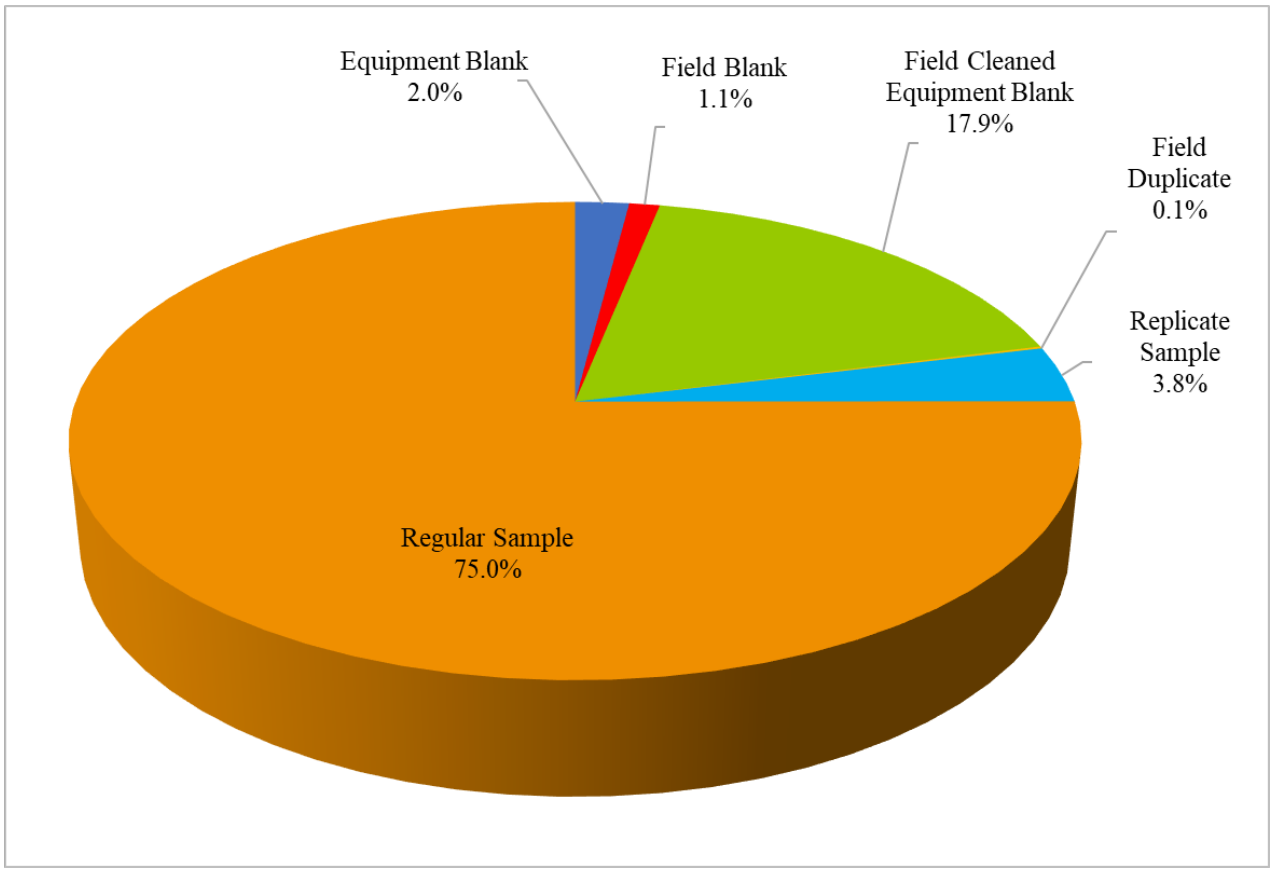

Figure 7-1. CERP WY 2017 and 2018 Water Quality Data According to Sample Type.

The matrices accounted for in the data set include surface water (50% of the data), deionized water for QC samples (21%), saline water (22%), fish tissue (4%), and sediment (3%). Samples were analyzed by the SFWMD Chemistry Laboratory, FDEP Central Laboratory, TestAmerica Pensacola (TAP), or Eurofins Frontier Global Sciences (EFGS). Eighty-five percent of the laboratory samples were analyzed by the SFWMD Chemistry Laboratory, approximately 10% by the FDEP Central Laboratory, 3% by TAP and 2% by EFGS.

A total of 178 different analytical tests were performed.[6] For the purpose of data analysis, test parameters were grouped into eight categories: Nutrient, Organic, Metals/Cations, Physical, General Chemistry, Biological, Total Mercury and Methylmercury. **Table 7-1** shows the distribution of samples analyzed by project and category. Nutrients (43%), Organic (14%), Physical (13%), and Metals/Cations (13%) were the largest categories.

Table 7-1. Data Distribution by Project and Test Analysis Category.

Project_Code	Nutrient	Metals/Cations	General Chemistry	Organic	Bioligical	Physical	Methyl Mercury	Total Mercury	Total	% ALL Records
BBCW	1,163		6		510	510		6	2,195	25.6
DPM	270	52	50			24			396	4.6
PEST			12	769					781	9.1
PIE	1,997	1,096	620			468			4,181	48.8
PSRP	264		66	420		133	45	91	1,019	11.9
Total	3,694	1,148	754	1,189	510	1,135	45	97	8,572	100.0
% All Records	43.1	13.4	8.8	13.9	5.9	13.2	0.5	1.1	100.0	

Nutrient: Ammonia, Total Kjeldahl Nitrogen, Nitrate + Nitrite (NO_x), Nitrate, Nitrite, Total Nitrogen, Orthophosphate, Total Phosphate

Organic: Herbicides and pesticides

Metals/Cations: Calcium, Iron, Magnesium, Potassium, Sodium

Physical: Bulk Density, Color, Soil moisture calculation, Total Suspended Solids, Turbidity

General Chemistry: Alkalinity, Dissolved Organic Carbon, Inorganic Carbon, Organic Carbon, Total Carbon, Chloride, Sulfate (SO_4), Total Sulfur, Hardness

Biological: Chlorophyll-a, Chlorophyll-b, Pheophytin-a

Table 7-2 shows the distribution of categories among the laboratories by matrix. All laboratories except TAP analyzed water samples, and all laboratories except FDEP Central Laboratory analyzed fish tissues. The SFWMD Chemistry Laboratory analyzed all Biological water samples, all General Chemistry water samples, all Physical water samples, all Nutrient water samples, all Metals/Cations water samples, and 42% of the Total Mercury in fish tissues. The FDEP Central Laboratory performed all General Chemistry analyses in sediment samples (12 samples), all Organic analyses in sediment samples and all Organic analyses in water samples. EFGS analyzed all Methylmercury tests in water and fish tissue samples, all Total Mercury in water samples, a portion (14%) of Organic analyses in fish tissues and a portion (10%) of the Total Mercury analyses in fish tissues for District project PSRP. The TAP laboratory performed 86% of all Organic analyses in fish tissues and 48% of the Total Mercury in fish tissues. In addition, all saline water samples were analyzed by the SFWMD Chemistry Laboratory. All sediment samples were analyzed by FDEP Central Laboratory.

