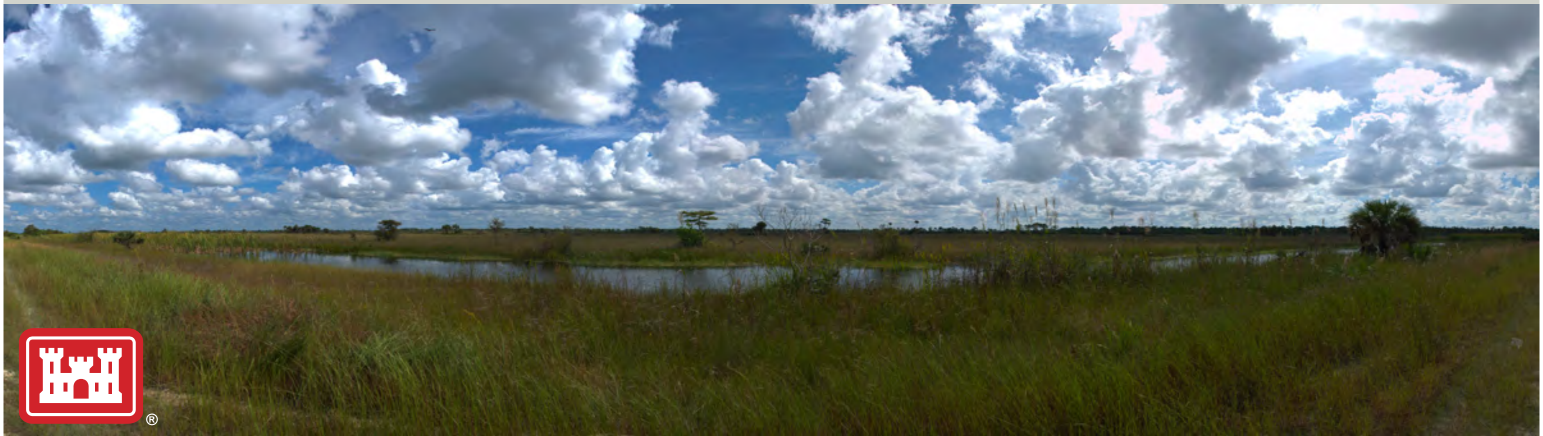
QUALITY ASSURANCE OVERSIGHT TEAM | QAOT

FACTS & INFORMATION



OCTOBER 2013

Generating high-quality environmental/ecological monitoring and assessment data for Everglades restoration, as part of the Comprehensive Everglades Restoration Plan (CERP), is critical. For CERP, achieving high-quality data is particularly challenging because data used for CERP are collected by many organizations for projects and programs whose monitoring activities may have different objectives. It is the role of the CERP Quality Assurance Oversight Team (QAOT) to provide quality assurance (QA) guidance at the program level to ensure data quality. The data collected for CERP can be merged to generate an overall picture of the current state of the Everglades system, and to track the ecological and hydrologic improvements that result from CERP projects. Programmatic data quality can be achieved by systematically incorporating quality assurance/quality control (QA/QC) into every aspect of data collection.

QAOT REQUIREMENTS

The QAOT is a multi-agency team comprised of four to six standing members from the U.S. Army Corps of Engineers (USACE), South Florida Water Management District (SFWMD), Florida Department of Environmental Protection, U.S. Environmental Protection Agency, U.S. Geological Survey, and U.S. Fish and Wildlife Service. The USACE and SFWMD are the lead agencies.

