Comprehensive Everglades Restoration Plan

Quality Assurance Oversight Team

2009 - 2010 Quality Assessment Report

for Water Years

May 1, 2008 – April 30, 2010

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ACRONYMS AND ABBREVIATIONS

ACRA	Allapattah Complex Restoration Area
ADaPT	Automated Data Processing Tool
AT	Assessment Team
BBCW	Biscayne Bay Coastal Wetlands
BHC	Benzene Hexachloride
BRL	Brooks Rand Laboratories
C-111 SC	C-111 Spreader Canal
CCPC	Collier County Pollution Control & Prevention Laboratory
CCV	Continuing calibration verification
CERP	Comprehensive Everglades Restoration Plan
CGM	CERP Guidance Memorandum
CID	CERP Integrated Database
DASR	Data Access Storage and Retrieval
DBCP	1,2-Dibromo-3-chloropropane
DBE	1,2-Dibromoethane
DBHYDRO	District (SFWMD) Corporate Environmental Database
DCT	Design Coordination Team
DERM	Miami-Dade Department of Environmental Resources Management
DFTPP	Decafluorotriphenylphosphine
EDD	Electronic Data Deliverable
EDMS	Environmental Database Management System
EGRET	EverGlades Restoration [data] Extraction Tool
EMCT	Everglades Monitoring Coordination Team
EPA	U.S. Environmental Protection Agency
EPJV	Everglades Partnership Joint Venture
ERA	Environmental Resources Assessment
ERDC	Engineer Research and Development Center
ETC	Environmental Testing and Consulting, Inc.
F.A.C.	Florida Administrative Code
FAI	Florida Analytical Inc.
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FSES	Florida Spectrum Environmental Services
FY	Fiscal Year
GC	Gas Chromatography
GE	Greater Everglades
GPS	Global Positioning Service
HVAC	Heating, Ventilating, and Air Conditioning

IDC/CDC	Initial demonstration of capability and continuous demonstrations of capability
IDM	Information and Data Management
LCS	Lab Control Sample
LIMS	Laboratory Information Management System
LMP	Laboratory Management Partners, Inc.
MAP	Monitoring and Assessment Plan
MDL	Method Detection Limit
MS	Mass Spectrometry
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NOx	Nitrogen Oxides
PCB	Polychlorinated Biphenyl
PDT	Project Delivery Team
PE	Performance Evaluation
PEM	PE Mixture
PI	Principal Investigator
PLMP	Project Level Monitoring Plan
PM	Project Manager
PrMP	Project Management Plan
PSRP	Picayune Strand Restoration Project
QA/QC	Quality Assurance/Quality Control
QAOT	Quality Assurance Oversight Team
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAR	Quality Assessment Report
QASR	Quality Assurance Systems Requirements
QMP	Quality Management Plan
QTF	Quality Task Force
RECOVER	Restoration Coordination and Verification
R&D	Research and Development
R&R	Repeatability and Reproducibility
SAV	Submerged Aquatic Vegetation
SFWMD	South Florida Water Management District
SOP	Standard Operating Procedure
SOW	Scope of Work
SRS	Standard Reference Sample
STA	Stormwater Treatment Area
TA	TestAmerica
TDQM	Total Data Quality Measurement
TKN	Total Kjeldahl Nitrogen

TOC	Total Organic Carbon
TP	Total Phosphorus
TPRR	Total Phosphorus Round Robin
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WBS	Work Breakdown Structure
WP	Work Plan
WY	Water Year

EXECUTIVE SUMMARY

The scope of this Quality Assurance Oversight Team (QAOT) Quality Assessment Report (QAR) is to describe the quality of the data generated for the Comprehensive Everglades Restoration Plan (CERP) during Water Years (WYs) 2009 and 2010, which is defined as the time period between May 1, 2008 and April 30, 2010, or the reporting period. Data are collected to support various CERP activities including (1) Restoration Coordination and Verification (RECOVER) system-wide monitoring efforts (i.e., Monitoring and Assessment Plan [MAP]), (2) project monitoring, and (3) permit-driven regulatory monitoring. Data from all three are included in the review of the chemical, biological/ecological, and hydro-meteorological data.

The QAOT employed a variety of methods to evaluate the quality assurance/quality control (QA/QC) procedures being implemented for CERP that could impact data quality. These methods include: updates of Standard Operating Procedures (SOPs), the review of one scope of work (SOW) and 10 monitoring plans for CERP projects, on-site laboratory and field audits and/or observations, assessment of field and laboratory water quality data, administration of performance evaluation (PE) samples, and outreach activities. RECOVER Data Management procedures were reviewed during each water year to assess data storage procedures for RECOVER (MAP) data. A QAOT Project Inventory was conducted during each water year to provide the QAOT with project information related to current and future monitoring activities and schedule.

The Quality Assurance System Requirements (QASR) manual provides details of QA/QC program requirements, including establishing data quality objectives and data management. All chapters of the QASR, except Chapters 6 and 8, were revised in early 2009. Chapter 6 – Hydrometeorological and Hydraulic Monitoring – was revised in 2010 and was presented to the Design Coordination Team (DCT) in late 2010. Chapter 8 – Biological Monitoring and Assessment Procedures – is currently being drafted. Appendices to this chapter will include a series of SOPs for various types of biological monitoring and assessment.

In addition to drafting the Program Management Plan (PrMP) for the QAOT for fiscal years (FY) 2011-2015, other reports produced by the QAOT during the reporting period include:

- Picayune Strand Restoration Project (PSRP) Baseline Data Review.
- Data Processing Assessment and Inventory of CERP Hydro-Meteorological Data.
- Quality Assessment of Hydro Meteorological Data.

One on-site field audit for water quality was conducted by the QAOT during the reporting period. Field techniques were determined appropriate for the required data collection except for a significant finding related to poor field procedure that could have led to potential cross-contamination of sampling equipment. An immediate corrective action was requested and implemented.

Meteorological, hydrologic, and hydraulic data acquisition field audits included 15 days of on-site field observation visits conducted by the QAOT. The results from the audits show that the SOPs should continue to be refined with an emphasis on which procedures should be performed during monthly, quarterly, and yearly preventive maintenance trips. The scheduling of the preventive maintenance intervals should be better monitored, better documentation of which procedures are required should be initiated, and more transparent records kept to ensure deadlines are met. A comprehensive calibration

program should be established and an interval of time for replacing calibration sensors should be developed and followed.

Four separate on-site field visits were conducted by the QAOT to observe biological/ecological monitoring activities. These visits will assist in the development of the SOPs which will be included in the appendices of the QASR. The review of documents, records, and field and laboratory procedures confirmed that activities were conducted according to the project requirements and that documentation was acceptable. For one project, the need for an SOP that described wading bird research was identified; development of this SOP was initiated for inclusion in QASR Chapter 8.

The QAOT completed assessments for seven organics laboratories and six inorganics laboratories. Findings in the organics laboratories included method deviations related to method detection limits (MDLs), analytical procedures, and data traceability. Findings in the inorganic laboratories included deviations from method analytical procedures, treatment and acceptance criteria for QC samples, and lack of adequate detail in SOPs. In most cases, corrective actions were undertaken by the laboratories to mitigate the findings. PE samples were provided to six of the seven organics laboratories. Most reported results fell within the control limits, but in some cases the PE results could not be reproduced during the on-site inspection. Two inorganic water PE samples and one inorganic soil PE sample were provided to laboratories performing chemistry analysis for CERP. Overall accuracy ranged from 70% to 100% with the lowest recoveries identified for trace elements.

A snapshot of data potentially relevant to CERP was assessed by determining the prevalence of data qualifiers in the South Florida Water Management District (SFWMD) database DBHYDRO. Data acceptability was based on the results of instrument calibration, QC samples, and the use of proper analytical procedures. Analytical, chemical and classical water quality data records for CERP-related projects indicated that 3.0% of the WY2009 and 2.7% of the WY2010 had qualifiers indicating that data quality was compromised.

Efforts to assess the quality of biological/ecological data focus on evaluating the SOPs currently in use. SOPs present the details of all monitoring components including measureable objectives, sampling design, field methodology, and data analysis. SOPs are currently being developed for submerged aquatic vegetation (SAV), oysters, fish, periphyton, birds, and crocodiles/alligators.

Many QAOT activities, initiatives and outreach activities were undertaken during the period. Routine responsibilities performed by the QAOT for the reporting period included the review of monitoring plans, revision of the QASR and lab evaluations through audits and PEs. QAOT initiatives included the preparation of regular management reports, and the completion of SOPs and field audits. Outreach activities included several workshops and training efforts.

QA is a cycle of planning, activity, lessons learned, and improvement. The QAOT identified several recommendations for improvement during the report period that will be the focus of planning and action during the next reporting period. These recommendations include: early integration of the QAOT into CERP and RECOVER planning; working with CERP and RECOVER to establish a realistic inventory of CERP projects and data; communicating field and laboratory audit findings as lessons learned for other projects; and establishing procedures to assess and define the quality of ecological and biological data.

1.0 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. The Quality Assurance Oversight Team (QAOT) was established by CERP Guidance Memorandum (CGM) 41.00 to *provide guidance on monitoring procedures, quality assurance/quality control (QA/QC) and data validation for CERP projects* and to *be the forum to develop consistency among the various entities involved with environmental monitoring, data quality and QA/QC processes*. The current version of that CGM, version 41.01 (South Florida Water Management District and U.S. Army Corps of Engineers [USACE], 2010), specifies that the lead QAOT agencies will *compile individual QA CERP reports and produce an integrated QA report on CERP projects to CERP management.* This Quality Assessment Report (QAR) had been prepared to meet that mandate.

It is critical that the environmental/ecological monitoring and assessment data generated for the restoration of the Everglades as part of the CERP provide a reliable and defensible basis upon which to formulate appropriate planning decisions because 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 into every aspect of data collection.

The CERP program Quality Assurance Systems Requirements (QASR) manual (http://www.evergladesplan.org/pm/program docs/qasr.cfm) defines protocols and procedures for environmental data gathering activities for the implementation of CERP and defines the quality system developed by CERP to ensure data quality. The QASR establishes fundamental QA/QC procedures that, if implemented, will ensure that 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 Florida Administrative Code (F.A.C.) 62-160 and FDEP-Standard Operating Procedure (SOP)-001/01. The QASR requirements are applicable to all data that will be used for CERP purposes.

The purpose of the QAR is to provide CERP management with an assessment of the state of data quality for CERP. The goals of the QAR are to identify practices that contribute to quality data, to identify data quality problems and best practices, to report on the activities of the QAOT, and to recommend improvements to the quality system. As such, when specific data quality issues are discussed in this report, a less-than-perfect assessment is meant to identify an opportunity for improvement, not failure. 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.[1]

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

This document provides an assessment of CERP data quality and QAOT activities for the period between May 1, 2008 and April 30, 2010, hereafter referred to as the *reporting period*. This is the fourth QAR developed by the QAOT.

2.0 SCOPE AND APPLICATION

The scope of the QAR is to describe the state of data quality being generated for CERP for the reporting period between May 1, 2008 and April 30, 2010. 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 monitoring, and (3) permit-driven regulatory monitoring. The QAOT employed a variety of methods to evaluate the QA/QC procedures being implemented for CERP that might impact data quality.

This report assesses CERP data quality both directly and indirectly. Direct assessments included reviews of field and laboratory QC data, the results of performance evaluation (PE) samples, and reviewing the findings of, recommendations to, and responses from field and laboratory audits. Indirect assessments of data quality were accomplished by reviewing monitoring plans, scopes of work (SOWs), and SOPs. The final QAR represents the combined contributions and suggestions of all reviewers.

3.0 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, plus valuable direction, 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 2010 QAOT Quality Assessment Report

Name of Participant	Organization
Rosanna Buhl	Battelle Memorial Institute (South Florida Water Management District [SFWMD] contractor)
Kenneth Menzies	PEER Consultants (SFWMD contractor)
Jennifer Auger	Everglades Partnership Joint Venture (EPJV) (USACE contractor)
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4.0 CURRENT QA/QC PROCESSES

This section summarizes QAOT activities conducted to assess current QA/QC processes implemented at the program level. During the reporting period, various QA/QC documents were prepared or revised to provide appropriate guidance with respect to field and laboratory SOPs. Reviews of monitoring plans and SOWs were also performed to assess QA/QC processes being implemented for CERP.

4.1 QAOT/CERP Document Updates

The QAOT has developed several SOPs that define QAOT responsibilities and procedures. SOPs ensure that activities are performed consistently and systematically over time. These SOPs are "living documents" that are revised to reflect procedural changes and lessons learned over time. The SOPs discussed below will be revised as needed.

4.1.1 QAOT Standard Operating Procedures

QAOT SOP-001 Format of QAOT SOP Procedures and Document Control Procedures

This SOP outlines the requirements for preparing SOPs used by the QAOT to conduct their activities and requirements for control of all documents. To ensure that the most current document is being used, to have a documented history of drafts and revisions, and to ensure a standard format for all documents, the QAOT developed a document control procedure, and standardized format. This document is an expansion of the original document titled "Document Control", which was finalized in January 2005. This SOP was approved on May 30, 2008.

QAOT SOP-002 Quality Assurance Activities and Responsibilities

This document outlines the QA management activities that must be integrated into all CERP monitoring projects. This document describes the QA responsibilities that QAOT, the Project Managers (PMs) and the QA Officers (QAOs) have during CERP project implementation. This SOP was approved on December 23, 2008.

Although the PM is ultimately responsible for the quality of the project data, the QAOT provides assistance through the QAOs. The QAOs should be involved early in the planning phase of environmental monitoring.

QAOT SOP-003 Preparation of the Quality Assessment Report

This SOP provides guidance for the preparation of the QAR – an integrated QA report on CERP projects to CERP management. This SOP was created and approved as Version 0.1 in December 23, 2008 and subsequently revised (Version 1.0). The purpose of the QAR is to provide to CERP management an assessment of the state of data quality for monitoring activities being conducted for CERP. Input to the QAR is gathered throughout the reporting period either as part of the routine activities of the participating organizations (e.g., audits and data validation) or as specific activities of the QAOT (e.g., monitoring plan reviews and quality system interviews). At the end of the reporting period, the results are compiled, tabulated, analyzed, and summarized in the QAR. The Draft QAR is reviewed by the QAOT, the Revised QAR receives a CERP-wide review, and the Final QAR is delivered to the DCT. This SOP was approved on December 12, 2009.