[6] Sediment, fish tissue and water tests were counted as separate tests even if the target analyte was the same.

Table 7-2. Distribution of Categories by Laboratory.

Laboratory	Category	Matrix	Number of Observations
EFGS	ORGANIC	Fish Tissue	45
EFGS	TOTAL MERCURY	Water	45
EFGS	TOTAL MERCURY	Fish Tissue	5
EFGS	METHYL MERCURY	Water	45
EFGS	METHYL MERCURY	Fish Tissue	10
SFWMD	BIOLOGICAL	Water	510
SFWMD	TOTAL MERCURY	Fish Tissue	22
SFWMD	PHYSICAL	Water	1,135
SFWMD	GENERAL CHEMISTRY	Water	742
SFWMD	METAL/CATIONS	Water	1,148
SFWMD	NUTRIENT	Water	3,694
FDEP	GENERAL CHEMISTRY	Sediment	12
FDEP	ORGANIC	Sediment	286
FDEP	ORGANIC	Water	573
TAP	TOTAL MERCURY	Fish Tissue	25
TAP	ORGANIC	Fish Tissue	275

Nutrient: Ammonia, Total Kjeldahl Nitrogen, Nitrate + Nitrite, Nitrate, Nitrite, Total Nitrogen (TN), Orthophosphate, Total Phosphate (TP)

Organic: Herbicides and pesticides

Metals/Cations: Calcium, Iron, Magnesium, Potassium, Sodium

Physical: Bulk Density, Color, Soil moisture calculation, Total Suspended Solids, Turbidity

General Chemistry: Alkalinity, Dissolved Organic Carbon, Inorganic Carbon, Organic Carbon, Total Carbon, Chloride, Sulfate, Total Sulfur, Hardness

In addition to internal data validation conducted by the laboratories, all data collected were also subjected to a Level 2 validation by the SFWMD's Data Validation Unit. Level 2 validation includes verification of login information and presence of all parameters requested, plus additional review of field QCs, method detection limits (MDLs), practical quantitation limits, and dilutions. Data not meeting certain criteria are qualified in accordance with rules set in the SFWMD FSQM, the SFWMD Chemistry Laboratory Quality Manual and SFWMD Analytical Services Section SOPs. The data qualifier definitions table is included in **Table 7-3**. Although data qualification is not a direct reflection the overall quality of the data or the laboratories that provided the data, an analysis of data qualification can be used as an indicator of possible quality system issues and as a guide to corrective actions.

Table 7-3. Data Qualifier Codes and Corresponding Qualifier Comments. [a]

Code	Comments
A	Value reported is the arithmetic mean (average) of two or more determinations. This code shall be used if the results of two or more discrete and separate samples are averaged. These samples shall have been processed and analyzed (e.g., laboratory replicate samples, field duplicates, etc.) independently. Do not use this code if the data are the result of replicate analysis on the same sample aliquot, extract, or digestate. Under most conditions, replicate values shall be reported as individual analyses.
I[b]	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
G	A "G"-qualified sample value indicates that the analyte was detected at or above the method detection limit in both the sample and the associated field blank, equipment blank, or trip blank, and the blank value was greater than 10% of the associated sample value.
L	Off-scale high. Actual value is known to be greater than value given.
J	Estimated value; value may not be accurate. This code shall be used in the following instances: 1. Surrogate recovery limits have been exceeded; 2. No known quality control criteria exist for the component; 3. The reported value failed to meet the established quality control criteria for either precision or accuracy; 4. The sample matrix interfered with the ability to make any accurate determination; or 5. The data are questionable because of improper laboratory or field protocols (e.g., composite sample was collected instead of a grab sample). 6. The field calibration verification did not meet calibration acceptance criteria. 7. Any field blank presents contamination. Note: "J" value shall not be used if another code applies (e.g., K, L, M, T, V, Y, I).
M	When reporting chemical analyses: presence of material is verified but not quantified: the actual value is less than the value given.
N	Presumptive evidence of presence of material.
PMR	Project manager remarks
Q	Sample held beyond the acceptable holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

Code	Comments
U[b]	Indicates that the compound was analyzed for, but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported.
Y	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.
?	Data are rejected and should not be used. Some or all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.

[a]This table is derived from the QA Rule and edited to describe only the applicable qualifiers identified in the data set for the QAR. The table also includes the PMR (a remark code), which is described in the SFWMD SOP Data Validation and Stewardship 002 (DVS-002) for Validation of Internal Laboratory Data

[b]I and U qualifiers are not process-related and should be excluded from tallied results.

Of the 8,572 total data records, 49% were not qualified.[7] Another additional 48% were qualified only with a "U" (indicating a value below the method detection limit), or "I" only (indicating a value between the method detection limit and quantification limit). These are qualifiers applied for issues not related to quality of the measurement. Nearly 3% of the total data were assigned other data qualifiers which may indicate issues related to quality of the measurement. **Table 7-4** lists the data qualifiers by project and test analysis category. The areas with the highest level of qualification (other than U or I) per category were methylmercury (11%) for project PSRP, Biological (8%) for project BBCW, Organic for project PSRP (7%) and PEST (5%), and Nutrient for project BBCW (5%) and project PSRP (4%).

For District projects BBCW and PSRP, most of the qualifiers were applied to the Nutrient category due to an analyte which was detected at or above the method detection limit in both the sample and the associated field blank or equipment blank, and the blank value was greater than 10% of the associated sample value and "G" qualifiers were assigned for this issue.

Biological samples were only analyzed for District project BBCW. Majority (93%) of the other than "U" or "I" qualifiers were assigned with "J" qualifiers to the Biological category due to either laboratory accuracy or precision criteria not met, or improper laboratory or field protocol used.