Each agency and individual involved with CERP monitoring must share responsibility for maintaining knowledge of the quality assurance system and for adhering to the procedures. The best way to stay apprised is through the Quality Assurance System Requirements (QASR) manual (www.evergladesplan.org/pm/program_docs/qasr.aspx) which lays out the protocols and procedures for data gathering activities for CERP in addressing the following areas:

- Water quality field sampling
- Biological monitoring and assessment
- Chemical analysis and laboratory requirements
- Remote sensing
- Verification and validation of water quality data
- Information and data management
- Hydrometeorological and hydraulic monitoring
- Data quality evaluation and assessment
- Soil and sediment characterization

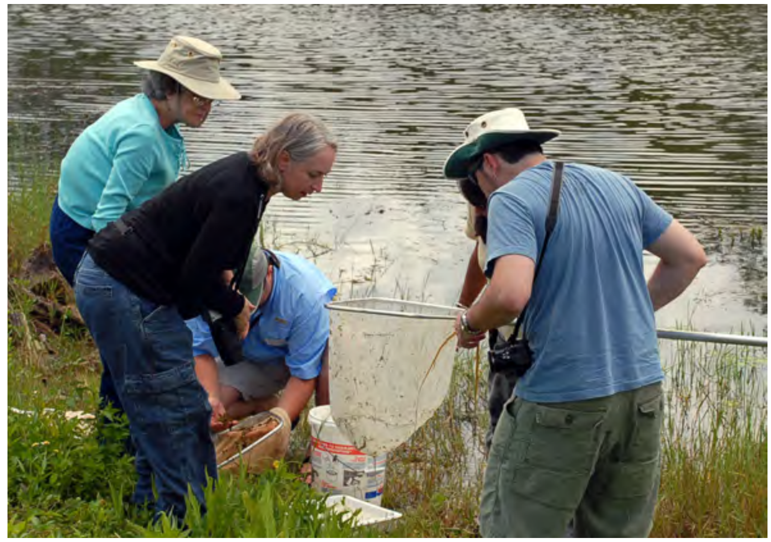
More than 85 percent of the data currently collected for the CERP program is biological and ecological data. Chapter 8 has been revised to provide guidance to CERP project managers, consultants, and contractors for achieving a level of acceptable quality, standardization, and consistency in their data and data-gathering methods.

QAOT GUIDANCE

The QAOT was established by **CERP Guidance Memorandum (CGM) 041**, which became effective Sept. 17, 2010. It provides guidance on monitoring procedures, QA/QC and data validation for CERP projects, and serves as the forum to develop consistency among the various entities involved with environmental monitoring, data quality and QA/QC processes. Additional information on CGMs available at:

www.evergladesplan.org/pm/program_docs/cerp-guidance-memo.aspx

FREQUENTLY ASKED QUESTIONS



Why is the quality and consistency of the data important?

We need defensible data to support CERP and we need to be able to compare data across time.

Who does QAOT report to?

The QAOT reports to the CERP Design Coordination Team (DCT), which meets monthly to provide consistent and effective communication, coordination and issue resolution on projects between USACE and SFWMD. The QAOT is responsible for providing a Quality Assessment Report (QAR), on a biennial basis, to the DCT summarizing CERP monitoring activities, and evaluating whether the QASR is being implemented by CERP projects and programs.

Does QAOT have responsibility to the project delivery teams and Restoration Coordination & Verification (RECOVER)?

Yes, with respect to quality assurance issues.

What are some of the things that the QAOT can do for me?

- Provide a QASR; which is a manual for data gathering activities for CERP and documents methodologies so that efforts remain compatible as time progresses and participants change.
- Conduct field water quality, hydrological and ecological monitoring QA assessments (within QAOT budget or project funds).
- Audit laboratories that work for CERP to ensure that laboratories are doing quality work (within QAOT budget or project funds).
- Review monitoring plans and scopes of work for quality assurance.

What kinds of things can the QAOT do for my team?

- Help to formulate a scope of work and monitoring plan.
- Review data and reports for scope of work compliance.
- Review Quality Assurance Project Plans that contractors formulate.
- Help to review ADAPT I ADR libraries and deliverables.

When do I submit monitoring plans and scopes of work to the QAOT?

When the scope of work/monitoring plan is ready for project delivery team review, please send it to Mike Wright at mwright@sfwmd.gov and Lisa Gued at lisa.r.gued@usace.army.mil.