QAOT SOP-004 Review of Project Monitoring Plans and Scopes of Work

The purpose of this SOP is to establish the procedures for QAOT reviews of CERP Project Level Monitoring Plans (PLMPs) and all SOWs arising from the PLMP. The QAOT reviews the QA/QC elements of PLMPs/SOWs for compliance with the QASR manual. Results of the review are summarized on a checklist and provided to the author of the PLMP/SOW. The PLMP/SOW author responds to the issues identified and revises the PLMP to ensure that it meets the QASR manual requirements. This SOP was approved on December 23, 2008.

4.2 Revision of QASR

The CERP quality system is defined in the QASR. During the reporting period all 11 chapters of the QASR were reviewed and revised as needed. This effort is detailed in Section 4.6.7.

4.3 Revision of CGM 41

CGM 41, *Agency Responsibility and Coordination for Quality Assurance, Quality Control and Data Validation for CERP Monitoring Activities*, defines the responsibilities of the QAOT and other CERP organizations for data quality. The document was revised by the QAOT during 2010 as CGM 41.01 and approved in July 2010. The major changes included modifying the QAOT roles and responsibilities for CERP data quality, clarifying that the QAOT role is to provide guidance in implementing the CERP quality system as defined in the QASR and then evaluating implementation of the QASR, and defining the QAR schedule as biennial rather than annual.

4.4 Monitoring Plan Reviews

Ten monitoring plans and one SOW were reviewed by the QAOT during the reporting period. A checklist based on the requirements of CGM 40 was used to assess the content and completeness of the 16 elements required for these documents. The 16 elements are identified in Table 4-1 as those for which evaluation results are tabulated. Each element was rated "acceptable" or "unacceptable." The results of the reviews are discussed below and summarized in Table 4-1. Overall, the number of acceptable elements ranged from 2 (14%) to 16 (100%) but there were no notable trends in missing elements, i.e., no element was unacceptable for a majority of the documents reviewed. The element most commonly unacceptable (for four documents) was Data Assessment Organizations and Responsibilities.

4.4.1 C-111 Project Monitoring Plans

C-111-Spreader Canal Western Hydrometeorological Monitoring Plan (February 2009)

This document serves as a reference for hydrologic and meteorological data collection for the C-111 Spreader Canal (C-111 SC) Western project. The document was reviewed by the QAOT on March 10, 2009.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on July 2, 2009.

C-111-Spreader Canal Western Water Quality Monitoring Plan (September 2008)

This document serves as a reference for surface water quality monitoring for the C-111 SC Western project. The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan on September 18, 2008 and April 3, 2009. Of the 16 QA/QC elements assessed, only three (19%) were acceptable. The unacceptable elements were related to Title Page, Project Organization, Data Assessment Organizations, Data Quality Objectives, Sample Receipt/Custody/Holding Time, Analytical Procedures, and Data Assessment.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on May 28, 2009.

C-111-Spreader Canal Western Ecological Monitoring Plan (February 2009)

This document serves as a reference for ecologic monitoring parameters and protocols for the C-111 SC Western project. This document was reviewed and edited by the QAOT in December 2009. Overall it was found to be a fairly comprehensive monitoring plan with appropriate references to the QASR. At the time of the review, minimal SOPs existed for biological/ecological monitoring.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on July 2, 2009.

4.4.2 L-31 Project Monitoring Plan

L-31N Pilot Project Design Report (September 2008)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Draft L-31N (L-30) Pilot Project Design Report: Appendix D on September 19, 2008 and on February 17, 2009. Of the 16 QA/QC elements assessed, only two (14%) were acceptable. The unacceptable elements were related to Title Page, Project Organization, Data Assessment Organizations, Data Quality Objectives, Sample Receipt/Custody/Holding Time, Analytical Procedures, Report Documentation, and Data Assessment.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on June 5, 2009.

4.4.3 Picayune Strand Restoration Project (PSRP) Monitoring Plan

Picayune Strand Restoration Monitoring Plan (February 2009)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan for the Picayune Strand Restoration Project (PSRP) on May 15, 2009. Of the 16 QA/QC elements assessed, all (100%) were acceptable. The monitoring plan was approved on May 28, 2009.

4.4.4 Allapattah Complex Restoration Area (ACRA) Project Monitoring Plan

Allapattah Monitoring Plan (March 2007)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Monitoring Plan for Allapattah Complex Restoration Area on July 11, 2008. Of the 16 QA/QC elements assessed, 14 (88%) were acceptable. The two unacceptable elements were related to the Title Page and Report Documentation. The Title Page was accepted although some information was missing.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on February 18, 2009.

4.4.5 C23 and C24 Stormwater Treatment Area (STA) Project Monitoring Plan

C23 / C24 Water Quality Monitoring Plan (February 2008)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan for C23/C24 STA on July 11, 2008. Of the 16 QA/QC elements assessed, all (100%) were acceptable. Editorial comments were provided. The monitoring plan was approved on February 18, 2009.

4.4.6 L8 Project Monitoring Plan

L8 Regional Testing (L8RT) Monitoring Plan (June 2007)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan for L8RT on October 24, 2008. Of the 16 QA/QC elements assessed, 15 (94%) were acceptable. The unacceptable element was related to the Data Assessment Organization. The sole recommendation was to reference the SFWMD Environmental Resources Assessment (ERA) Department Quality Management Plan (QMP). The deficiency was corrected and the monitoring plan was approved on February 18, 2009.

4.4.7 C43 Project Monitoring Plan

C43 Water Quality Monitoring Plan (June 2007)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan for C43 on September 19, 2008. Of the 16 QA/QC elements assessed, 14 (88%) were acceptable. The unacceptable elements were related to the Project Organization and Data Assessment Procedures.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on February 18, 2009.

4.4.8 Nubbin Slough Project Monitoring Plan

Nubbin Slough Monitoring Plan (August 2005)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Monitoring Plan for Nubbin Slough on October 21, 2008. Of the 16 QA/QC elements assessed, 15 (94%) were acceptable. The unacceptable element was related to the Data Assessment Organization.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on February 18, 2009.

4.4.9 Site 1 Project Monitoring Plan

Site 1 Impoundment Monitoring Plan (May 2009)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Monitoring Plan for the Site 1 Impoundment on May 7, 2009. Of the 16 QA/QC elements assessed, all (100%) were acceptable. The monitoring plan was approved on May 28, 2009.

4.4.10 Biscayne Bay Coastal Wetlands (BBCW) Monitoring Plan

BBCW Part 1 – Hydrometeorological Monitoring Plan (July 2009)

This document serves as guidance for hydrologic and meteorological monitoring data collection and management for post-project objectives of Part I of the BBCW project. The document was reviewed by the QAOT on November 19, 2009. Overall, the monitoring program is comprehensive and well developed.

Deficiencies were corrected by addressing the QAOT comments (Table 4-1) and the monitoring plan was approved on July 29, 2010.

BBCW Part 2 – Water Quality Monitoring Plan (July 2009)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the Water Quality Monitoring Plan for Part 2 of the BBCW on November 19, 2009. Of the 16 QA/QC elements assessed, all (100%) were acceptable. The monitoring plan was approved on July 29, 2010.

BBCW Part 3 – Ecological Monitoring Plan (July 2009)

This document serves as a reference for ecological monitoring parameters and protocols for Part 3 of the BBCW project. The entire document was reviewed by the QAOT on December 2, 2009 and comments were provided in the area of oysters, submerged aquatic vegetation (SAV), wetland and wetland algae. Overall, the monitoring program is comprehensive and well developed. A few areas of confusion were noted in the annotated text. The monitoring plan was approved on July 29, 2010.

4.5 SOW Reviews

4.5.1 Site 1 Hillsboro Canal L-40 Scope of Work

Scope of Work – Sediment Characterization (September 2008)

The QAOT Monitoring Plan Checklist was utilized by the QAOT to review the acceptability of the SOW for the Hillsboro Canal Sediment Characterization on February 17, 2009. The document was determined to be acceptable since all 16 QA/QC criteria were addressed.

Table 4-1. Results of QAOT Monitoring Plan and SOW Reviews

Monitoring Plan/SOW Element	C-111 WQ MP	L-31N Pilot Project Design	Picayune Strand WQ MP	Allapattah MP	C23/24 STA WQ MP	L8 Regional Testing MP	C43 WQ MP
1. Title Page							
• Contains project title, revision and date	U	U	A	U	A	A	A
• Contains QA Manager signature	U	U	A	A	A	A	A
2. Project Organization and Responsibilities	U	U	A	A	A	A	U
3. Data Assessment Organizations and Responsibilities	U	U	A	A	A	U	A
4. Data Quality Objectives							
• background: defines project specific data needs; describes media and analyses required to meet the data needs	A	A	A	A	A	A	A
• Measurements of quality objectives: required reporting limits, precision, accuracy, comparability and acceptance criteria	U	U	A	A	A	A	A
5. Sample Receipt, Custody and Holding Time Requirements	U	U	A	A	A	A	A
6. Analytical Procedures							
• Preventative maintenance	U	U	A	A	A	A	A
• Calibration procedures and frequency	U	A	A	A	A	A	A
• Laboratory QC procedures: type and frequency of internal QC measures	U	U	A	A	A	A	A
• Performance and system audits	U	U	A	A	A	A	A
• Nonconformance / corrective actions for field and laboratory	A	U	A	A	A	A	A
• Data reduction / calculation of data quality indicators: describes bias, accuracy, limits of detection, and precision calculations	U	U	A	A	A	A	A
7. Report Documentation: Defines Report format and Data Archival Requirements	A	U	A	U	A	A	A
8. Data Assessment Procedures							
• Data verification	U	U	A	A	A	A	A
• Data validation	U	U	A	A	A	A	U
TOTAL U	13	14	0	2	0	1	2
TOTAL A (% Acceptable)	3 (19%)	2 (14%)	16 (100%)	14 (88%)	16 (100%)	15 (94%)	14 (88%)

Review Codes: A (Acceptable), U (Unacceptable)

Table 4-1. Results of QAOT Monitoring Plan and SOW Reviews (continued)

Monitoring Plan/SOW Element	Nubbin Slough MP	Site 1 Impoundment MP	BBCW Water Quality MP	Site 1 Hillsboro L-40 Sediment SOW	Total U	Total A (% Acceptable)
1. Title Page						
• Contains project title, revision and data	A	A	A	A	3	8 (73%)
• Contains QA Manager signature	A	A	A	A	2	9 (82%)
2. Project Organization and Responsibilities	A	A	A	A	3	8 (73%)
3. Data Assessment Organizations and Responsibilities	U	A	A	A	3	8 (73%)
4. Data Quality Objectives						
• Data use background: defines project specific data needs; describes media and analyses required to meet the data needs	A	A	A	A	0	11 (100%)
• Measurements of quality objectives: required reporting limits, precision, accuracy, comparability and acceptance criteria	A	A	A	A	2	9 (82%)
5. Sample Receipt, Custody and Holding Time Requirements	A	A	A	A	2	9 (82%)
6. Analytical Procedures						
• Preventative maintenance	A	A	A	A	2	9 (82%)
• Calibration procedures and frequency	A	A	A	A	1	10 (91%)
• Laboratory QC procedures: type and frequency of internal QC measures	A	A	A	A	2	9 (82%)
• Performance and system audits	A	A	A	A	2	9 (82%)
• Nonconformance / corrective actions for field and laboratory	A	A	A	A	1	10 (91%)
• Data reduction / calculation of data quality indicators: describes bias, accuracy, limits of detection, and precision calculations	A	A	A	A	2	9 (82%)
7. Report Documentation: Defines Report format and Data Archival Requirements	A	A	A	A	2	9 (82%)
8. Data Assessment Procedures						
• Data verification	A	A	A	A	2	9 (82%)
• Data validation	A	A	A	A	3	8 (73%)
TOTAL U	1	0	0	0	32	/
TOTAL A (% Acceptable)	15 (94%)	16 (100%)	16 (100%)	16 (100%)	/	144 (82%)

Review Codes: A (Acceptable), U (Unacceptable)

4.6 QAOT Initiatives

4.6.1 RECOVER Data Management Review

Much of the monitoring data collected by RECOVER, through the MAP, is biological or ecological in nature and is not stored in the database used for water quality and quantity data (DBHYDRO). The primary storage area for these data and related documentation is the Data Access Storage and Retrieval (DASR) area of CERPZone. The QAOT requested that a review of data storage procedures for RECOVER-generated data be performed in both 2008 and 2009. The purpose of these reviews was to determine if data and metadata delivered and stored in DASR complied with the contractor SOWs and good data management practices. The review of current data management procedures was based on the data management guidelines defined in *Important Considerations in Database Quality* (QAOT 2009) and the metadata template attached to RECOVER SOWs. Although DASR is not a database, the principles related to documentation, metadata, and traceability are applicable to any data management activities. These reviews represent a snapshot of DASR contents during the review periods, i.e., April through September 2008 for the 2008 report and December 2009 for the 2009 report. It should be noted that since the time of these reviews, the DASR metadata tool for the MAP components (Morpho) has been populated to include data identified as missing during these reviews.

In 2008, the type and completeness of data stored in DASR was assessed for three projects chosen at random from a pool of 32 SOWs:

- Lake Okeechobee Benthic Macroinvertebrates Sampling
- St. Lucie Estuary-Southern Indian River Lagoon SAV
- Greater Everglades (GE) - Crayfish as Prey Population (MAP 3.1.4.06)/GE - Crayfish Methodology.

The 2008 review of the above three projects indicated that of the 75 separate metadata elements defined in the SOW, only 50% to 75% could be identified in the project files. The SAV mapping project was the only one of the three with a specific metadata file. None of the three project folders reviewed contained information for the following SOW metadata elements:

- Site description: landform geology, watersheds hydrology, site history, or climate
- Data set status and accessibility: data verification procedures or status
- Accessibility/proprietary restrictions
- Data set files: format and structure requirements
- Data type elements: storage type, variable code definitions, value ranges, missing value codes, and precision
- Data format requirements
- QA/QC procedures
- Backup and procedures to maintain a history of data set usage.