Organic samples were analyzed for District projects PEST and PSRP. Most "J" qualifiers for the Organic category were due to laboratory accuracy or precision QC failures.

Methylmercury samples were only analyzed for District project PSRP. All "J" qualifiers were applied to the Methylmercury category data due to field duplicate QC criterion failures.

[7] Project manager remark (PMR) qualifiers were removed from analysis.

Table 7-4. Total Number of Data Qualifiers by Project and Test Analysis Category.

Project Code	Category	Total Records	Data Qualifier (Other than U or I)	Count of Data Qualifier	Total (Other than U or I)	% Qualified per Category
BBCW	Physical	510	Q	2	4	0.8
			U,Q	2		
	Biological	510	J	22	43	8.4
			I,J	2		
			U,J	16		
			U,V	1		
			V	2		
	General Chemistry	6		0	0	0.0
	Nutrient	1,163	G	52	60	5.2
			Q	6		
			U,Q	2		
	Total Mercury	6		0	0	0.0
DPM	Physical	24		0	0	0.0
	General Chemistry	50		0	0	0.0
	Nutrient	270	?	1	5	1.9
			G	4		
	Metals / Cations	52		0	0	0.0
PEST	General Chemistry	12		0	0	0.0
	Organic	769	I,N	1	41	5.3
			J	1		
			U,J	39		
PIE	Physical	468	G	2	4	0.9
			I,Q	1		
			U,Q	1		
	General Chemistry	620		0	0	0.0
	Nutrients	1,997	G	26	42	2.1
			I,G	11		
			I,J	1		
			U,J	4		

Project Code	Category	Total Records	Data Qualifier (Other than U or I)	Count of Data Qualifier	Total (Other than U or I)	% Qualified per Category
	Metals/Cations	1,096	-	0	0	0.0
PSRP	Physical	133		0	0	0.0
	Organic	420	J	2	28	6.7
			U,J	26		
	General Chemistry	66		0	0	0.0
	Nutrient	264	G	11	11	4.2
	Total Mercury	91		0	0	0.0
	Methylmercury	45	J	5	5	11.1

Nutrient: Ammonia, Total Kjeldahl Nitrogen, Nitrate + Nitrite, Nitrate, Nitrite, Total Nitrogen, Orthophosphate, Total Phosphate

Organic: Herbicides and pesticides

Metals/Cations: Calcium, Iron, Magnesium, Potassium, Sodium

Physical: Bulk Density, Color, Soil moisture calculation, Total Suspended Solids, Turbidity

General Chemistry: Alkalinity, Dissolved Organic Carbon, Inorganic Carbon, Organic Carbon, Total Carbon, Chloride, Sulfate, Total Sulfur, Hardness

Biological: Chlorophyll-a, Chlorophyll-b, Pheophytin-a

7.2 CERP Field Test Monitoring Data Quality and Field QC Data in SFWMD Database

As stated at the beginning of Section 7, the QAOT compiled analytical laboratory data for CERP projects in the SFWMD DBHYDRO database and conducted a review of data qualifiers assigned during data validation to ascertain potential data quality issues. The District projects included in this evaluation are Decompartmentalization Physical Model (DPM), Biscayne Bay Coastal Wetlands (BBCW), Picayune Strand Restoration Project (PSRP) and selected stations from Everglades National Park Inflows East (PIE) and Pesticide Monitoring (PEST). [8]

[8] Data for District project PIE includes five stations (AJC1, FPDAH1, S177, S200, and S332DX) and PEST includes one station (S177). All data for station FPDAH1 were No Bottles and not included in calculations. All data for District projects PIE and PEST presented in this report are associated with the CERP C-111 Spreader Canal Phase 1 (Western Features) project.

7.2.1 CERP Field Test Monitoring Data Quality

The District projects included in the field test monitoring data evaluation for this QAR are DPM, BBCW, PSRP and selected stations of PIE as defined earlier. The CERP field test monitoring data for Water Years 2017 and 2018 were downloaded from the SFWMD's corporate database DBHYDRO on July 26, 2018.[9] A total of 3,768 field test data[10] were measured at 19 stations for the four District projects. District project BBCW (1,485 records) was the largest data set, followed by PIE (1,440 records), PSRP (587 records), and DPM (256 records). Approximately 87% of the data were analyzed for standard environmental field test parameters including Temperature, Specific Conductance, pH, Dissolved Oxygen, and Salinity, 8% were for Total Depth and Secchi Disk Depth, and 5% for Other parameters with biological metadata including Gender, Species, Tissue Type, and Total Length (**Figure 7-2**).