Do I still have to submit monitoring plans to RECOVER?

Yes. RECOVER reviews monitoring plans with respect to consistency with the objectives of the Monitoring and Assessment Plan (MAP); the QAOT reviews monitoring plans with respect to quality assurance issues.

What are ADAPT/ADR libraries and deliverables?

ADAPT /ADR libraries and deliverables are an electronic data package of chemistry data that is delivered by the laboratory or contractors. It ensures the correct and exact transmission of analytical data in a standardized format with quality control information.

Can we use ADAPT/ADR libraries and deliverables for ecological data?

No, at the present time ADAPT/ADR data submissions are only applicable to chemistry data.

FOR MORE INFORMATION

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904-232-2610

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www.evergladesplan.org/pm/qaot.aspx

CERP Guidance Memorandum

South Florida Water Management District – Jacksonville District, U.S. Army Corps of Engineers

CGM NUMBER-REVISION: 041.01

EFFECTIVE DATE: July 21, 2010

CATEGORY: Data Management

SUBJECT: Agency Responsibility and Coordination for Quality Assurance, Quality Control and Data Validation for CERP Monitoring Activities

DESCRIPTION:

This memorandum provides guidance to the staff of the Jacksonville District, U.S. Army Corps of Engineers (USACE), South Florida Water Management District (SFWMD), members of the Program [including REstoration, COordination, and VERification (RECOVER)] and Project Delivery Teams (PDTs) on the establishment and administration of a Quality Assurance (QA)/Quality Control (QC) and Data Validation program for Comprehensive Everglades Restoration Plan (CERP) environmental data.

QA/QC processes help provide accurate and defensible monitoring and sample data (hydrological, meteorological, water quality and biological) which is critical to the overall success of CERP and each of its project and program components. However, the design, development, and documentation of a QA/QC Program does not of itself ensure the quality of the data generated. The Quality Assurance Systems Requirements (QASR) manual, located at the following link http://www.evergladesplan.org/pm/program_docs/qasr.aspx ,is the CERP Quality System, and provides specific guidance for CERP monitoring and sampling QA/QC. Critical to effective implementation of this program are the knowledge of and conformance to sampling and analytical protocols-, as well as the implementation of minimum standards for data submittal, processing, and review. This CERP Guidance Memorandum (CGM) establishes multi-agency responsibilities for CERP Quality System development and implementation through the formation and continuous support of a Quality Assurance Oversight Team (QAOT).

PURPOSE OF QUALITY ASSURANCE OVERSIGHT TEAM

The QAOT is responsible for providing guidance on, and evaluating the implementation of, the CERP Quality Systems through the QASR and CGMs. This responsibility includes developing and providing guidance on procedures, QA/QC requirements and data validation for CERP monitoring activities. The

QAOT is the forum to develop consistency regarding data quality and QA/QC processes among the various entities involved with hydrological, meteorological, water quality, and biological monitoring activities for CERP.

GUIDANCE:

Each agency and individual involved with CERP monitoring activities has the responsibility for maintaining knowledge of the CERP Quality System and for adhering to the procedures listed in the QAOT QASR. The ultimate responsibility for maintaining the QAOT QASR and evaluating whether the QASR is being implemented by CERP projects and programs and/or their contractors rests with the QAOT.

The USACE and SFWMD are the lead agencies for the QAOT, with the goal of providing guidance such that data collected meet or exceed the data quality objectives of each project. In addition to providing guidance, other responsibilities of the QAOT include:

- Develop and implement data review criteria and quality assessment procedures.
- Standardize electronic data deliverables.
- Establish Standard Operating Procedures (SOPs) when they do not exist.
- Oversee the approval process for alternative procedures for sampling and analysis as described in the QASR.
- Implement a QA audit program for CERP monitoring activities.
- Oversee the laboratory and field comparison studies program to assess consistency and comparability among agencies involved in CERP monitoring activities.
- Produce a QA report on CERP monitoring activities on a biennial basis, evaluating whether the QASR is being implemented by CERP projects and programs and/or their contractors.
- Review and provide guidance in the development of QA/QC procedures in Scopes of Work and Monitoring Plans for CERP projects and programs.
- Review program and project-level monitoring plans and scopes of work to ensure all required QA/QC protocols are addressed.