For the 2009 review, an additional three projects were chosen from a pool of 53 SOWs. One project was chosen randomly from each of three geographic areas (GE Wetlands, Southern Estuaries, and Northern Estuaries):

- Monitoring Periphyton using Chemotaxonomy
- South Florida Fish Habitat Assessment Program

- Oyster Monitoring Network.

The 2009 review of the above projects indicated that of the 75 separate metadata elements defined in the SOW, 43% to 60% of the elements could be identified. The Oyster Monitoring Network project was the only one of the three that had a specific metadata file. None of the three project folders reviewed contained information for the following SOW metadata elements:

- Site description: landform geology, watersheds hydrology, site history, or climate
- Data set status and accessibility: data verification procedures or status
- Accessibility/proprietary restrictions
- Data type elements: storage type, variable code definitions, value ranges, missing value codes, precision
- Backup and procedures to maintain a history of data set usage.

Both reports recommended the use of an Electronic Data Deliverable (EDD) format with required fields and structure for data delivery especially if the data (current and future) might be loaded into a database system in the future. The development of a consistent file deliverable format should be incorporated into the SOW submission requirements. In addition, both reports recommended that metadata be contained in a separate file for each project and that all metadata elements should be addressed. The second report recommended the use of Morpho, a data management tool for ecologists, to create and edit metadata to help ensure the completeness of the data. Morpho is currently used for the storage of ecological metadata. It was noted in the second report that tools are being created to facilitate the storage, compilation, verification, and access of MAP data currently on DASR, including standardized file formats for the various types of ecological data where applicable.

4.6.2 QAOT Project Inventory

In order for the QAOT to adequately review the quality of data being collected and to make recommendations for improvement, it is important that the QAOT is aware of what monitoring activities are planned, the monitoring schedule, and who will conduct the monitoring. The QAOT conducted a QAOT Project Inventory in 2008 and 2009 to assist in determining what monitoring activities are occurring.

The inventory task had two purposes: first, to identify current CERP monitoring activities, and second, to determine if the information captured by various tracking tools (spreadsheets and tables) provided sufficient information for the QAOT to schedule assessment activities.

The 2008 QAOT project inventory identified 160 active CERP projects,[2] however the inventory includes projects that are finished or not yet started and there may have been duplicate listings. Most sources defined at least the general type of field monitoring and laboratory analysis to be performed for the project. Fourteen different field organizations were identified. The report concluded that the best way to

[2] Battelle. 2009. Final QAOT 2008 Project Inventory. February.

determine detailed information appeared to be by sending questionnaires to project managers and MAP coordinators as was done in previous years.

The 2009 QAOT project inventory identified 102 CERP projects.[3] The inventory list includes projects that are finished or in progress. Several CERP activities are on hold or have uncertain start dates as a result of financial or regulatory issues. Baseline monitoring may have been conducted for proposed construction projects but permit monitoring has not occurred due to delays in construction. Virtually all active projects have included field monitoring of physical water quality, hydrological, and biological parameters. Laboratory analyses generally include nutrients. Some (30%) of RECOVER monitoring activities have been completed but others are in progress. The report concluded that the current database and tracking tools do not contain detailed information on field monitoring and laboratory analysis. The most detailed information can only be generated by personal communication with project contacts/managers. None of the individual tracking tools provides all of the details concerning monitoring parameters, analyses and schedule necessary to easily determine the scope and timing of a QAOT audit. This information can only be determined by personal communication on a short-term basis.

4.6.3 QAOT Program Management Plan (PrMP)

Draft PrMP (April 2010)

The purpose of the QAOT PrMP is to provide a guide for QA/QC efforts that supports the implementation of the CERP. The PrMP is developed as a dynamic document that will require periodic updates to reflect progress, as well as revisions to denote major changes in the scope, schedule, costs and/or resource allocation of the program. Efforts on the QAOT PrMP, which covers FY 2011-2015, were begun in the spring of 2010. At the time of this report, all sections of the PrMP had been reviewed and updated to reflect the current goals, objectives, constraints, and assumptions. The major revisions include:

- Format updated to follow the approved PrMP outline, which means that some information appears in a different section
- Incorporation of CGM 041.01 revisions
- Revised work breakdown structure (WBS) to reflect current CGM 041.01 responsibilities
- Addition of several new sections, including a responsibility matrix, constraints and assumptions, and contracting plan.

[3] PEER Consultants. 2010. Final Report. Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. QAOT 2009 Project Inventory. June.

4.6.4 PSRP Baseline Data Review

Final Baseline Project Review (September 2009, Revised June 2010)

Because much of the baseline data for the PSRP project were collected before the QAOT was fully underway, the QAOT performed a review of the QA aspects of that baseline data. A compilation of interviews, statements of work, final reports, and database records were used to evaluate the quality of data collected and the quality of the procedures used to produce the data. Some data were not reviewed due to a lack of information provided. Nevertheless, the range of data covered in this review should provide planners with useful information of what QA/QC elements had already been included in the PSRP and how the QA plan for post-construction efforts can be improved.

Suggestions to improve water quality data include:

- Field audits for PSRP sampling teams
- Quicker turnaround time from data collection to data validation
- Use of the same field quality manual to maintain consistency in sampling procedures.

Suggestions to improve the quality of hydrometeorological data include:

- Annual review of SOPs
- QAOT audit of hydrometeorological data processing procedures.

The biological component of the PSRP is a collection of data on several wildlife species from varying trophic levels. Not all biological components were evaluated in this report due to lack of documents and data provided. Original or "raw" data were also not provided. Thus, this review focused on documenting the various QA/QC aspects of biological/ecological data production: data/sample collectors, sampling methods, documentation, and data analysis. Information for the biological review was obtained through interviews, statements of work, journal publications, and progress/final reports.

Recommendations for the biological component of PSRP are as follows:

- Although trained or expert personnel were used in field/laboratory activities, SOWs should list specific experience requirements for conducting the work.
- Skill verification and audits/ground-truthing should be incorporated as QC practices on a regular basis.
- Sampling methods were detailed well in SOWs and were also preapproved by field professionals. This practice should be continued.
- QA/QC for sampling methods could be improved by explicitly detailing QC measures, referencing a common quality manual or plan, and listing accuracy requirements in the SOW.
- SOWs can be improved by listing metadata to be recorded during each sampling or collection event and should require the use of standardized forms.
- Documentation would also be improved by having a central storage location for all project data.
- Data analysis procedures were often well defined in the SOW and used appropriate software for statistical analysis. However, incorporating QC criteria for data usage and requiring peer review for verification of results would provide more assurance of the data quality.

4.6.5 Data Processing Assessment and Inventory of CERP Hydro-Meteorological Data (September 2009)

The QAOT conducted an assessment of data processing procedures and compiled an inventory of hydro-meteorological data used for CERP projects. This work started by acquiring and reviewing all existing data processing. Once the documentation was fully reviewed, an assessment checklist was formulated from the information. The assessments showed the need for the data processing SOPs to be updated and further refined. Several procedures were outdated and other new procedures needed to be added. A few procedures needed to be clarified and/or reinforced. Some procedures were interpreted and executed differently across the data processors.

Recommendations made in the report include:

- Review a year's worth of archive data semiannually to identify anomalies such as sensor drift
- To improve the inspection of the data, a library of data anomalies should be maintained
- The most frequently occurring errors should reside in the SOP with detailed instructions on how to identify the error and how to fix them.

4.6.6 Quality Assessment of Hydro-Meteorological Data (December 2009)

The SFWMD sponsored a task force to assess the quality of hydro-meteorological data collected by the SFWMD during the period of May 1, 2004 through April 30, 2009 (WY 2005-2009). These data, encompassing 110 parameters generated by up to 24 different recorders, are stored in SFWMD's Data Collection, Validation and Preprocessing (DCVP) database. Because CERP uses hydro-meteorological data collected by the SFWMD, the assessment results represent a snapshot of CERP hydro-meteorological data quality. All data can have quality tags associated with it which give the user an indication if the data are estimated, missing, or questionable, etc. The magnitude of quality tags placed on the breakpoint data, the length between tags, and the duration of each string of tags are assessed. Each of these attributes is also analyzed across different data types and recorder classes.

The study reveals that the most frequently tagged results were: estimated data (E), missing data (M), questionable data (?), and less than data (<). The most frequently tagged parameters were: groundwater, headwater, tailwater, and stage. While the durations of other failures (Tags ?, M) have remained steady over the past four years, the duration of defects (Tags: B,R,E,A,<,>,L,S,X,N) has increased every year for the past five years. Loggernet was the most frequently tagged recorder class, due in part to the fact it records the most data. Some of the older recorder classes, as a percent of the total data recorded, have a higher percentage of tagged results.

The next task was to develop strategies to decrease the occurrence of quality tags. Intuitively, the best way to lower the occurrence of quality tags is to improve the quality of the data. The cornerstone approach is to change the focus away from monitoring productivity and efficiency and switching towards observing key quality indicators. These key quality indicators will provide a scorecard for all future quality improvements. The major finding of the task force was that the majority of tags on the database are "E" tags. The highest percentage of "E" tags is associated with water level recorders and the trends in the maintenance procedures suggest that recalibration is a major factor in the production of "E" tags. For this reason, the first quality improvement initiative should begin with improving the recalibration process.

Once the quality of the data is being monitored, strategies for improvement can be implemented. Thirteen recommendations were outlined that would lead to reduced amounts of quality tags. The report recommended the establishment of a Total Data Quality Management (TDQM) Initiative at the SFWMD with a Quality Task Force (QTF) to investigate each of the recommendations identified to improve hydro-meteorological data process quality and productivity. The recommendations are as follows:

- Continuous quality improvement by QTF
- Use of quality tools to identify the causes of variability
- Monitoring sensor failures to improve processes
- Development and documentation of sensor quality standards in SOPs
- Installation of an automatic notification process for missed calibrations
- Development of a process control chart to document the history of sensor calibration
- Data inspection to improve the process of site selection, installation, maintenance, calibration, and data collection
- Standardized data annotations
- Monitoring of response time to resolve a malfunction
- Data processing water level calibrations to reduce the number of "E" tags (e.g., a good initiative would be to develop a threshold that must be exceeded before a data point is considered an estimate)
- Conduct a gage repeatability and reproducibility (R&R) study to create a better tolerance in the process of calibrating water level sensors
- Evaluate low water procedures for possible improvements
- Review the procedures for applying "?" tags.

4.6.7 QASR Manual

The QASR manual was developed to address system-wide and project-specific environmental monitoring QA/QC, including data collection, analysis, and archiving activities, during implementation of CERP. The manual provides details of QA/QC program requirements, including establishing data quality objectives and data management. Also included in this manual are procedures and references for water quality, hydrometeorological, and biological sample collection, laboratory methods, and data assessment protocols.

The QASR manual serves as the basis of the QA program for all monitoring activities conducted during CERP implementation. It is updated and refined periodically to strengthen the QA program. All agencies involved in environmental data acquisition during CERP implementation are required to adhere to the provisions of the QASR.

All Chapters except Chapters 6 and 8 (April 2009)

All chapters of the QASR, except Chapters 6 and 8, were revised in early 2009. The QASR was updated to improve both format and content. During the revision process, technical comments were solicited. Technical experts (Table 4-2) were selected to coordinate the review of each chapter. These experts identified and updated procedures or equipment that were outdated, inaccurate, or not relevant to CERP and provided suggestions for streamlining or clarifying the chapter. The revised QASR chapters were posted on www.EvergladesPlan.org and Documentum in April 2009.

Table 4-2. QASR Section Coordinators/Technical Experts

Section No.	Title	Contact Person(s)
1.0	Introduction	Scott Huebner, SFWMD
2.0	Administration Procedures	Ming Chen, SFWMD
3.0	Water Quality Field Sampling	John Moorman, SFWMD; Becky Terry, USACE
4.0	Chemical Analysis and Laboratory Requirement	Zdzislaw Kolasinski, SFWMD; Lisa Gued, USACE
5.0	Verification and validation of Water Quality Data	Mike Wright, SFWMD; Jeff Hendel, USACE
6.0	Quality Assurance Practices for Hydrometerologic and Hydraulic Monitoring	Chandra Pathak and Gary Wu, SFWMD
7.0	Soil and Sediment Sampling Procedures	Becky Terry, USACE
8.0	Biological Monitoring and Assessment Requirements and Guidance	Sal Resurreccion and Tim Lewis, USACE
9.0	Quality Assurance for Remote Sensing	Ken Chen, SFWMD; Sal Resurreccion, USACE
10.0	Information and Data Management	Brian Turcotte, SFWMD
11.0	Data Quality Evaluation and Assessment	Pam Lehr, SFWMD; Dave Splichal, USACE

Chapter 6 (September 2010)

The purpose of Chapter 6 – Hydro-meteorological and Hydraulic Monitoring - is to provide guidelines for an efficient and effective collection, processing, and dissemination of automated hydrologic and meteorologic data for CERP projects by the various agencies in Central and South Florida. Measurements include the stage of surface water levels, groundwater levels, operational information at structures and pump stations, rainfall, evapotranspiration, and pan evaporation.

Standardized protocols include procedures for data collection, processing, analysis and interpretation of data, QA, and measurement of uncertainty. References to industry guidelines, standards and published documents covering the most relevant aspects of hydrologic, meteorologic, and field flow (discharge) measurements are provided in this chapter. The approach is to provide broad guidelines that establish criteria for accuracy and precision for each data type. The actual procedures for calibrating and using the various instruments that may be deployed to actually measure, record, and transmit hydrologic data are not included in this chapter. However, sensor or measurement device documentation should be reviewed to ensure that the sensor is capable of achieving the accuracy and precision specified in this chapter. Chapter 6 will be presented to the DCT in late 2010 and posted to the Web page.

Chapter 8 (September 2010)

Extensive work on QASR Chapter 8 – Biological Monitoring and Assessment Procedures – was performed during the reporting period. Edits focused on outlining the minimum data requirements and reporting elements along with the list of recognized methods currently in use. The appendices to this chapter will provide SOPs for the wide variety of biological monitoring and assessment activities implemented for CERP. Currently, detailed SOPs are being developed for SAV, oysters, fish, periphyton,

birds, and crocodiles/alligators. The following steps were implemented to revise or update the SOPs for each biological species/ecological category to accurately reflect current practices:

- Gather and review SOWs/Work Plans (WPs)/SOPs for each category/species
- Perform field observation to determine if the CERP project is being conducted according to the current SOW/WP on file using acceptable methods
- Prepare and finalize SOPs.