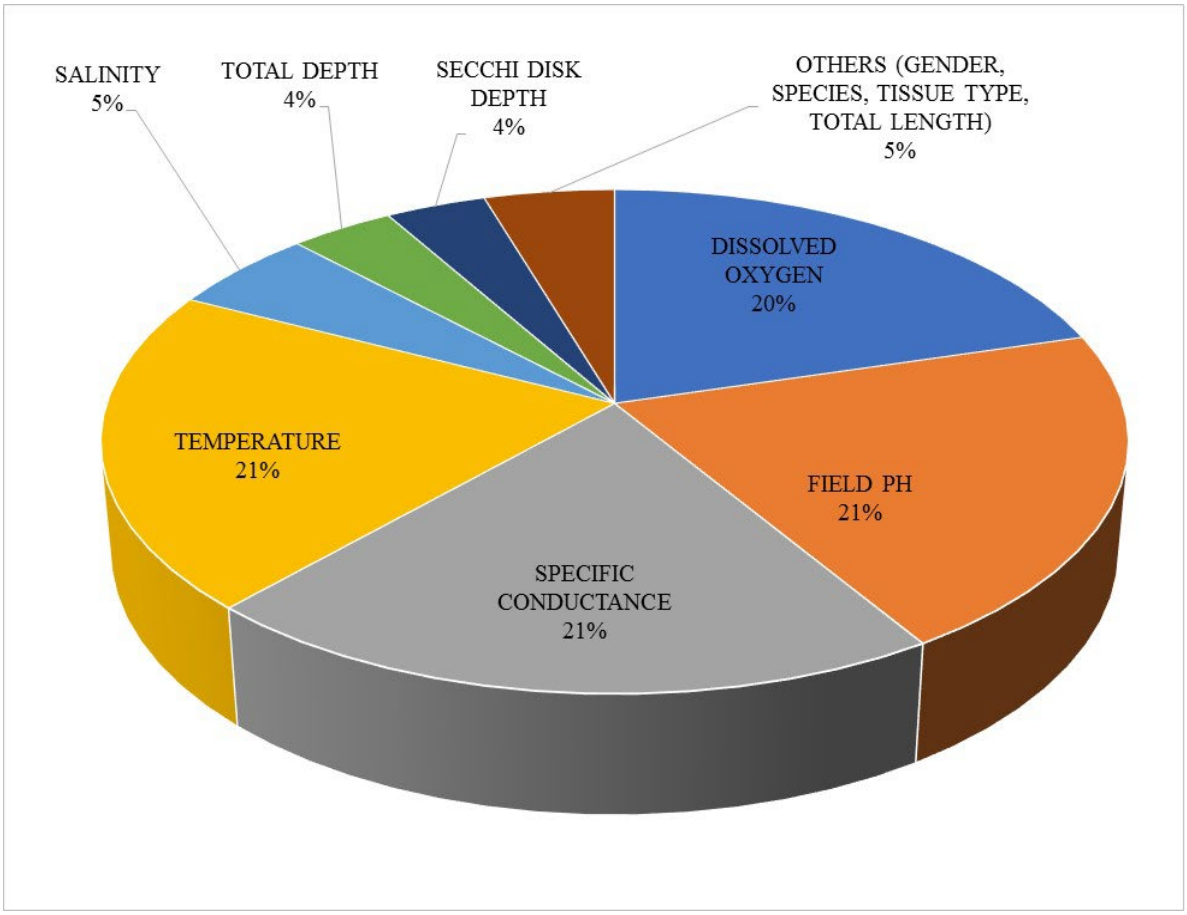

Figure 7-2. CERP WY 2017 and 2018 Field Test Monitoring Data According to Analysis Category.

[9] The analysis contained herein reflects the status of the data at the time the data were downloaded and does not account for changes made to the data after July 26, 2018.

[10] Data set includes field test results, depth and biological metadata. Chemistry laboratory data and no bottle records (sampling attempted but no sample collected) were not included in this section.

A total of 12 different field test monitoring parameters were evaluated for this report. **Table 7-5** shows the distribution of field test monitoring parameters by project and category. Field pH (21%), Specific Conductance (21%), Temperature (21%), and Dissolved Oxygen (20%) were the largest categories and analyzed for all District projects. Salinity, Secchi Disk Depth, and majority of the Total Depth data were only tested for District project BBCW. Biological metadata parameters included in the "Others" category, were analyzed only for District project PSRP. Field test monitoring data qualifier codes are summarized in **Table 7-6.**

Table 7-5. Field Test Monitoring Data Distribution by Project and Analysis Category.

Project Code	Dissolved Oxygen	Field pH	Specific Conductance	Temperature	Salinity	Secchi Disk Depth	Total Depth	Others	Total	% All Records
BBCW	242	248	248	248	202	138	142	17	1,485	39.4
DPM	64	64	64	64					256	6.8
PIE	360	360	360	360					1,440	38.2
PSRP	106	106	106	106			1	162	587	15.6
Total	772	778	778	778	202	138	143	179	3,768	100.0
% All Records	20.5	20.6	20.6	20.6	5.4	3.7	3.8	4.8	100.0	

Others: Biological metadata parameters including Gender, Species, Tissue type, and Total length.

Table 7-6. Field Test Monitoring Data Qualifier Codes and Corresponding Qualifier Comments.

Code	Comments
J	Estimated value. A "J" – qualified sample value shall be accompanied by a detailed explanation to justify the reason(s) for designating the value as estimated. This code is used in the following instances: 1. The data are questionable because of improper laboratory or field protocols. 2. Field instrument calibrations or calibration verifications did not meet calibration acceptance criteria, including quantitative or chronological bracketing requirements for field testing.
PMR	Project manager remarks.
S	Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.

Of the 3,768 total field test monitoring data records, 96.9% were not qualified.[11] Nearly 3.1% of the total data were assigned either a "J" or an "S" data qualifiers; a "J" qualifier may indicate issues related to quality of the measurement. The areas with the highest level of qualification per category were Secchi Disk Depth (80%), and Dissolved Oxygen (3.1%). The 'S' qualifier for Secchi Disk Depth indicates that the disk was visible on the bottom of the water body at that station. While this means the true Secchi disk depth could not be measured, this is an indication of good water clarity because the light was reaching the bottom.

Table 7-7 lists the field test monitoring data qualifiers by project and test analysis category. For District project BBCW, the high qualification of the Secchi disk depth data was due to the 'S' qualifiers. For District project DPM, only two Dissolved Oxygen data were qualified with 'J' qualifier due to continuous calibration verification QC (i.e., precision or accuracy) criterion failure.

All other categories had a less than 2% data qualification for qualifiers other than "PMR." The 2% limit is a "best practice" benchmark. Some analyses or field test data have higher percentages of qualified data (e.g., DO) due to the nature of the test or sample collection or analysis procedures.

Table 7-7. Total Number of Field Test Monitoring Data Qualifiers by Project and Analysis Category.

Project Code	Category	Total Records	Data Qualifier *	Count of Data Qualifier	% Qualified per Category
BBCW	Secchi Disk Depth	138	S	111	80.4
DPM	Dissolved Oxygen	64	J	2	3.1
	Specific Conductance	64	J	1	1.6
PIE	Temperature	360	J	4	1.1

* S qualifier on Secchi depth indicates clarity which is not a quality system issue; J qualifier on Temperature data (PIE) and DO and Specific Conductance (DPM) refers to calibration issues.

7.2.2 CERP Field QC Data in SFWMD Database

The CERP monitoring data for Water Years 2017 and 2018 were downloaded from the SFWMD's corporate database DBHYDRO on August 7, 2018, as specified in subsection 7.1.

Field QC blanks are assessed against the requirements of the QA Rule where the qualification of data is required based on the QC blank passing if the value is less than the MDL. Field QC blanks that are equal to or greater than the MDL for that specific analysis are identified as a failure of the QC blank criterion. Samples associated with the QC blank (collected on the same day and sampling trip) that are less than ten times the failed blank value are qualified with a 'G' qualifier. Blanks that fail the criterion are not qualified with a "G" qualifier.