- Familiarize Project Delivery Teams (PDTs) and programs (such as RECOVER) with the requirements of the QASR.
- Provide guidance, if requested, for data quality objectives to PDTs and programs.
- Coordinate and/or Facilitate Relevant Workshops, Meetings and Coordination Activities
- Prepare and Update the Program Management Plan
- Provide a Link between QAOT and DCT
- QAOT Document Control
- QASR Preparation and Updates
- CGM Development and Updates Related to QAOT

QAOT Membership

The QAOT is a multi-agency team comprised of one representative from six standing member agencies:

- U. S. Army Corps of Engineers, Jacksonville District (USACE)
- South Florida Water Management District (SFWMD)
- U.S. Environmental Protection Agency (USEPA)
- Florida Department of Environmental Protection (FDEP)
- U.S. Geological Survey (USGS)
- U.S. Fish and Wildlife Service (USFWS)

While the lead agencies for the QAOT are the USACE and SFWMD, critical technical advice is provided by the FDEP, USFWS, USGS, and the USEPA. While each organization has only a single representative, any number of agency personnel may attend to support the team's efforts. Final decisions are, however, made by the standing members only. The QAOT organizationally reports to the Design Coordination Team - DCT (CERP Program Managers) and maintains communication with programs and projects.

CGM NUMBER-REVISION: 041.01

QAOT Roles and Responsibilities

The QAOT roles and responsibilities are further outlined in the QAOT Program Management Plan http://www.evergladesplan.org/pm/qaot_plan.aspx and QAOT SOPs http://www.evergladesplan.org/pm/qaot.aspx#team.

APPLICATION:

Effective the date of this memorandum, the provisions of this CGM, maintains the QAOT as the body governing all environmental QA/QC and data validation activities undertaken in conjunction with CERP monitoring and sampling activities.

APPROVAL:

Tom Teets
Assistant Deputy Executive Director
Everglades Restoration and Capital Projects
South Florida Water Management District

DATE: Aug 30, 2010

Eric L. Bush
Assistant Chief,
Everglades Division
U.S. Army Corps of Engineers

DATE: 26 JULY 2010

CGM NUMBER-REVISION: 040.02

EFFECTIVE DATE: 2 APR 2012

CATEGORY: Data Management

SUBJECT: **Project Level Monitoring and Assessment**

1.0 DESCRIPTION AND BACKGROUND

This memorandum provides guidance to the staff of the Jacksonville District, U.S. Army Corps of Engineers (USACE), the South Florida Water Management District (SFWMD) and other members of Project Delivery Teams (PDTs) on how to address and incorporate monitoring and assessment activities in planning, design, and implementation documents for projects covered under the Comprehensive Everglades Restoration Plan (CERP). Monitoring and assessment are central elements for management of CERP projects. The collection and analysis of environmental data is critical for assessing project area conditions and for evaluating project performance and/or compliance with project-related permits. Monitoring programs should be established to enable the tracking of environmental conditions from baseline conditions to after project completion. These activities provide a technical basis for alternative design decisions, adaptive management, monitoring of operations, and evaluation of progress toward restoration goals.