It is anticipated that Chapter 8 will be finalized and posted during FY2011.

5.0 EVALUATION OF FIELD MONITORING

This section summarizes QAOT activities to assess the quality of CERP field monitoring. Assessment input for field data quality consists of field QC checks and audits. RECOVER field observations, CERP project, and CERP permit monitoring field audits are reviewed.

5.1 Water Quality Monitoring Activities

One on-site field audit was conducted by the QAOT during the reporting period. This on-site audit represented an effort by the QAOT to observe field monitoring activities from a QA/QC perspective. The full observation report is summarized below.

5.1.1 MSA Field Sample Collection: ACRA

On August 20, 2009, an on-site visit was conducted to observe water quality monitoring. The SOP (from the Methods section of the SOW) and the MSA-SFWMD Contract were used to provide guidance on the essential evaluation criteria for the on-site field study review. The results of the on-site field review are summarized below. It should be noted that this project is no longer actively monitored.

Review of Required Project Documents

The QASR defines document types and elements applicable to water quality monitoring. The field review confirmed that the documents appropriate for field activities were in place. These included:

- Contract SOW includes specific contract requirements and deliverables with effective dates for each version.
- SOP outlines the methods used in the project and is provided in the form of the "Methods" section in the SOW.

Review of Field Procedures/Methodologies

Field procedures and methodologies performed during the site visit on August 20, 2009 were compared with the methods outlined in the study SOWs. A significant finding related to proper cleaning of sample equipment was observed. Subsequent to transfer of the water sample from the autosampler sample collection container to the lab sample bottle, overflow water in the equipment base was poured back into the sample collection container for disposal. This action is unacceptable because the equipment base is not cleaned in any manner. Therefore, any contamination in the uncleaned equipment base would be transferred to the sample collection container which must be clean prior to receiving sample water.

Review of Internal QA/QC and Data Management

The assessment of QA/QC and data management procedures was based on discussions with the field sample collector. No applicable issues were observed.

Summary

Based on a comparison of field procedures and methods with the SOW, the study design and objectives appear to address the overall needs and questions of CERP and the proposed field study. Data are being collected appropriately for the project objectives. Field techniques are appropriate for the required data

collection except for a significant finding related to poor field procedures that could lead to potential cross-contamination by sampling equipment. An immediate corrective action was requested and completed.

Recommendations

The reviewer recommended that the improper water transfer/disposal procedure be ceased. The corrective action was an agreement not to conduct this procedure in the future. In addition, the sample collection container was immediately thoroughly cleaned in accordance with the proper field decontamination procedure.

5.2 Hydrology Monitoring Activities

5.2.1 Meteorological, Hydrologic, and Hydraulic Data Acquisition Field Audits (September 2008)

Fifteen days of on-site field observation visits were conducted by the QAOT during the reporting period. These on-site visits were designed to conduct and document audits of field activities associated with the instrumental measurement of meteorological, hydrologic and/or hydraulic data. Specifically, the intent was to evaluate the performance of preventative maintenance activities undertaken to ensure that all types of sensors are properly maintained and calibrated so as to collect accurate and precise data.

The project started by acquiring and reviewing all existing field maintenance SOPs. Once the documentation was reviewed, an audit checklist was formulated from the information found in the documents. The results from the audits show that the SOPs should be revised to clarify which procedures should be performed during monthly, quarterly, and yearly preventive maintenance trips. The audit also identified the need for improvements in preventive maintenance scheduling and tracking, documentation of maintenance requirements, and detailed recordkeeping procedures that document when maintenance is performed so that it is possible to verify that maintenance schedules are being met. Most deficiencies were related to technician disagreement on the maintenance procedures and requirements. All technicians are skilled in the methodology and when a procedure was performed, it was done correctly. Additional needs identified during the audit included:

- A comprehensive calibration program should be established.
- A schedule for replacing calibration sensors should be developed and followed.
- Installation deficiencies should be fully documented and corrected in real time.
- Any problems should be well documented and logged into the site folder so that anyone using the data can be notified.

5.3 Biological/Ecological Monitoring Activities

Four separate on-site field observation visits were conducted by the QAOT during the reporting period. The full observation reports are provided in Documentum and summarized below.

5.3.1 Caloosahatchee Estuary Oyster Monitoring (Contract # CP040626)

On October 8-9, 2008, an on-site visit was conducted to observe oyster monitoring in accordance with contract CP04062. The objectives were to (1) review required project documents, (2) review field and

laboratory procedures and methodologies, and (3) review internal QA/QC and data management procedures. The field sampling efforts observed during this site visit were conducted in accordance with:

- MAP Component FY04 SOW for MAP Activity Title: Caloosahatchee Estuary Oyster Monitoring and Research (Contract # CP040626) SOW and Final Report 2004-2007
- Quality Assurance Project Plan (QAPP): Caloosahatchee Estuary Oyster Monitoring and Research (Contract # CP040626) SOW and Final Report 2004-2007
- QASR Chapter 8 Biological Monitoring and Assessment Procedures and Appendix L - Invertebrates Method Summary.

Review of Field Procedures/Methodologies

Field procedures and methodologies performed during the site visit to five sites on October 8, 2008 were compared with the methods outlined in the study SOWs and Quality Assurance Project Plan (QAPP). Based on these comparisons, the study design/objectives appear to address the overall needs and questions of CERP and the proposed field study. Data are being collected appropriately for the project objectives and with the same methods as a different Principle Investigator (PI) used on the east coast of Florida. Field techniques are appropriate for the required data collection.

Field sampling was conducted as described in the project SOW and the supplementary protocols. The collections are conducted at fixed sites for which the location is known and on file in several documents. Field notes were recorded in a bound, waterproof field notebook and checked by the laboratory manager for completeness.

Review of Laboratory Procedures/Methodologies

Laboratory procedures and methodologies performed during the site visit were compared with the methods outlined in the study SOWs. Records of regular equipment maintenance and calibration, and training and safety are kept in a centralized and labeled cabinet.

Reproductive potential, a histological analysis, was partially observed to follow the SOW and SOPs. Condition Index, an analysis involving calculating a ratio between shell and tissue dry mass, was partially observed and agreed with the SOW and SOPs.

Review of Internal QA/QC and Data Management

Procedures were in accordance with FL DEP-SOP-FD100 001/01, with any modifications noted in the SOW and Final Report. Required QA/QC/data management components being performed by these projects include (1) *Data Verification Process, (2) Data Validation Process,* and *(3) Data Archiving.*

5.3.2 Wading Bird Colony Location, Size, Timing and, Wood Stork and Roseate Spoonbill Nesting Success CERP Studies (CERP MAP Activity)

On May 20-22, 2008, an on-site field study was conducted to review the Wading Bird project. The objectives were to (1) review all required project documents; (2) discuss and review all field data collection protocols; and (3) review QA/QC and data management procedures used to ensure data quality and validity. The field sampling efforts observed during this site visit were conducted in accordance with:

- MAP Component FY07 SOW for MAP Activity Title: Wading Bird Colony Location, Size, Timing, and Wood Stork and Roseate Spoonbill Nesting Success
- QASR Chapter 8: Biological Monitoring and Assessment Procedures and Appendix O - Bird Methods Summary (Method #501: Wading Bird colony location and nest number).

Review of Field Procedures/Methodologies

Field procedures and methodologies performed during the site visit on May 20, 2008 were compared with the methods outlined in the study SOW. Based on these comparisons, the study design/objectives appear to address the overall needs and questions of CERP and the proposed field study. Field review included accompanying researchers during ground-based surveys through the use of an airboat to access nesting colonies in the Watershed Conservation Areas north of the Everglades National Park. Aerial surveys are regularly conducted in this study, but no flight survey was conducted during the review. Based on the field review and discussions, data appeared to be collected appropriately, and field techniques were appropriate for the project objectives and necessary data needs. Data collection efforts match sampling methods described in the South Florida Wading Bird Project Protocols, and the protocols adequately incorporate measures to ensure data accuracy and quality.

Airboat surveys were conducted as described in the project SOW. Field survey methodologies were observed to follow those described in the project SOW and other descriptive documentations. Global positioning system (GPS) reference points were also recorded for every wading bird colony located and monitored during the study. During the wading bird field survey, data were recorded in a waterproof field notebook. Data are entered into computer databases directly from the field notebooks. The field technicians recording the data into the bound notebooks are the same personnel transcribing the data onto individual data sheets. Data sheets are double-checked against the notes in the field notebook and the data entered into the project databases by field technicians and checked by a supervisor.

Review of Internal QA/QC and Data Management

The visit to the field site in Kendall, FL focused on reviewing methods of data collection on wading bird reproductive success and not on procedures for data management and QC. Most parameters monitored in this study (e.g., nest location and timing, colony size, nesting success or failure, etc.) do not have corresponding SOPs within FDEP; therefore, it is one of the SOPs being developed for QASR Chapter 8 based on known standard field methods for wading bird research.

5.3.3 Role of Marsh-Mangrove Interface Habitats as Aquatic Refuges for Wetland Fish and other Aquatic Animals (MAP Activity 3.1.4.7)

On February 25, 2009, a QA/QC on-site field study review was conducted to assess the Marsh-Mangrove Habitats MAP activity. The objectives were to (1) review all required project documents; (2) discuss and review all field procedures; and (3) review QA/QC and data management procedures used to ensure data quality and validity. The results of the field study review were documented in the standard Field Audit Checklist (QASR Appendix B).

During the review, a visit to the field study area was conducted on February 25, 2009 in the Everglades National Park mangrove habitat. An interview with the PI provided a comprehensive overview of the ongoing project, focusing on project protocols and documentation.

The field sampling efforts observed during this site visit were conducted in accordance with:

- QASR Chapter 8: Biological Monitoring and Assessment
- QASR Chapter 10: Data Collection Standards, EDD Protocol, and Data Reporting Standards
- QASR Chapter 11: Data Quality, Evaluation, and Assessment Standards.

Review of Field Procedures/Methodologies

Field procedures and methodologies performed during the site visit on February 25, 2009 were compared with the methods outlined in the study SOW. Based on these comparisons, the study design/objectives appear to address the overall needs and questions of CERP and the proposed field study.

Review of Internal QA/QC and Data Management

The visit to the field site focused on reviewing methods of required QA/QC/data management components performed by this project including: (1) *Data Standardization,* (2) *Data Verification, (3) Data Validation, (4) Data Assessment, (5) Data Reporting,* and *(6) Data Archiving*. Most necessary procedures are followed and documents are maintained for the project as appropriate.

5.3.4 South Florida Fisheries Habitat Assessment (FHAP-SF), Seagrass Monitoring and Observations (MAP Activity)

On May 13, 2010, a QA/QC on-site field study review was conducted to assess the South Florida Fisheries Habitat MAP activity. The objectives were to (1) review all required project documents; (2) discuss and review all field procedures; and (3) review QA/QC and data management procedures used to ensure data quality and validity. The results of the field study review were documented in a non-standard Field Audit Report.

Review of Field Procedures/Methodologies

Observed tasks of seagrass monitoring at one field site (Manatee Bay) in Key Largo were (1) seagrass and macroalgae distribution, (2) epiphyte loads, (3) flowering of *Thalassia testudium,* and (4) photosynthetic measurements. Light and water quality readings were also obtained.

All monitoring equipment was calibrated at the start of the sampling trip and the LiCor unit is calibrated by the manufacturer every two years. Each pre-printed datasheet was completed with site name, date, diver name, and seagrass species.

Hard copies of field datasheets were placed in a closed cooler for protection during transportation. All observed procedures were in accordance with those documented in the SOW. All field personnel involved in this project were professional and well-versed in seagrasses and marine algal communities of the region.

6.0 LABORATORY AUDITS

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. Four types of assessments were performed to assess the quality of CERP monitoring laboratory data: desk audits, on-site laboratory audits, PE samples, and QC data evaluation.

6.1 QAOT Laboratory Assessments: Organics

The QAOT completed assessments for seven laboratories for organics during the May 2008 through April 2010 reporting period according to the USACE SOP for Laboratory Assessment Support for QAOT of the CERP: Remote and On-Site Assessments. The purpose of a laboratory assessment is to evaluate, at the bench-level, the proficiency that the laboratory has to perform chemical analysis. The assessment is to ensure that the analytical chemistry laboratories meet the QA/QC requirements defined in the U.S. Environmental Protection Agency (EPA) methods that are specified in the project documents, and the QASR. The primary focus of the QAOT organics assessment program is to provide a mechanism to verify, document, and improve the analytical procedures used by the laboratory to generate chemical measurement data.

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 review of the laboratory's documentation (SOPs, Laboratory Quality Manual, control charts, method detection limits [MDLs], standard data package, and previous National Environmental Laboratory Accreditation Conference [NELAC] PE sample results). The On-Site Assessment entails in-depth review of analytical procedures used by the laboratory with emphasis on review of data at the bench level including detailed discussion with the analysts. The PE samples are provided by the EPA's Contract Laboratory Program QA Technical Support and the laboratory's results are compared to the Superfund PEs Scoring-Web application.

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]).

The following sections summarize the assessments for the seven laboratories assessed during the reporting period.

6.1.1 Florida Analytical Incorporated (formerly P.E. LaMoreaux and Associates)

Florida Analytical Incorporated (FAI) of Lakeland, FL was the first of seven laboratories to be assessed during the reporting cycle. The two methods assessed were EPA Methods 505 (Analysis of Organohalide Pesticides and Commercial Polychlorinated Biphenyl [PCB] Products in Water by Microextraction and GC) and 507 (Determination of Nitrogen- and Phosphorus-containing Pesticides in Water by Gas Chromatography [GC]/Nitrogen-Phosphorus Detection). The draft Desk Assessment report was issued on July 3, 2007 with the on-site assessment conducted on July 18, 2007. PE sample (water matrix) results for the determination of pesticides by EPA Method 505 were received for evaluation on August 2, 2007.