Of the 8,752 data records 75% (6,431) were samples while the remaining 25% (2141) were QC samples. Of the 2,141 QC samples 1,532 (71.6%) were FCEBs, 173 (8.1%) were equipment blanks (EBs), 98 (4.6%)

[11] Project manager remark (PMR) qualifiers were removed from analysis.

were field blanks (FBs), 326 (15.2%) were replicate samples (RSs), and 12 (0.6%) were Field Duplicates (FDs). Results are presented in **Figure 7-3** and **Table 7-8**.

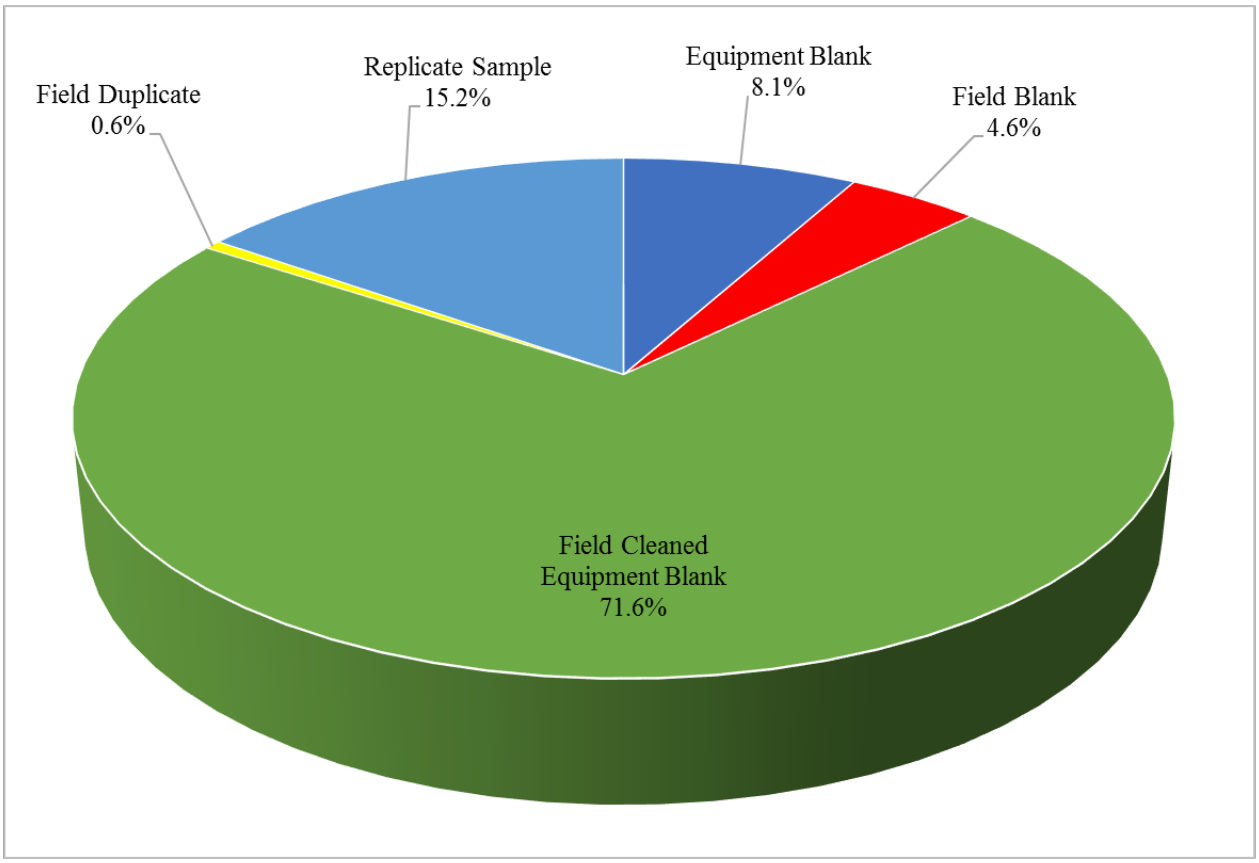

Figure 7-3. Field QC Samples Associated with CERP WYs 2017 and 2018 Water Quality Data.

Table 7-8. Summary of Field QC Samples Failed QC Criteria.

Field QC Sample Category		Count of Field QC Records	Count of Field QC Failed QC Criteria	% of QC Field Failed QC Criteria
Field Blanks	Equipment Blank	173	11	6%
	Field Blank	98	0	0%
	Field Cleaned Equipment Blank	1,532	34	2%
	TOTAL	1,803	45	2%
Other Field QC Samples	Field Duplicate	12	2	17%
	Replicate Sample	326	10	3%
	TOTAL	338	12	4%

For the 12 field duplicates collected only 2 values resulted in qualification of 4 samples (J qualifier), 2 each for cis-Nonachlor and trans-Nonachlor on the same sampling event under project PSRP. However, review of the laboratory comments shows that this was not a field issue, but rather a matrix spike recovery issue.

For the 326 RSs, 10 replicates (5 events) were of concern. One of these was for pheophytin A under project BBCW. The other 4 events were under project PSRP and included 2 for MeHg, 1 for chlordane, and 1 for p,p'-DDE in fish tissue.

Of the 1,803 QC blanks, 45 failed the QC blank criterion. No FBs failed but 11 EBs and 34 FCEBs were equal to or greater than the MDL (**Table 7-9**).

Review of the records provided for DPM identified nitrate as having 16 FCEB records, 2 of which were qualified but nitrate is not monitored for the DPM project, so these records were discounted. Otherwise, for project DPM there was 1 out of 31 EBs for TP that failed and 3 out of 10 FCEBs that failed for NOx.

For project PSRP, 1 out of 16 FCEBs for sulfate failed, and 1 out of 8 EBs for TN failed. For TP, 1 out of 18 FCEBs and 4 out of 8 EBs failed.

For project BBCW the 2 FCEBs for ammonia, 2 for NOx, 1 for chlorophyll A and 6 for TP out of 47 each failed. TP was also found in 1 out of 6 EBs. Chlorophyll-a was also found in 1 of 6 EBs.

Under project PIE, out of 3 EBs each 1 for NH_4, 1 for Cl, and 1 for SO_4 failed. Out of 38 FCEBs 2 failed for Ammonia. Out of 69 FCEBs, calcium was detected once, chloride 3 times, NOx 4 times, and both orthophosphate and TP twice.