- Desk Assessment: Four deficiencies were associated with MDLs; the most notable was for Method 505 where the calculated MDLs for three analytes were greater than the mean recovery determined from the analysis of the seven replicate samples demonstrating lack of precision.
- On-Site Assessment: Two deficiencies showed lack of control procedures in the laboratory. Logbooks were not available for each instrument. Data for a PE sample could not be located on the instrument computer or in hardcopy. Only the hardcopy of the final report was available for review.
- PE Samples: A PE sample was only provided by the QAOT for Method 505. The laboratory reported one false positive, and three compounds outside the 99th percent confidence interval.

P.E. LaMoreaux and Associates, Inc. was purchased by Laboratory Management Partners, Inc. shortly before the on-site assessment was performed. During the entrance briefing, it was stated by the laboratory QAO that only two individuals remained in the organic section. Numerous contacts with FAI in the fall of 2007 failed to resolve the deficiencies noted in both the desk and on-site assessment reports, along with problems associated with evaluation of the PE sample results. Given the lack of communication, the Final Report was issued on August 28, 2008.

Note: No CERP samples were sent to this laboratory.

6.1.2 Xenco Laboratories

Xenco Laboratories of Miami Lakes, FL was the second of seven laboratories to be assessed during the reporting cycle. The seven methods assessed were EPA Methods 524.2 (Measurement of Purgeable Organic Compounds in Water by Capillary GC/Mass Spectrometry [MS]), 525.2 (Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary GC/MS), 608 (Organochlorine Pesticides and PCBs), 610 (Polynuclear Aromatic Hydrocarbons), 615 (Determination of Chlorinated Herbicides in Municipal and Industrial Wastewater), 624 (Purgeables) and 625 (Base/Neutrals and Acids). The draft Desk Assessment report was issued on May 31, 2007, but an on-site assessment was not conducted due to the lack of responsiveness by the laboratory. PE sample results (water matrix) for the determination of volatile organics (Methods 524.2 and 624), base/neutral/acids (Methods 525.2 and 625), and pesticides and PCBs (Method 608) were received from the laboratory on June 27, 2007. Numerous contacts with Xenco Laboratories in the fall of 2007 (including two extensions in the summer) failed to resolve the deficiencies noted in the desk assessment report, along with problems associated with evaluation of the PE sample results. Given lack of communication from the laboratory, a Final Report was issued on November 20, 2008.

- Desk Assessment: The laboratory attempted to combine "like" procedures/methods into one analytical SOP. There were many conflicting requirements for the methods versus what was

stated in the SOP. Eight Deficiencies dealt with MDLs for the seven organic methods reviewed including some compounds where the calculated MDLs was > spike amount (one recovery was 1090%). On two occasions, the laboratory SOP requirements for the evaluation of the initial calibration curve did not meet method requirements. For Method 8270C, the laboratory did not evaluate the condition of the column prior to analysis of samples. The laboratory agreed to update the respective SOPs to reflect method requirements; however, revised SOPs were not received.

- On-Site Assessment: An on-site assessment was not performed for Xenco Laboratories.
- PE Samples: PE samples were provided for five methods (524.2, 525.2, 608, 624, and 625). There were numerous results that were outside of acceptance limits. It was recommended that the laboratory review chromatograms, calibration curves, and other QC samples to determine the potential cause for these observations noted. The laboratory failed to respond.

  Note: No CERP samples were sent to this laboratory.

6.1.3 TestAmerica Laboratories, Inc., Tallahassee

TestAmerica Laboratories, Inc., Tallahassee (TA Tallahassee) was the third of seven laboratories to be assessed during the reporting cycle. The methods assessed were EPA Methods 608 (Organochlorine Pesticides and PCBs), 609 (Nitroaromatics and Isophorone), 619 (Determination of Triazine Pesticides in Municipal and Industrial Wastewater), 624 (Purgeables), 625 (Base/Neutrals and Acids), 8011 (1,2-Dibromoethane [DBE] and 1,2-Dibromo-3-chloropropane [DBCP] by Microextracton and GC), 8081A (Organochlorine Pesticides by GC), 8082 (PCBs) and 8260B (Volatile Organic Compounds by GC). The draft Desk Assessment report was issued on February 15, 2008, with the on-site assessment conducted from February 25-27, 2008. PE sample results (water matrix) for the determination of pesticides (Method 608), pesticides and PCBs (Methods 8081A and 8082), nitroaromatics (Method 609), triazine pesticides (Method 619), volatiles (Method 624), base/neutrals and acids (Method 625), DBE and DBCP (Method 8011) and volatiles (Method 8260) were received from the laboratory on March 31, 2008. Results from the reanalysis of volatiles by Method 8260 were received June 13, 2008. The Final Report for TA Tallahassee was issued on January 7, 2009.

- Desk Assessment: The laboratory was not evaluating the tune criteria per method requirements (EPA Method 8260B). The laboratory was also using retention time windows for qualitative identification of target analytes that were contradictory to those listed in each method.
- On-Site Assessment: Review of the MDLs for compounds showed some errors, most notably extremely high recoveries (up to 1000%). The laboratory was unaware that they were not following method requirements for the decafluorotriphenylphosphine (DFTPP) tune criteria listed in Method 625.
- PE Samples: PE samples were sent for seven methods (608, 8081A/8082, 609, 619, 624, 625 and 8260B). For Method 609, the laboratory could not reproduce the result reported. For Method 8260B, the laboratory did not follow the preparation instructions and obtained results five-times higher than the expected value.

6.1.4 Florida Department of Environmental Protection (FDEP)

The FDEP Chemistry Section Laboratory of Tallahassee, FL was also assessed during the reporting cycle. The methods used by the laboratory had been modified to include analysis of compounds not normally

tested at commercial laboratories. As such, the SOPs were reviewed to ensure they included the general QC requirements found in the parent/referenced method. The SOPs assessed were Analysis of Organochlorine Pesticides and PCBs in Water, Soil/Sediment, and Waste by GC with Electron Capture Detection (SOP GC-011-5), Analysis of Organonitrogen and Organophosphorus Pesticides in Water, Soil/Sediment, and Waste by GC with Nitrogen-Phosphorus Detection (SOP GC-012-3.10), and Analysis of Urea Herbicides and Imidacloprid in Water and Sediment/Waste Sample Extracts by High Performance Liquid Chromatography with Turboionspray MS (SOP LC-001-99). The Desk Assessment Report was sent to the laboratory on June 4, 2008, with the on-site assessment conducted on June 24-25, 2008. Results for PE samples (water matrix) for SOP GC-011-5.11 and GC-012-3.10 were received from the laboratory on November 13, 2008. The Final Report for FDEP was issued on March 5, 2009.

- Desk Assessment: For both the organonitrogen and organophosphorus pesticides methods, the laboratory was not following requirements for the evaluation of the continuing calibration verification (CCV) standard. The laboratory was not following the method sample preparation procedure for soils.
- On-Site Assessment: A deviation was noted when samples and the initial calibration standards should be analyzed.
- PE Samples: The laboratory successfully analyzed the two PE samples.

6.1.5 Florida Spectrum Environmental Services (FSES)

FSES of Ft. Lauderdale, FL was assessed during the reporting cycle. The method assessed was EPA Method 8081A (Organochlorine Pesticides by GC). The draft Desk Assessment Report was sent to the laboratory on December 11, 2008, with the on-site assessment conducted on January 14, 2009. Results for the PE sample (water matrix) for Method 8081A were received from the laboratory on November 4, 2008. The Final Report for FSES was issued on April 10, 2009.

- Desk Assessment: In the SOP for Method 8081A, the solvent listed for the standards and sample extracts conflicted at least three times. For beta-benzene hexachloride (BHC), the calculated MDL of 0.0619 µg/L was greater than the spike amount used (0.025 µg/L). The laboratory agreed to rerun the MDL study for beta-BHC; however, the data were not provided to the QAOT for evaluation.
- On-Site Assessment: The laboratory did not follow requirements for the critical quantification techniques listed in the method regarding the PE mixture (PEM) standard and the CCV. The Lab Control Sample (LCS) had three of 10 analytes reported above their respective acceptance limits. The surrogate recovery for the LCS reported could not be verified from the data packet.
- PE Samples: One water PE sample was provided for Method 8081A. Of the 20 analytes reported, 15 were within acceptance limits; three were reported above warning limits (95% confidence level), but within action limits (99% confidence limit), and two were reported as false positives.

6.1.6 Laboratory Management Partners, Inc. (LMP), dba: Environmental Testing and Consulting, Inc. (ETC) and A&L Analytical Laboratories, Inc.

ETC of Memphis, TN was also assessed during the reporting cycle. The methods assessed were EPA Methods 8081A (Organochlorine Pesticides by GC for Chlorothalonil only), and 8270C (Semivolatile Organic Compounds by GC/MS for Trifluralin only). These methods were used for the analysis of soils. The draft Desk Assessment Report was sent to the laboratory on March 18, 2009 with the on-site

assessment conducted on June 10, 2009. Results for the PE sample (soil matrix) for Method 8270C (Trifluralin) were received from the laboratory on November 12, 2008. The Final Report for ETC was issued on September 2, 2009.

- Desk Assessment: ETC was not following the requirement listed in Method 8081A for the percent differences for the calibration verification standard. The laboratory did not have a sub-sampling SOP.
- On-Site Assessment: During the sonication process, the solid material was not being agitated for all four probes being used. The laboratory is not following the frequency of analyzing the endrin/DDT breakdown sample as stated in Method 8081A (every 12 hours). There was also an inadequate number of PEM samples.
- PE Samples: One soil PE sample was provided for Trifluralin extraction and analysis. The result reported was acceptable.

6.1.7 TestAmerica Laboratories, Inc., Savannah

TestAmerica Laboratories Savannah of Savannah, GA was assessed during the reporting cycle. The methods assessed were EPA Methods 508 (Organochlorine Pesticides and PCBs by GC) and 504.1 (Microextractables by GC/Electron Capture Detection). The Desk Assessment Report was sent to the laboratory on August 20, 2009, with the on-site assessment conducted on September 22, 2009. No PE samples were provided to this laboratory. The Final Report for TestAmerica Savannah was issued on April 9, 2010.

- Desk Assessment: The laboratory was not using the correct Internal Standard Response acceptance criteria of ±30% as stated in the method. The laboratory was not adding the surrogate to the sample bottle as described in the method.
- On-Site Assessment: Two critical deficiencies were cited in the November 2007 QAOT Laboratory Assessment Report that were addressed (i.e., revised in the SOP), but were not implemented, or observed, during the on-site visit. The laboratory was not calibrating its concentrator tubes used for concentrating sample extracts to a known volume.
- PE Samples: No PE samples were sent to TestAmerica Savannah.

6.2 QAOT Laboratory Assessments: Inorganics

The QAOT completed assessments for six laboratories which performed inorganic chemistry analyses for CERP during the 2008-2010 reporting period. The assessment process consisted of a review of laboratory documents, raw data, implementation of the laboratory quality system, and the performance of analytical methods at the bench. The purpose of a laboratory assessment is to evaluate the laboratory's capabilities to support CERP projects and to assess laboratory compliance with contract requirements, NELAC standards, and the laboratory's Quality Manual and SOPs. Audits were conducted according to the SFWMD-QS-SOP-002-01 *Conducting Laboratory Audits*. Prior to each laboratory audit, the following documents were reviewed in preparation for the on-site visit:

- Contracts or SOWs
- Laboratory Quality Manual
- SOPs for audited parameters and methods
- EPA methods corresponding to the audited SOPs
- Most recent external audit report with corrective actions

- Most recent NELAC audit report with corrective actions.

The on-site visit was conducted to confirm, through independent observation, that the procedures defined in the laboratory quality documents were being implemented effectively. The on-site audit consisted of staff interviews, demonstrations, and a review of pertinent records and raw data. The following aspects of analytical laboratory operation were reviewed at each laboratory:

- Adequacy of the laboratory facility, records management, and personnel qualifications
- Sample handling, shipping, receiving, and custody procedures
- Analytical laboratory equipment, reagents and standards, bench-level documentation, and analytical procedures vs. the SOP and method requirements
- Report preparation, data verification, and data validation
- MDL determination and currency
- Initial demonstrations of capability and continuous demonstrations of capability (IDC/CDC)
- Previous audit findings and implementation of corrective actions
- Results of recent PE samples and corrective actions.

Issues identified during the audits were categorized as observations or findings with the following definitions:

- Finding (F): Pertinent statement of fact based on a comparison of actual laboratory practice to the minimum requirements of the method, standard, system, or contract.
- Observation (O): A comment based on actual laboratory practice in which the auditor believes a modification may improve operations. Not considered a finding.

The audit summary table also included recommendations for each observation and the required corrective action for each finding, with the reference that defines the requirements. The following sections summarize the results of each laboratory audit.

6.2.1 Miami –Dade Department of Environmental Resources Management (DERM) Laboratory

An audit of the Miami-Dade DERM Laboratory of Miami, FL was conducted on November 21, 2008. The focus of this audit was on the ability of the laboratory to analyze aqueous samples for nutrients (total phosphorus [TP], orthophosphate, and nitrogen-containing compounds), metals (cadmium, copper, lead, and zinc) and water quality parameters (color, turbidity, total suspended solids [TSS]), and chlorophyll a by specific EPA methods.

The DERM Laboratory specializes in testing water samples collected from Biscayne Bay, Florida Bay, canals, and other surface waters in south Florida. The lab has sufficient facilities, personnel, sample handling, IDC/CDCs, and MDLs. The laboratory procedures are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in its SOW except as specified in the audit.

- Assessment: Four findings and 12 observations were identified during the audit. Example findings and the required corrective actions are presented below.

  Matrix spike duplicates, LCS duplicates, and sample duplicates for Total Kjeldahl Nitrogen (TKN) analysis are not digested as discrete stand-alone samples.

MDL for nitrogen oxides (NOx) in the automated data processing tool (ADaPT) project library is higher than those given for NOx in the SOW and SOP, and is assumed to be a data entry error.

- PE Samples: The DERM Laboratory participated in the FDEP's TP Round Robin (TPRR) XVIII interlaboratory study, conducted from March through June 2008, and had an overall score of 3.8 on a scale of zero to five. The laboratory also participated in an interlaboratory PE study of inorganics and metals in natural waters conducted by SFWMD in July 2008 in which 16 laboratories participated. For results reported as detections, the laboratory earned acceptable scores for all but TKN.
- Previous Audits and Corrective Actions: The laboratory's last NELAC audit was in August 2007, and the SFWMD last audited DERM in May 2004. Corrective actions for each of the observations or findings applicable to the audited methods were confirmed as having been implemented during the November 21, 2008 audit.

The DERM Laboratory has implemented good quality systems as demonstrated by standards tracking and review of data and documentation of these reviews. The laboratory implemented the required corrective actions and also made needed revisions or clarifications to several SOPs.

6.2.2 Brooks Rand Laboratories, Inc.

An audit of Brooks Rand Laboratories (BRL), Inc., Seattle, WA was conducted on May 18, 2009. The focus of this audit was on the ability of the laboratory to analyze CERP aqueous samples for total mercury and methyl mercury.

BRL facilities, personnel, sample handling, analytical procedures, IDC/CDCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in its SOW except as specified in the audit and summarized below.

- Assessment: Five findings and one observation were identified during the audit. For example, the lab's QAPP indicates that GC columns are conditioned monthly, whereas the actual practice is quarterly conditioning. Also, on lab worksheets, the analyst used handwritten arrows to indicate the same observation in a table rather than entering the information for the discrete observation in real time.
- PE Samples: BRL participated in NELAC certification testing on four semiannual rounds for low level total mercury between 2007 and 2009. FDEP's most recent total mercury and methyl mercury Round Robin indicated that BRL earned scores that are considered satisfactory.
- Previous Audits and Corrective Actions: The laboratory's last NELAC audit was on May 12, 2008. With one minor exception, corrective actions for each of the observations or findings applicable to the audited methods were confirmed as having been implemented (the laboratory's Sample Processing Form had not been revised to include a separate sign-off line for the person uploading the data to the laboratory information management system [LIMS]).

6.2.3 Collier County Pollution Control & Prevention Department Laboratory

An audit of the Collier County Pollution Control & Prevention Department Laboratory (CCPC) was conducted on March 24, 2009. The audit focused on analyses for nutrients, general chemistry parameters, various metals, and microbiological analyses identified in the laboratory's contract with SFWMD. The audit also was prompted by concerns about the laboratory's performance for TP analyses in water in

several inter-laboratory PE studies conducted in 2008, including the FDEP TPRR XVIII and PE studies conducted in the spring and fall by the CERP QAOT.

During this audit, it was noted that the laboratory had made several improvements to its quality systems, including greater individual responsibility for checking data generated and entered into LIMS. However, the laboratory had not yet determined why PE results reported for TP for the PE studies mentioned above were unacceptably low. Ultimately, it was concluded that several factors contributed to the unacceptable results. These included one instance of gross reporting error (dilution factor misapplied to one result for TP reported for the QAOT's spring study) and another instance of not adhering to the PE sample provider's instructions to analyze the (unpreserved) sample for TP "promptly" but instead analyzing it within the 28-day holding time allowed for acid-preserved samples (QAOT's fall study). The laboratory also questioned the integrity of samples supplied for the FDEP TPRR study. Following the audit, the laboratory analyzed PE samples for low-level TP in water and obtained acceptable results.

- Assessment: Four findings and 10 observations were summarized in the audit report. One of the more important findings was that the laboratory was using an expiration limit of one year for the ascorbic acid reagent used for TP analyses, whereas the analytical method specifies an expiration limit of no more than one week. This finding could not be ruled out as a possible contributing factor to the unacceptable results for TP in the PE studies mentioned above. As corrective action, the laboratory began using an expiration limit of one week for the ascorbic acid reagent.
- PE Studies: All other results reported for the QAOT PE studies conducted in 2008 were acceptable, including the result for TP reported for a second, preserved PE sample included in the QAOT's fall study.
- Previous Audits and Corrective Actions: The laboratory's most recent National Environmental Laboratory Accreditation Program (NELAP) audit was conducted in May 2008, and the most recent audit by SFWMD was conducted in November 2007. Nearly all of the required corrective actions had been implemented. During the March 2009 audit, it was noted that several SOPs still needed updating and that communication with SFWMD was needed to determine whether the laboratory's new MDL for TKN, which exceeded the MDL specified in the SOW, was acceptable.

6.2.4 FDEP Central Laboratory and Innovation Park Laboratory

An audit of the FDEP Central Laboratory and Innovation Park Laboratory, Tallahassee, FL was conducted on October 22, 2008. FDEP generated water quality data for several projects that may generate data useful for CERP and RECOVER. The focus of this audit was on the ability of the laboratory to analyze environmental samples for low-level total mercury and methyl mercury.

The FDEP lab had generated analytical blanks with high mercury levels in 2008. A laboratory investigation revealed that a potential source of contamination was a broken mercury thermometer in an adjacent laboratory. Corrective actions included laboratory decontamination, elimination of mercury thermometers from the laboratories, and cleaning of the heating, ventilating, and air conditioning (HVAC) air supply. Another issue related to mercury analysis was that the laboratory results for the FDEP mercury Round Robin study in May 2008 had an unacceptable positive bias that was greater than could be attributed to the use of the direct ethylation methyl mercury technique. The laboratory investigation identified four corrective actions to address this issue, including replacement of old analytical standards and the use of an independent standard reference sample (SRS) to assess method bias.

FDEP facilities, personnel, sample handling, data reporting and verification, IDC/CDCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in its SOW except as specified in the audit and summarized below.

- Assessment: Ten findings and six observations were identified during the audit. For example, in the total mercury SOP, there is no information regarding storage temperatures, expiration dates for reagents or sample digestion temperature. Also, the acceptance criterion for methyl mercury analysis in the CCV standard is <30% difference from the most recent calibration, rather than the <15% difference specified in the SFWMD Agreement as well as in the FDEP Quality Manual.
- PE Samples: The FDEP laboratory participated in a mercury Round Robin (HgRR-8) study from May 2008 conducted by FDEP. For total mercury and methyl mercury, the labs earned scores of 1.67 and 1.33 (both within the "poor to questionable" range) out of a possible score of 5.0.
- Previous Audits and Corrective Actions: Two corrective actions from the last NELAC audit report were followed up during this October 22, 2008 audit. A training documentation finding was corrected by updating the training system and records management SOP and requiring analysts to sign a training certification. A finding of the lack of operational activities (e.g., digestion temperature) documentation, was corrected by requiring such documentation on a lab preparation log. The corrective action was confirmed but it was noted that the SOP did not specify what the digestion temperature should be.

Corrective actions for each of the observations or findings applicable to the methods audited during the last SFWMD audit of July 19-20, 2007 were confirmed as having been implemented during this October 22, 2008 audit.

6.2.5 TestAmerica - Savannah

An audit of TestAmerica Savannah was conducted jointly with the QAOT on September 22-23, 2009, with the QAOT's auditor focusing on organics analyses and SFWMD's auditor focusing on inorganics analyses. The focus of this audit was on the ability of the laboratory to support CERP work, specifically in regard to the Kissimmee River Site project. It also allowed an opportunity for the QAOT and SFWMD auditors to work together and improve consistency in audits conducted by these two parties.

TestAmerica's facilities, personnel, sample handling, analytical procedures, IDC/CDCs, and MDLs are compliant with the laboratory's quality system and NELAP requirements. The laboratory is sufficiently prepared to perform the analyses defined in its SOW except as specified in the audit and summarized below.

- Assessment: Four findings and two observations were noted as a result of SFWMD's audit of inorganics analyses. Findings included two items from the laboratory's NELAP audit conducted in July 2008; namely, the laboratory's need to update its Quality Assurance Manual and SOPs and make adjustments to its LIMS to allow pH to be reported in association with results for color.
- PE Samples: The laboratory's performance in the QAOT's spring and fall 2008 PE evaluations was acceptable overall, with 95% of the laboratory's results within the acceptance range as measured by Z-score (difference in the reported result from most probable value as a percentage of the group standard deviation).
- Previous audits and corrective actions: Excluding the two items noted above, all corrective actions from the laboratory's July 2008 NELAP audit that were relevant to this on-site audit were

implemented. The laboratory had also taken several steps to improve areas cited by the laboratory's QAO as part of internal audits.

6.2.6 SFWMD Chemistry Laboratory

An audit of SFWMD Chemistry Laboratory, West Palm Beach, FL was conducted on March 18-19, 2010. The lab conducts most (90%) of the inorganic analyses of field samples collected by SFWMD staff and contractors for activities undertaken as part of the CERP.

The audit examined the ability of the laboratory to analyze aqueous samples for (1) nutrients: TP, orthophosphate, NO_2, total NOx, NH_3, and TKN, (2) metals, (3) cations, (4) anions, and (5) chlorophyll; and to analyze biological tissue for mercury.

The SFWMD facilities, personnel, IDC/ODCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements.

- Assessment: One finding and four observations were identified during the audit. The one finding and the required corrective action is presented below:

  Several SOPs contain incomplete identification numbers, incorrect statements, minor misstatements, or typographical errors.
- PE Samples: The SFWMD laboratory participated in two recent PE studies during the reporting period. The results for non-potable water and for mercury in solid/biological tissue were acceptable in all instances.

  For the Spring 2009 QAOT PE study, the reported results were considered acceptable in all but two of 31 instances (a result for fluoride yielded a slightly high percent difference from the most probably value, while a finding of non-detect for arsenic was considered inconsistent).
- Previous Audits and Corrective Actions: The laboratory's last NELAP audit was conducted on November 18-20, 2009, and the last internal audit was conducted on February 12-19, 2010. Corrective actions for all seven findings applicable to the NELAP audit were submitted to the Florida Department of Health (FDOH) in January 2010 and were confirmed to be completed during this audit.

6.3 PE for Inorganic Samples

During the reporting period, inorganic PE samples were administered to laboratories performing chemistry analysis for CERP. The purpose of the PE samples was to assess laboratory performance on single blind samples. The inorganic PE samples were provided to laboratories that had SOWs with the SFWMD or the USACE and that may perform inorganic analyses for CERP-related water quality monitoring.

6.3.1 Aqueous Inorganic Performance Evaluation Samples

Two aqueous inorganic PE studies were conducted during the reporting period. The U.S. Geological Survey (USGS) SRS program provided PE samples for each study. More than 200 laboratories participate in the SRS studies, making them statistically robust. Six SRS types are available through the USGS program (major ion, trace element, nutrients at low concentrations, nutrients at high

concentrations, precipitant, and mercury). All SRSs were prepared using natural water except the low concentration nutrient sample.

Summer 2008 Water PE Study

The QAOT selected 17 laboratories to participate in the July 2008 aqueous inorganic PE study. Most laboratories reported data for fewer than the full parameter suite, based on their certification and USACE or SFWMD SOW. The overall results demonstrated that the participating laboratories were successful in analyzing the inorganic parameters of interest to CERP: over 85% of the results were within the acceptance range based on accuracy (Z-score) and over 80% were within the acceptance range based on the percent difference of the reported results and the most probable value. Among the six parameter classes, accuracy ranged from 82% (trace elements) to 100% (mercury) and percent differences ranged from 74% (nutrients) to 100% (mercury). The most troublesome parameter (≥30% failures in accuracy) was lithium, with bromide falling just below the cutoff (29%).

Summer 2009 Water PE Study

The QAOT selected 18 laboratories to participate in the July 2009 aqueous inorganic PE study. A total of 13 different methods were used to analyze for 70 parameters. The overall results demonstrated that the participating laboratories were relatively successful in analyzing the inorganic parameters of interest to CERP: for both accuracy (Z-score) and percent difference, over 70% of the reported results were within passing ranges. Recoveries ranged from 66% (trace elements) to 100% (mercury and nutrients-high) and percent differences ranged from 64% (trace elements) to 100% (mercury and nutrients-high). The most troublesome parameters (≥30% failures in accuracy) were lithium and nitrogen (nitrite + nitrate).

6.3.2 Soil Inorganic Performance Evaluation Samples

One soil inorganic PE study was conducted during the reporting period (Summer 2008). This soil PE study was the first conducted by the QAOT to assess the ability of laboratories to accurately quantify the concentrations of selected inorganic parameters in soil samples at environmentally realistic concentration levels. Single-blind samples were submitted to six laboratories identified by the QAOT for analysis using routine analytical procedures. Wibby Environmental, a full service proficiency testing provider since 2001 and a NELAC certified PE provider, was selected as the PE provider for the QAOT soil PE study. The study consisted of three PE samples (corrosivity/pH; nutrients and total organic carbon [TOC]; and trace metals, including total calcium and mercury) containing inorganic parameters that may be analyzed for CERP by the selected laboratories. The laboratories were instructed to prepare and analyze samples following their SOP.

Wibby performed data analysis using the PE sample results for its separate Summer Soil 2008 PE study HW0708. Fifty-five laboratories participated in this study. Values reported by the laboratories were compared to assigned values and acceptance limits. Based on parameter class, 94% of the results reported by the six laboratories were within the acceptance criteria.

- For corrosivity/pH, results were acceptable for three of the four laboratories that analyzed the PE. For essential nutrient and TOC, results were acceptable for 79% of the reported values.
- For trace metals (27 elements), results were acceptable for 97% of the reported values.

7.0 QUALITY OF DATA

7.1 Water Data Quality

This section presents a snapshot of water quality data contained in the SFWMD database DBHYDRO. The data presented were generated for CERP or may be used for CERP analysis in the future. However, these data do not represent the quality of all CERP water quality data or all organizations that are generating data for CERP. Currently, CERP data are not stored in central locations or in standardized formats. "CERP-related" data were extracted from DBHYDRO to provide an example of the quality of water quality data.

As described for field data, data qualifiers may be assigned to laboratory data to indicate the acceptability of the data as a result of data validation or internal review by the organization generating the data. Determination of acceptability is based on the results of instrument calibration, QC samples, and the use of proper analytical procedures. Most data qualifiers indicate that QC problems identified during the review may limit the use of data and that the data should be used with caution at the discretion of the user. Other qualifiers provided added information about the data but do not indicate a quality-related problem. A list of data qualifiers is provided in Table 7-1. Those qualifiers which may limit the reliability of data and require further assessment by the data user are indicated with a "Yes" in the "Caution" column in Table 7-1.