All projects combined showed a blank failure rate of 6.3% for EBs and 2.2% for FCEBs. These blank issues combined with the duplicate and replicate failures resulted in 163 sample data being qualified representing approximately 1.9% of the 8,483 data points.

7.3 Hydrology Data Quality

An assessment of hydrologic data in DBHYDRO was conducted for the period of WY 2017 and WY 2018 (from May 1, 2016 to April 30, 2018). Due to the interrelated nature of hydrological field data collected at all sites throughout south Florida, it is not feasible or technically reasonable to evaluate the quality of hydrological field data that are specifically collected for, or that may be used for CERP. Therefore, all data in DBHYDRO were evaluated as an indicator of the quality of hydrometeorologic field data collected for CERP projects. Thirteen data types were reviewed (**Table 7-9**). For each data type, the daily values data set was assessed to identify the number of missing, estimated, and not processed values vs. the total number of records in the data set. Data quality tags are assigned to these data in the database to indicate that the data should be used with caution.

Table 7-9. Summary of Hydrologic Data Qualifiers for Water Year 2017 and Water Year 2018.

Data Type[a]	Number of Records	Number Missing	Percent Missing	Number Estimated	Percent Estimated	Number Not Processed	Percent Not Processed
Water Year 2017							
BARO	11,930	307	2.57%	158	1.32%	0	0.00%
ETPI	7,902	344	4.35%	30	0.38%	0	0.00%
EVAP	1,398	459	32.83%	0	0.00%	0	0.00%
FLOW	487,368	72,251	14.82%	50,108	10.28%	813	0.17%
HUMI	8,645	338	3.91%	74	0.86%	0	0.00%
RADN	5,824	354	6.08%	8	0.14%	6	0.10%
RADP	8,104	696	8.59%	288	3.55%	12	0.15%
RADT	7,904	591	7.48%	46	0.58%	0	0.00%
RAIN	101,083	1,365	1.35%	600	0.59%	298	0.29%
STG	387,154	7,033	1.82%	23,222	6.00%	728	0.19%
WELL	164,581	5,523	3.36%	42,648	25.91%	176	0.11%
WNDG	365	5	1.37%	0	0.00%	0	0.00%
WNDS	9,226	429	4.65%	12	0.13%	0	0.00%
2017 Total	**1,201,484**	**89,695**	**7.47%**	**117,194**	**9.75%**	**2,033**	**0.17%**
Water Year 2018							
BARO	11,562	245	2.12%	466	4.03%	0	0.00%
ETPI	7,456	407	5.46%	5	0.07%	0	0.00%
EVAP	1,092	493	45.15%	2	0.18%	2	0.18%
FLOW	467,027	80,662	17.27%	55,382	11.86%	223	0.05%
HUMI	8,187	265	3.24%	43	0.53%	0	0.00%
RADN	5,632	212	3.76%	21	0.37%	0	0.00%
RADP	7,457	431	5.78%	10	0.13%	0	0.00%
RADT	7,457	259	3.47%	15	0.20%	0	0.00%
RAIN	98,890	1,360	1.38%	1,064	1.08%	0	0.00%
STG	372,728	8,101	2.17%	26,763	7.18%	487	0.13%
WELL	156,764	6,575	4.19%	41,747	26.63%	28	0.02%
WNDG	365	155	42.47%	0	0.00%	0	0.00%
WNDS	8,552	526	6.15%	1	0.01%	0	0.00%
2018 Total	**1,153,169**	**99,691**	**8.64%**	**125,519**	**10.88%**	**740**	**0.06%**

[a] BARO (Barometric Pressure [mm Hg]); ETPI (Evaporation Potential, Computed [inches]); EVAP (Evaporation Pan, Measured [inches]); FLOW (Flow [cfs]); HUMI (Relative Humidity [%]); RADN (Net Radiation [kilowatt/M^2]); RADP (Photosynthetic Radiation [micromole/M^2/S]); RADT (Total Solar Radiation [kilowatt/M^2]); RAIN (Rainfall [inches]); STG (Water Level, NGVD29 [ft NGVD29]); WELL (Ground Water Level [ft NGVD29]); WNDG (Wind Gust [MPH]); WNDS (Wind Speed, Scalar [MPH])

The WY 2017 dataset contained 1,201,484 records and the WY 2018 dataset contains 1,153,169 records. The results of the analyses are presented in **Table 7-10.** Comparison of Hydrologic Data Qualifiers for Water Year 2011 through Water Year 2018. Analysis revealed that for both years:

- Measured evaporation data sets contained the largest "percent (%) missing" data (32.8% and 45.2%). For all data types, the overall "% missing" was 8.0% for the two years' data combined.
- Ground water level data sets contained the largest "% estimated" data (approximately 25.9% and 26.6%). For all data types, the overall percent estimated was 10.3% for the two years' data combined.
- "Percent not processed" was 0.1% for all data types considered together.

Table 7-10. Comparison of Hydrologic Data Qualifiers for Water Year 2011 through Water Year 2018.

Water Year	Number of Records	Number Missing	Percent Missing	Number Estimated	Percent Estimated	Number Not Processed	Percent Not Processed
2011 Total	1,060,814	24,100	2.27%	95,851	9.04%	4,396	0.41%
2012 Total	1,010,851	18,445	1.82%	91,971	9.10%	5,467	0.54%
2013 Total	960,213	32,859	3.42%	89,806	9.35%	9,326	0.97%
2014 Total	944,587	20,008	2.12%	79,505	8.42%	7,611	0.81%
2015 Total	1,094,146	34,375	3.14%	107,026	9.78%	52,434	4.79%
2016 Total	1,213,657	70,450	5.80%	126,131	10.39%	23,838	1.96%
2017 Total	1,201,484	89,695	7.47%	117,194	9.75%	2,033	0.17%
2018 Total	1,153,169	99,691	8.64%	125,519	10.88%	740	0.06%

The SFWMD is continuing to implement process improvements to enhance operational efficiency. These differing percentages (increase in "% missing" and decrease in "% not processed") appear to be related to changes which took place in the new data processing techniques at the SFWMD. For FLOW data, "% missing" had increased from 6.5% to 11.1% from WY2015 to WY2016 and was related to the sub-minute data processing, which greatly increased the number of data points to be processed and at the same time populated more "missing" tags to flow data (which was a composite quantity of stage and operations). If any data point during the day was missing, the daily mean as an aggregate would be missing. Further for FLOW data from WY 2017 to WY 2018, "% missing" has increased from 14.8% to 17.3%. This is related to the single time series data generation, which is in a transition period of leaving much data unpopulated. Because of this, "% missing" for all data types from WY 2017 to WY 2018 was between 7.5% to 8.6% higher than previous years. Since the District is now improving the single time series generation, the occurrence of missing data will decrease over time.