Table 7-1. Water Data Qualifiers

Qualifier	Definition	Caution (Yes/No)
A	Arithmetic Mean	No
B	Bacterial Colony Count outside acceptable range	Yes
D	Field Measurement	No
F	When reporting species, sex is female.	No
H	Field Kit value	No
I	Value between MDL and Practical Quantitaiton Limit	No
J	Estimated value, QC criteria failed	Yes
K	Off scale low	Yes
L	Off scale high	Yes
M	Semi-quantitative value	Yes
N	Unconfirmed analyte presence	Yes
O	Analysis lost	Yes
Q	Out of holding time	Yes
T	Value less than MDL	Yes
U	Analyte not detected	No
V	Analyte detected in method blank	Yes
Y	Sample unpreserved	Yes
Z	Bacteria too numerous to count	Yes
?	Data is rejected	Yes
*	Not reported due to interference	Yes

An evaluation of the DBHYDRO data was conducted by selecting data for only CERP and CERP-related projects (Table 7-2). These CERP related projects include those non-CERP projects for which data may be leveraged by project managers. The CERP-related dataset (Table 7-2) included both routine field samples (85%) and QC samples (15%). These data were filtered for the presence of "Yes" QC Qualifiers. The percentage of qualified data for the CERP dataset (Table 7-3) was 3.0% and 2.7% in WY 2009 and WY 2010, respectively. If the dataset is split into routine field samples and QC samples, the percentage of qualified data is found to be lower for routine field samples (2.3%; 2.3%) than for QC samples (6.9%; 5.0%). This difference is due to the fact that a much larger number of QC samples (i.e., replicates, blanks and spikes) are analyzed for organic analyses than inorganic analyses and the organic analyses are more problematic, leading to more exceedances of QC acceptance criteria and thus the presence of more qualifiers in QC samples.

Table 7-2. Snapshot of CERP-Related Water Quality Data using DBHYDRO

Water Year	Sample Type	Number of CERP-Related Data Results	% of Total Results
2009	Routine Field Samples	37,700	83.9
	QC Samples	7,213	16.0
	Total CERP-Related Samples	44,913	--
2010	Routine Field Samples	49,282	86.6
	QC Samples	7,650	13.4
	Total CERP-Related Samples	56,932	--

Table 7-3. Summary of CERP-Related Data Quality Based on Analytical Data from DBHYDRO

Water Year	Sample Type	Number of CERP-Related Data with Quality-Related Data Qualifiers	% of Total Results
2009	Routine Field Samples	850	2.3
	QC Samples	495	6.9
	Total CERP Qualified Samples	1,345	3.0
2010	Routine Field Samples	1,134	2.3
	QC Samples	380	5.0
	Total CERP Qualified Samples	1,514	2.7

7.2 Hydrology Data Quality

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 hydrometeorological field data collected for CERP projects. Data quality tags

are assigned to hydro-meteorological field data to indicate the acceptability of the data and indicate if the data are estimated, missing, or questionable; these tags indicate that the data should be used with caution. Other tags provided added information about the data but do not indicate a quality-related problem.

Of the 630 million data points collected during WY2005 through WY2009, 11% (69 million values) have caution tags. The four most abundant tags are: "E" (estimation), "?" (questionable), "M" (missing), and "<" (less than).

- The "E" tags accounted for 71% of the caution tags and the number of E tags increased over the four years examined.
- The number of "?" and "<" tags doubled between WY2005 and 2009.
- The number of "M" tags increased by 7% during the five-year period.

A closer evaluation of the distribution of the estimated (E-tagged) data indicates that over 50% of the stations have less than 1,000 "E" tags and that 1.5% of the stations have over 100,000 "E" tags. The "E" tags are much more widely distributed across the different stations than the other three tags (M, ?, <). The majority of parameters with "E" tags were related to water levels. This is reasonable due to the abundance of stage and groundwater recorders and the need for regular, constant calibrations. Conductance, temperature and salinity data measured with water quality sensors had the most "?" tags.

The large number of "E" tags may be mainly due to the use of an artificially small change in the calibration value (i.e., anything greater than 0.01 ft.) as a criterion for use of the estimated tag. The trends in maintenance procedures suggest that recalibration is a major factor in the production of "E" tags. For this reason, a quality improvement initiative should address the recalibration process.

7.3 Biological/Ecological Data Quality

Unlike chemical and hydro-meteorological data, which have data qualifiers to express any quality issues, biological/ecological data generally do not have such qualifiers. As such, efforts in determining the quality of the data are currently focused on defining the SOPs that are being used. SOPs present the details of all monitoring components including measureable objectives, sampling design, field methodology, and data analysis. SOPs are currently being developed for SAV, oysters, fish, periphyton, birds, and crocodiles/alligators. Once the SOPs are firmly established, the QAOT can then determine if data qualifiers are appropriate for measurable objectives and whether all procedures have been followed. In the future, biological/ecological data will be placed in a database such as the CERP Integrated Database (CID) and can readily be compared to the applicable QC criteria.

8.0 Alternative Procedures Approved

This section identifies any alternative procedures approved during the previous year. Between May 1, 2008 and April 30, 2010, no applications for approval of alternative procedures were submitted to the QAOT.

9.0 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 of the deviation.

No known deviations from the CERP QASR or specific monitoring plan requirements were identified by the QAOT or key organizations, other than those discussed in Sections 4.0, 5.0, and 6.0.

10.0 SUMMARY OF QAOT ACTIVITIES

10.1 On-going QAOT Activities

Routine responsibilities performed by the QAOT for the reporting period are detailed throughout this report. These included:

- Reviewed 10 monitoring plans and one SOW.
- Revised all QASR chapters except Chapters 6 and 8, and posted the revised drafts on www.evergladesplan.org.
- Began development of new SOPs for QASR Chapters 6 and 8.
- Administered three PE sample studies.
- Conducted six field audits, 13 laboratory audits, and three PE sample audits.
- Completed the 2008 QAR and presented the results to the DCT in December 2008.
- Revised and finalized CGM 41.

10.2 QAOT Initiatives in 2008-2010

- Completed two annual RECOVER Data Management Reviews.
- Completed two annual QAOT Project Inventories.
- Prepared a draft PrMP for FY 2011-2015.
- Completed a Final Baseline Project Review of the PSRP.
- Completed hydrological field audits for one of the participating agencies (i.e., SFWMD).
- Completed a Data Processing Assessment and Inventory of CERP Hydro-Meteorological Data of one of the participating agencies (i.e., SFWMD).
- Completed a Quality Assessment of Hydro-Meteorological Data for one of the participating agencies (i.e., SFWMD).

10.3 QAOT Outreach in 2008-2010

Throughout the reporting period, the QAOT presented period status reports to the DCT, Assessment Team (AT), and continued communication efforts with the Project Delivery Teams (PDTs). The QAOT Web site was updated to communicate workshops, presentations, and revised documents. In addition, the QAOT sponsored several presentations and outreach activities during the reporting period including:

- Conducted ADaPT training to the USACE Jacksonville District in June 2009.
- Prepared and hosted the 3rd QAOT Workshop on June 23, 2009. Prepared a QAOT Team Fact Sheet and posted on www.evergladesplan.org in September 2009.
- Presented a technical conference poster on CERP QA procedures at the Engineer Research and Development Center (ERDC) Research and Development (R&D) Conference in November 2009.

Presented QAOT duties to the USACE Project Managers for South Florida Restoration in April 2010. These presentations are summarized below.

ADaPT Workshop 2009

Under contract with Laboratory Data Consultants, FDEP's Bureau of Laboratories developed the ADaPT and Environmental Database Management System (EDMS) software programs that aid data users in an accelerated review and assessment of analytical data. The expedited review allows users to make earlier

decisions for corrective action with laboratories, assess trends in data quality, decrease turnaround time for data availability, and reduce labor costs. ADaPT is written into the QASR manual for CERP for submitting and reviewing chemical testing data generated during project execution. As a result, training of USACE Jacksonville staff on the use of the ADaPT and EDMS software was conducted. Laboratory Data Consultants conducted ADaPT training at the Jacksonville district's facility on June 16-17, 2009.

3rd CERP Quality Assurance Workshop 2009

The USACE and SFWMD QAOT hosted a workshop at its June 23, 2009 monthly meeting at SFWMD headquarters. The workshop consisted of eight presentations related to monitoring plan reviews, field and laboratory audits, and reviews of methodology.

The QAOT co-chairs updated the status of monitoring plans and SOWs conducted during the previous water year. The USACE laboratory process, which includes much on-site review time, was discussed. The SFWMD lab audit presentation discussed improvement of the quality of data by determining adherence to the SOW and QASR. The 31 field audits performed in 2008 identified direct observation as the best mechanism to assess the integrity of the data collection process. Deficiencies are regularly identified and corrective actions required of the field team. Hydro-meteorological data audits were discussed to identify the status of preventative maintenance, installation, and data processing procedures. The comparability of chlorophyll methods, which are commonly used in CERP projects, was summarized with the identification of high performance liquid chromatography as the most accurate analytical methodology.

QAOT Fact Sheet 2009

In September 2009, the QAOT developed a Fact Sheet and Frequently Asked Questions document (http://www.evergladesplan.org/pm/pm_docs/qaot/091809_qaot_factsheet_lowres.pdf) to explain the objective of the QAOT as established by CGM 041 to provide guidance on monitoring procedures, QA/QC and data validation procedures for CERP projects, and to be the forum to develop consistency among the various entities involved with environmental monitoring. It stressed that each agency and individual involved with CERP monitoring must share responsibility for maintaining knowledge of the QA system and for adhering to procedures documented in the QASR manual.

The Fact Sheet described:

- Who the QAOT are.
- What their responsibilities are.
- What support activities they provide.
- When monitoring plans are submitted.
- How data is submitted.
- Which Guidance Memoranda define monitoring, assessment and quality assurance activities.

QAOT Posters 2009

In November 2009, USACE ERDC conducted an R&D Conference in Memphis TN. The objective of this technical conference was to disseminate information and provide networking concerning on-going research conducted by ERDC. QAOT presented a poster entitled "Quality Assurance of Biological/Ecological Monitoring for CERP" in the Environmental Monitoring and Prioritization Session.

QAOT Outreach to Project Managers 2010

At a branch meeting of the USACE PMs for South Florida Restoration in Spring 2010, a presentation was given on the duties of the QAOT and the need for projects to have their monitoring plans and SOWs (for monitoring) reviewed not only by RECOVER, but also by the QAOT. In addition, the QAOT fact sheet was handed out to all attendees.

10.4 Development of Integrated Data Repositories

During the reporting period (WY May 2008 – April 2010), the CERP Information and Data Management (IDM) team initiated the development of the CID, a relational, Microsoft® Sequel Server database. This database will address many of the concerns identified in the QAR related to data management by establishing a central repository and reporting tool for CERP biological and ecological data. Standardized data loading templates will be used to upload data to Morpho and enable the software tool MetaCat to create packages of data based on the template headers (i.e., the type of data being loaded). All original files, including historical files that are subsequently updated, are stored in DASR, which provides the filing structure. Data in CID can be accessed using a drop-down menu driven query tool called EGRET (EverGlades Restoration [data] Extraction Tool). The benefits of this system include (1) establishing a central repository for RECOVER biological, ecological, and GIS data, (2) ensuring that all of the most recent data for a geological area are available to develop reports, and (3) enable data traceability.

10.5 QAOT Response to Recommendations of the 2008 QAR

The 2008 QAR identified 13 QAOT activities that could result in improved data quality. These recommendations, the QAOT initiatives to implement improvements, and the status of those initiatives are summarized in Table 10-1.

Table 10-1. Status of QAOT Initiatives to Improve CERP Data Quality

Improvement Area	QAOT Initiatives	Status
1. Conduct focused lab audits Several laboratories performing analyses for CERP (e.g., the SFWMD laboratory), have not yet been audited by the QAOT. A review of laboratories contributing data to CERP and focused audits of these laboratories should be conducted.	These laboratories have been audited. Laboratory audits are an on-going QAOT activity. The QAOT will continue to identify and audit laboratories that are generating data for CERP-related projects	Complete
2. QAOT Metrics The QAOT should develop metrics that measure whether or not the QAOT has been effective in improving the data generated for CERP.	The PrMP will establish metrics do assess QAOT effectiveness.	In progress
3. Field and Laboratory Audit Staff Field and laboratory audits of all aspects of CERP data should be conducted by qualified QA Officers.	Technical experts within both USACE and SFWMD have been identified and now perform field and laboratory audits.	Complete
4. QASR Chapter 6 QASR Chapter 6 (Hydraulics and Hydrology) requires major revisions. During this process the use of the term "ground truthing" should be reviewed and clarified.	QASR Chapter 6 has been revised by hydrology staff and posted to Evergladesplan.org.	Complete
5. NELAC Certification The QAOT and AT chairs should determine when NELAC certification, required by QASR, is appropriate and applicable for RECOVER laboratory analysis.	The QAOT has determined that NELAC certification is not applicable to all analyses and will be determined on a case-by-case basis.	Complete
6. Remote Sensing QASR SOP The Remote Sensing QA/QC questionnaire should be reviewed for clarity, condensed, and incorporated into	A Remote Sensing checklist has not yet been developed.	In progress

Table 10-1. Status of QAOT Initiatives to Improve CERP Data Quality, continued

Improvement Area	QAOT Initiatives	Status
the QASR as a checklist for project planning and SOW development		
7. Remote Sensing QASR QA/QC Elements The QAOT should obtain and review the remote sensing SOW to ensure that the essential QASR QA/QC elements are included.	The QAOT reviewed a sample of recent remote sensing SOWs to assess inclusion of QASR QA/QC elements. It was determined that QA/QC elements are not included in the SOWs. More outreach and communication is needed to address this recommendation.	In progress
8. MAP Training Topic-specific training modules/workshops of 30-45 minutes in length targeting one specific QA/QC "problem" area for the MAP PIs could occur in conjunction with MAP module meetings.	The QAOT developed a series of short, specific training modules that could be presented during MAP module meetings. To date, the QAOT has not been given the opportunity to conduct these 'mini workshops.' More outreach and communication is needed to address this recommendation.	In progress
9. QASR Bio/Eco SOPs The review of the QA/QC Biological/Ecological Questionnaires did not include reviews of training procedures, methods for dealing with questionable data, or SOPs/methods. These areas should be reviewed for adequacy	SOPs for biological/ecological monitoring are being developed to document methodology, quality assurance and training in the QASR Chapter 8. The QAOT has surveyed SOPs available from various agencies and is the process of developing Chapter 8.	In progress
10. QA/QC Vocabulary The questionnaire reviewers noted confusion over QA/QC vocabulary used by the QAOT, AT, and PIs.	The QAOT is considering a glossary of common QA/QC terminology, based on the NELAC glossary, and determining whether the QASR should contain a separate glossary or whether QA/QC terminology should be incorporated into CGM 13.03 *Acronyms and Glossary of Terms.*	In progress

Table 10-1. Status of QAOT Initiatives to Improve CERP Data Quality, continued

Improvement Area	QAOT Initiatives	Status
11. MAP PI – QASR Training The MAP PIs were not familiar with the location of the QASR, which chapters applied to them, whether alternative methods still had to be approved by the AT and QAOT, and exactly what that process entailed.	No training has been conducted although USACE and SFWMD Project Managers have discussed the role of the QAOT in the QA/QC oversight process on two team meetings. The QAOT will continue outreach to the PIs. The RECOVER AT module provides links to the location, requirements, and application of the QASR.	In progress
12. Biological/Ecological QASR Elements Not all essential elements of project documentation or data management defined by the QASR are being performed because PIs have determined that these procedures were not applicable to the current project.	The QAOT has reviewed the documentation elements identified in the QASR as essential data management components, and reviewed/revised the guidance, as appropriate. Biological/ecological SOPs are being developed so that PIs understand the need and requirement to conduct such QA/QC efforts.	Complete
13. Unified SOPs Field teams or organizations performing similar monitoring procedures should compare individual SOPs, and where appropriate, create one unified SOP for monitoring so that a particular monitoring technique will be applied uniformly.	The QAOT has reviewed all QASR Chapters. All SOPs present in the QASR have been revised to create unified methodology for field monitoring conducted by CERP projects. The QAOT recognizes that geographic restraints imposed by terrain and species-specific behaviors may limit standardization of procedures in many cases. The QAOT further supports the identification and utilization of the most cost-effective and scientifically-efficient procedures as conditions may demand, with the caveat that these procedures are adequately documented, formally approved, and incorporated into the QASR. The QASR is a 'living' document and this recommendation will be continually addressed during revisions to the document.	Complete.

11.0 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. During the current reporting period, six specific recommendations for improvement were identified. These recommendations are summarized in Table 11-1 with proposed QAOT improvement activities.

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

Improvement Area	Proposed QAOT Initiatives
1. Early Integration of QAOT into CERP and RECOVER Planning The QAOT should be integrated with PDTs during project planning instead of at the end of the report/monitoring plan preparation. Some PDTs are not familiar with the requirements for monitoring plan reviews and need assistance in developing the QA/QC elements of the monitoring plans. The QAOT, PDTs, Technical Leads, and Planning Leads will benefit from early and regular integration and communication.	Plan focused QAOT integration and outreach activities to PDTs, Technical Leads, and Planning Leads. For example, establish with DCT mechanisms for early involvement; develop guidance for monitoring plan preparation; invite USACE Environmental Planning Lead representatives to QAOT meetings; and ensure that PDTs Technical Leads, Planning Leads as well as project managers are included in QAOT workshops.
2. Inventory of CERP Projects and Data Active CERP projects are not easily identified and information about monitoring activities, schedules, and responsible parties is not readily available. Data for CERP are not stored in central locations. This information is needed so that the QAOT can plan audit activities and develop the QAR.	Work with CERP DCT to develop effective procedures to define active CERP projects and data storage locations for those projects.
3. Address Impact of Significant Field and Laboratory Audit Issues Significant audit findings that impact data quality should receive elevated attention to minimize impact and avoid re-occurrence. For example, improve recalibration process for water level recorders.	Include in outreach activities: Implement program-wide communication and corrective action for audit findings that impact CERP data quality.

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

Improvement Area	Proposed QAOT Initiatives
4. Notification of Final Monitoring Plans and SOWs The QAOT is not notified when Monitoring Plans and SOWs are finalized. Documentation of approvals is not consistently maintained.	Include in outreach activities: Work with PDT PIR to establish a notification process for final documents.
5. RECOVER Data Management Review Standardized reporting formats are needed for biological and ecological data and meta data.	The IDM is developing standard templates that will be used to upload biological and ecological data into CID. The QAOT should work with IDM to identify quality data needed.
6. Defining Quality of Biological and Ecological Data Data qualifiers that identify quality issues are not typically applied to biological/ecological data. The QAOT should develop procedures to assess and define the quality of these data.	The QAOT should assist the PIs in identifying appropriate QA/QC procedures, quantitative when applicable, and incorporating them into the Chapter 8 SOPs. The QAOT should provide input to the IDM to ensure that the CID includes biological QC data. This will enable reviewers to compare the QC results to the applicable QC criteria.
7. Field and Laboratory Assessment Procedures Agencies conducting field and laboratory assessments use different assessment procedures. Efforts should be made to ensure that these assessments are comparable among organizations.	Joint field and laboratory assessments should be conducted to enable the QAOT to compare procedures and develop consistent criteria for evaluation of field and laboratory activities.

12.0 RESOURCE NEEDS

12.1 Management Support from CERP and Participating Agencies

The QAOT was able to achieve several breakthrough accomplishments during the reporting period because of the direction and support of CERP management, as well as the support and cooperation of all participating agencies:

- FDEP
- SFWMD
- USACE
- USEPA
- U.S. Fish and Wildlife Service
- USGS

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

12.2 Cooperation from PDT, RECOVER, and EMCT

Under the leadership of CERP DCT, the QAOT recognizes the continued need to improve communication between QAOT and the PDTs for implementing the QASR into CERP monitoring activities. Cooperation from the PDTs, RECOVER (especially MAP), and Everglades Monitoring Coordination Team (EMCT) are essential to achieving this goal. CGM 41.01 and the QAOT PrMP specify that the QAOT will review all monitoring plans and strive to implement effective outreach mechanisms to communicate CERP QA/QC policies and procedures to the scientific community that is performing CERP activities. The QAOT needs the support and backing of the CERP leadership to improve outreach through mechanisms such as workshops.

12.3 Financial Support for QA/QC Activities

Based on CGM 41.01 and the updated QAOT PrMP, the QAOT will continue to hold monthly meetings, will continue to conduct field audits for water quality, hydrology, biological and ecological activities, and will evaluate the quality of data generated for pre- and post-construction CERP projects and other CERP monitoring.

13.0 REFERENCES

Advanced Hydro Technologies, Inc., Data Processing Assessment and Inventory of CERP Hydro Meteorological Data, September 16, 2009.

Advanced Hydro Technologies, Inc., Quality Assessment of Hydro-Meteorological Data, December 2009.

Battelle, Final QAOT 2008 Project Inventory. February 2009.

Battelle, Final Report. Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Review of RECOVER Data Management Procedures. December 2008.

Battelle, QAOT (Quality Assurance Oversight Team), Comprehensive Everglades Restoration Plan Annual Quality Assessment Report for May 2007 – April 2008, November 2008.

Comprehensive Everglades Restoration Plan, CERP Guidance Memorandum 041.00. Agency Responsibility and Coordination for Quality Assurance, Quality Control and Data Validation for CERP Environmental Monitoring. South Florida Water Management District and the U.S Army Corps of Engineers, Jacksonville District. Effective 2010.

Comprehensive Everglades Restoration Plan, CERP Guidance Memorandum 041.01. South Florida Water Management District and the U.S Army Corps of Engineers, Jacksonville District. July 21, 2010.

Comprehensive Everglades Restoration Plan,CERP Monitoring and Assessment Plan. Restoration Coordination and Verification Program, c/o Jacksonville District, United States Army Corps of Engineers, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida. January 2004.

DBHYDRO, as a Microsoft Access Database, for WY 2009 and WY 2010, May 2010.

Florida Department of Environmental Protection (FDEP) QA Rule Chapter Florida Administrative Code (F.A.C.) 62-160

Florida Department of Environmental Protection FDEP-SOP-001/01.

NELAC (National Environmental Laboratory Accreditation Conference), 2003 NELAC Standard. EPA/600/^04/003. Approved at Ninth NELAC Annual Meeting, June 5, 2003.

PEER Consultants, Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Picayune Strand Restoration Project Baseline Data Review. Final. June 2010.

PEER Consultants, Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Summer 2008 Water PE Study, July 2008.

PEER Consultants, Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Summer 2009 Water PE Study, July 2009.

PEER Consultants, Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Summer 2008 Soil Inorganic PE Study, July 2009.

PEER Consultants, Final Report. Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. Review of RECOVER Data Management. December 2009.

PEER Consultants, Final Report. Comprehensive Everglades Restoration Plan, Quality Assurance Oversight Team. QAOT 2009 Project Inventory. June 2010.

Quality Assurance Oversight Team 2010, C-111-Spreader Canal Western Water Quality Monitoring Plan review, September 2008.

Quality Assurance Oversight Team, Laboratory Management Partners, Inc. (LMP), dba Environmental Testing and Consulting, Inc. (ETC) and A & L Analytical Laboratories, Inc. Lab Audit, September 2, 2009.

Quality Assurance Oversight Team, Allapattah Monitoring Plan review, March 2007.

Quality Assurance Oversight Team, BBCW Part 1 – Hydrometeorological Monitoring Plan Review, July 2009.

Quality Assurance Oversight Team, BBCW Part 2 – Water Quality Monitoring Plan Review, July 2009.

Quality Assurance Oversight Team, BBCW Part 3 – Ecological Monitoring Plan Review, July 2009.

Quality Assurance Oversight Team, Brooks Rand Laboratories, Inc. Lab Audit, May 18, 2009.

Quality Assurance Oversight Team, C-111-Spreader Canal Western Ecological Monitoring Plan Review, February 2009.

Quality Assurance Oversight Team, C-111-Spreader Canal Western Hydrometeorological Monitoring Plan Review, February 2009.

Quality Assurance Oversight Team, C23 / C24 Water Quality Monitoring Plan Review, February 2008.

Quality Assurance Oversight Team, C43 Water Quality Monitoring Plan Review, June 2007.

Quality Assurance Oversight Team, Caloosahatchee Estuary Oyster Monitoring (Contract # CP040626) Field Audit. October 8, 2008.

Quality Assurance Oversight Team, FDEP Central Laboratory and Innovation Park Laboratory Audit, October 22, 2008.

Quality Assurance Oversight Team, Florida Analytical Incorporated (formerly P. E. LaMoreaux and Associates) Lab Audit, July 18, 2007.

Quality Assurance Oversight Team, Florida Department of Environmental Protection Lab Audit, March 5, 2009.

Quality Assurance Oversight Team, Florida Spectrum Environmental Services (FSES) Lab Audit, April 10, 2009.

Quality Assurance Oversight Team, L-31N Pilot Project Design Report Review, September 2008.

Quality Assurance Oversight Team, L8 Regional Testing (L8RT) Monitoring Plan Review, June 2007.

Quality Assurance Oversight Team, Meteorological, Hydrologic, and Hydraulic Data Acquisition Field Audits, September 2008.

Quality Assurance Oversight Team, Miami –Dade Department of Environmental Resources Management (DERM) Laboratory Audit, November 21, 2008.

Quality Assurance Oversight Team, MSA Field Sample Collection: Allapattah Complex Restoration Area (ACRA), August 20, 2009.

Quality Assurance Oversight Team, Nubbin Slough Monitoring Plan Review, August 2005.

Quality Assurance Oversight Team, Picayune Strand Monitoring Plan Review, February 2009.

Quality Assurance Oversight Team, QAOT Fact Sheet 2009, September 2009. (http://www.evergladesplan.org/pm/pm_docs/qaot/091809_qaot_factsheet_lowres.pdf)

Quality Assurance Oversight Team, QAOT Program Management Plan (PrMP) - Draft April 2010.

Quality Assurance Oversight Team, QAOT SOP-001 Format of QAOT SOP Procedures and Document Control Procedures, May 30, 2008.

Quality Assurance Oversight Team, QAOT SOP-002 Quality Assurance Activities and Responsibilities, December 23, 2008.

Quality Assurance Oversight Team, QAOT SOP-003 Preparation of the Quality Assessment Report, December 23, 2008

Quality Assurance Oversight Team, QAOT SOP-004 Review of Project Monitoring Plans and Scopes of Work, December 23, 2008.

Quality Assurance Oversight Team, QAOT-SOP-003 - Preparation and Review of the Quality Assurance Report (QAR) for Comprehensive Everglades Restoration Plan Monitoring, December 12, 2009.

Quality Assurance Oversight Team, Quality Assurance System Requirements (QASR) Manual – 2010, www.evergladesplan.org.

Quality Assurance Oversight Team, Quality Assurance Systems Requirements (QASR) Manual for the Comprehensive Everglades Restoration Plan. U.S. Army of Corps Engineers and South Florida Water Management District. QAOT, June 2010. http://www.evergladesplan.org/pm/program docs/qasr.cfm

Quality Assurance Oversight Team, Review of RECOVER Data Management Procedures, Revised Final Report, Attachment B, February 2009.

Quality Assurance Oversight Team, Role of Marsh-Mangrove Interface Habitats as Aquatic Refuges for Wetland Fish and other Aquatic Animals (CERP-MAP Activity 3.1.4.7) Field Audit, February 25, 2009.

Quality Assurance Oversight Team, SFWMD Chemistry Laboratory Audit, March 18, 2010.

Quality Assurance Oversight Team, Site 1 Hillsboro Canal L-40 Scope of Work Review – Sediment Characterization, September 2008.

Quality Assurance Oversight Team, Site 1 Impoundment Monitoring Plan Review, May 2009.

Quality Assurance Oversight Team, South Florida Fisheries Habitat Assessment (FHAP-SF), Seagrass Monitoring and Observations (CERP-MAP Activity) Field Audit, May 13, 2010.

Quality Assurance Oversight Team, TestAmerica Laboratories, Incorporated, Tallahassee Lab Audit, January 7, 2009.

Quality Assurance Oversight Team, TestAmerica Laboratories, Incorporated, Savannah Lab Audit, April 22, 2009.

Quality Assurance Oversight Team, Wading Bird Colony Location, Size, Timing and, Wood Stork and Roseate Spoonbill Nesting Success CERP Studies (CERP MAP Activity) Field Audit, May 20, 2008.

Quality Assurance Oversight Team, Xenco Laboratories Lab Audit, November 20, 2008.