7.4 Continuous Water Quality Monitoring Data (PSRP)

There were 18 active stations with continuous monitoring of water quality for the Picayune Strand Restoration Project during WYs 2017 and 2018. The water quality parameters monitored were temperature, salinity, and conductivity. The analysis, validation, and loading to DBHYDRO of these data are performed using graphical verification analysis software in accordance with processes detailed in the SFWMD's

Analytical Services Section Data Validation and Stewardship (DVS) SOP (SFWMD-DVS-SOP-003). Approximately 1.25 million data points were validated for WY 2017 and WY 2018. A total of 32,891 data points were missing (2.6% of possible data) due to equipment malfunctions, telemetry issues, or due to flat lined data because of dry conditions. A total of 74,614 data points (6.0% of validated data points) were qualified as estimated (assigned a 'J' qualifier due to one or more deviations from QC requirements) and 1.6% (20,170 data points) were determined as unusable (assigned the '?' qualifier) due to erratic data because of dry conditions, instrument failure, or a significant deviation from QC requirements. Data are summarized in **Table 7-11**.

Table 7-11. Summary of Water Quality-Related Qualifiers from Picayune Strand.

Water Year	Total Number of Data	Number of Quality Related Qualifiers	Missing, Estimated, and Rejected Data			Percent Samples with Quality Related Qualifiers
			Missing	Estimated	Rejected	
2013/2014	1,239,602	454,732	13,171	436,806	17,926	36.7
2015/2016	1,246,708	19,959	22,266	15,042	4,917	1.6
2017/2018	1,244,055	94,784	32,891	74,614	20,170	7.6

8 ALTERNATIVE PROCEDURES APPROVED

This section identifies any alternative procedures approved during the previous two years. Between May 1, 2016 and April 30, 2018, no applications for approval of alternative procedures were submitted to the QAOT.

9 SUMMARY OF DEVIATIONS FROM QASR AND CORRECTIVE ACTIONS

This section summarizes any deviations from the QASR or CGMs during the reporting period and any corrective action taken to address the immediate deviation and to avoid re-occurrence.

Section 5 (Evaluation of Field Monitoring) and Section 6 (Laboratory Assessments) contain deficiencies and observations from SOPs, methods and other documentation noted by QAOT members during on-site assessments. Both the sample collection teams and the laboratories submitted corrective action plans (CAPs) that were accepted by the QAOT. These CAPs contain details that document changes to processes to enhance assurance that high quality data is being produced for CERP projects.

10 ADDITIONAL QAOT ACTIVITIES

10.1 Communication and Outreach

Throughout the reporting period, the QAOT presented periodic status reports to the DCT and continued communication efforts with the Project Delivery Teams (PDTs). The QAOT web page on the Everglades Restoration website (https://evergladesrestoration.gov/qaot/) was updated to communicate workshops, presentations, and revised documents. The QAOT hosted the seventh annual Quality Assurance Workshop in February 2018 at the USACE Jacksonville District office building. Nineteen SFWMD and USACE employees participated in the training. The QAOT is providing input to PDTs to help SFWMD PMs take a more active role in contractor – laboratory interface. The SFWMD now has a better understanding of QA Rule in Chapter 62-160, Frequently Asked Questions regarding district projects. QAOT members from SFWMD, USACE and FDEP worked closely to adopt verbiage regarding laboratory certification for QASR Chapter 4 (Chemical Analysis).

10.2 QAOT Collaboration with other CERP Entities

It is critical that QAOT members collaborate with other entities to ensure QA/QC measures for CERP are being successfully implemented at both the Program and Project levels. These activities included participation by PDTs in QAOT meetings, presenting relevant QA/QC topics at symposia, and training those who are actively involved with CERP. The QAOT/Information and Data Management (IDM)/RECOVER is improving dialogue resulting in added success of projects. RECOVER data is now part of the QAR. Some of these activities are formally included in this report; however, since the QAOT members are actively involved in multiple non-QAOT-related projects, some QA review by the QAOT members merges with other workload duties and is not captured here. The following lists some of the collaboration documented during this time period.

10.2.1 QAOT/IDM/RECOVER

During this reporting period, the QAOT/IDM/RECOVER teams have improved dialogue opening the doors for better cooperation on CERP projects. The teams are actively developing flowcharts which detail interactions between the three entities that will help to ensure success of their projects. RECOVER data summary is now part of the QAR. See subsection 5.4 for further details.

10.2.2 QAOT Meetings

The CERP Project Listing sheet, a living document, was updated and will be used to alert the QAOT to when field, lab, or other assessments/reviews are necessary. RECOVER presented their interaction during project implementation to the team at the May 18, 2016 QAOT meeting. Due to the presentation given by FDEP at the October 19, 2016 meeting, the QAOT became actively involved in understanding the QA Rule (Chapter 62-160) and informing PDTs how to implement those requirements.

10.3 Status of QAOT Action Items

Quality assurance includes the concept of continuous improvement. The areas targeted for improvement were identified in subsection 10.3 (Status of QAOT Action Items) and Section 11 (Recommendations for QA/QC Program Improvements) of the 2016 QAR. **Table 10-1** summarizes the status of QAOT Action Items.

Table 10-1. Status of QAOT Action Items.

Improvement Area	QAOT Initiatives	Status
1. QAOT Metrics (QAR2014 – Table 10-1) The QAOT should develop metrics that measure whether or not the QAOT has been effective in improving the data generated for CERP.	The Program Management Plan will establish metrics to assess QAOT effectiveness with documentation provided in the QAR.	In Progress; see QAR2012, QAR2014 and QAR2016. Indirect measurements through field and lab audits cannot be quantified. This is an ongoing effort. This item will be deleted in QAR 2020.
2. Biological Field Evaluation with SOP (QAR2014 - Table 11-1) A process to evaluate biological field activities against standardized SOPs from QASR Chapter 8.	Develop a checklist to be used for biological field activities to determine compliance with QASR Chapter 8.	The task item is on hold and may be reevaluated in the next reporting period. The upcoming RECOVER re-evaluation process provides an opportunity to assure the application of QA principles to biological programs.
3. Project Status Listing (QAR2016 - Table 11-1) A process to ensure the QAOT is aware of when sampling events are occurring.	Develop a spreadsheet that will be distributed to PDTs that will be updated to ensure QAOT performs field and laboratory assessments.	Complete. Agenda item for each QAOT meeting.
4. QAOT/IDM Flowchart (QAR2016 – Table 11-1) A process to ensure Project Managers are aware of when QAOT involvement is required.	Develop a flowchart that encourages PMs to use the QAOT to ensure continued success of their projects. Distribute to PMs through outreach workshops.	In Progress. Draft developed by the respective agency co-chairs, flowchart/checklist will be distributed to appropriate PMs/Principal Investigators.
5. Laboratory Selection Process (QAR2016 - Table 11-1) A process to select a laboratory for analytes where NELAP certification is not possible.	Update QASR Chapter 4 that will document the QAOT procedure to ensure data for CERP can be used when NELAP certification is not possible.	Complete. QASR manual chapter 4 has been updated by FDEP to ensure QA Rule 62-160 and policies are being followed.

11 RECOMMENDATIONS FOR QA/QC PROGRAM IMPROVEMENTS

This section summarizes recommendations resulting from QAOT assessments that could improve CERP QA/QC processes and procedures. As discussed throughout this report, success in implementing the CERP QA/QC program is essential to ensure that CERP data are of consistent high quality, accurate, traceable, comparable, and legally defensible. Section 10 defines several recommendations identified during that past QAR cycles that are still in progress or have been completed. During the current reporting period, three specific recommendations for improvement were identified. These recommendations are summarized in **Table 11-1**.

Table 11-1. New Areas of Improvement Identified during the Reporting Period.

Improvement Area	Proposed QAOT Initiatives
Item #1 A process is needed to assess RECOVER monitoring activities from a QA standpoint and incorporate findings into the QAR.	RECOVER has developed a five-year plan (2017-2021) to help prioritize and focus its efforts during that time period. One of the focus areas will be to evaluate the current Monitoring and Assessment Plan (MAP) and provide recommendations for a revision. During this revision all project monitoring will also be evaluated to ensure that it is of consistent high quality and that traceable and quantifiable quality assurances are built in to every project across the system.
Item #2 DQOs are needed to assess the relevance of % qualifiers for various parameters**.**	The QAOT will consider developing a process to determine data quality objectives for CERP Program data, which include criteria on the percentage of data qualified by process related qualifiers, which will trigger a quality assurance investigation. The QAOT will determine a process for the investigation including identification of affected projects, appropriate notifications, Project Manager coordination, root cause analysis and/or triggers for field or laboratory audits. (This is a long-term endeavor.)
Item #3 Biological metadata may not be appropriate for inclusion in the QAR.	Evaluate the need to include biological metadata in future QARs (see **Figure 7-2**, subsection 7.2.1).

12 RESOURCE NEEDS

12.1 Management Support from CERP and Participating Agencies

The QAOT was able to achieve several breakthrough accomplishments during the reporting period. The QAOT acknowledges the continual participation, direction, and support from CERP management, as well as the support and cooperation from all participating agencies, especially:

- FDEP
- SFWMD
- USACE
- USEPA*
- U.S. Fish and Wildlife Service*
- U.S. Geological Survey*

**Participation has been limited due to limitation of funding at their agency levels for QAOT involvement*.

Continuous support from CERP management and participating agencies is the key for the continued success of the QAOT. The QAOT cannot function effectively without this essential management support. Thus, continued management support for outreach of QAOT with PDTs, PMs, and module leads is needed.

12.2 Financial Support for QA/QC Activities

Additional QAOT activities such as training workshops, laboratory audits, and QAR assistance are essential in sustaining the excellence of the quality system for CERP monitoring. The current budget from both SFWMD and USACE, however, is very limited and is only available to these two agencies. The QAOT has started to hold meetings quarterly (as opposed to every other month as had been done in the past); target the scope of field and laboratory audits, limit the frequency of laboratory PE studies, and postpone field audits for biological and ecological monitoring activities for CERP projects due to the current budget constraints.

13 REFERENCES

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Attachment A
QAOT Workshop Presentations
February 15, 2018

The QAOT and How We Can Assist You: The QAOT is authorized by CGM 041.01 to provide quality assurance (QA) guidance at the program level to ensure data quality. QASR manual for chapter 3 (water quality sampling procedures), chapter 4 (chemical analysis), chapter 5 (verification and validation of analytical chemistry data) and chapter 10 (information and data management) provide the backbone for CERP QA practices.

The QAOT and Project Delivery Team/Recover Team Responsibilities for Quality Assurance of Monitoring Activities: Created to document responsibilities among the QAOT, project delivery team and Recover by working closely with all entities ensuring project objectives are achieved. Improved communication regarding guidance, monitoring plans and contracts preparation, reviews and awards, and monitoring of data are clearly spelled out for the planning, design/construction and operations/maintenance phases of a project.

The QAOT Review and Audit Processes: Field sampling audits and laboratory assessments by the QAOT should occur shortly after project initiation to catch errors as quickly as possible. Analytical chemistry data is delivered to the PDT in an electronic format and is checked for compliance by using the Microsoft Access software ADaPT. Once the validated data has been approved, it should be sent to the SFWMD for uploading into DBHYDRO for archiving.

Monitoring Plans and Scopes of Work Review Process: CGM 040.02 provides guidance to the PDT on how to address and incorporate monitoring and assessment activities in planning, design, and implementation documents for projects covered under CERP. The PLMP must identify how observation, measurement, sampling, and analysis will be conducted to achieve the Data Quality Objectives. CGM 040.02 contains a template for developing project-level monitoring plans for Hydrometeorologic, Water Quality and Biological/Ecological monitoring. QAOT SOP-004 is the process used by the QAOT when reviewing these plans.

2016 Quality Assessment Report to the Design Coordination Team - Findings: CGM 041 requires the QAOT to provide an assessment of CERP Data Quality through issuance of a biennial Quality Assessment Report spanning consecutive water years. Included in the summary of QAOT activities are CERP projects assessed, outreach, and field and laboratory assessments. The yearly inorganics performance evaluation samples studies evaluation ratings are presented. Evaluation of data stored in DBHYDRO is discussed. QAOT recommendations for improving data quality is also summarized.

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