This CERP Guidance Memorandum (CGM) and the CERP Quality Assurance System Requirements (QASR) manual are provided to ensure consistency in addressing monitoring and assessment activities from project to project, and from project to system-wide monitoring. Environmental data generated from various projects must be comparable so that performance, scale-sensitive or synergistic benefits, and compliance can be systematically assessed. Comparability is achieved through consistency in monitoring approaches and methodologies. A well-conceived monitoring plan/program should minimize operational problems and long-term additional costs. Quality Assurance (QA) principles and Quality Control (QC) procedures are critical elements of monitoring and assessment activities. It is imperative that strict QA/QC protocols for sampling and laboratory analyses, data management, and data evaluation be followed for all CERP data. The QA/QC criteria defined in the QASR should be applied consistently from project to project, and between project-level monitoring and system-wide level monitoring, so that data are comparable and stand up to scientific scrutiny.

This CGM focuses on observing and recording water quality, hydro-meteorological/hydraulic parameters and biological/ecological conditions. For the purposes of this document, water quality monitoring may include any of the following matrices: water, tissue, or sediment. Hydrometeorological monitoring may include any of the following: wind speed and direction, rainfall, evapotranspiration, hydrologic surface or groundwater stage or flow. Biological/Ecological monitoring may include any measurements that do not fall into the former two categories, such as species counts, sea grass densities or heights, enzyme decomposition and biomarkers. Specific guidance for the monitoring activities described in this CGM is provided in the following documents, which should be referenced during development of the monitoring plan:

- The CERP Monitoring and Assessment Plan (MAP)
- CGM 23: Water Quality Considerations for the Project Implementation Report Phase
- CGM 28: Technical Specifications for CERP Geographic Information System (GIS) Data.
- CGM 42: Toxic Substances Screening Process - Mercury and Pesticides
- CGM 56: Guidance for Integration of Adaptive Management (AM) into Comprehensive Everglades Restoration Plan (CERP) Program and Project Management
- CERP Adaptive Management Integration Guide http://www.evergladesplan.org/pm/pm_docs/adaptive_mgmt/062811_am_guide_final.pdf
- Implementation Guidance for Section 2039 of the Water Resources Development Act of 2007 (WRDA 2007) - Monitoring Ecosystem Restoration
- Comprehensive Everglades Restoration Plan (CERP) - Requirements for Project Implementation Reports (PIRs) and Other Implementation Documents
- Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 07) - Mitigation for Fish and Wildlife and Wetlands Losses
- USACE Engineering Manual (EM) 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, http://140.194.76.129/publications/
- SFWMD QS-SOP-004-01
- U. S. Environmenta*l Protection Agency (EPA) QA/G5, Guidance for Quality Assurance Project Plans,* http://www.epa.gov/quality/qs-docs/g5-final.pdf
- Quality Assurance System Requirements (QASR) manual http://www.evergladesplan.org/pm/program_docs/qasr.aspx

The QASR manual serves as the basis for the quality assurance program for all monitoring activities conducted in implementing the CERP. All agencies that will provide data during the implementation of CERP should use this manual.

1.1 System-wide vs. Project-level Monitoring

1.1.1 System-wide Monitoring

The REstoration COordination and VERification (RECOVER) program is responsible for developing and implementing the system-wide monitoring program for CERP to track and measure cumulative responses and the overall performance of the CERP. RECOVER has developed the CERP Monitoring and Assessment Plan (MAP) as the framework for measuring and understanding system responses. The MAP is based on a set of system-wide hypotheses designed to allow stakeholders to determine how well CERP is meeting its goals and objectives, and to identify opportunities for continual improvement, where needed. The MAP identifies regional environmental performance measures associated with system-wide hypotheses and the methods used to quantify these measures, including water quality, hydro-meteorological/hydraulic and biological/ecological (bio/eco) parameters.

1.1.2 Project-level Monitoring

Project-level monitoring is focused on a smaller scale than program-level monitoring to ensure that projects meet their operational, environmental, and ecological goals stated in the project management plan and implementation report, and to ensure permit and contract compliance. The project managers, with assistance from the PDT, are responsible for identifying the need for, cost-effectiveness, and implementation of any required project-level monitoring and assessment activities. Common themes in a monitoring plan are:

1) monitoring water quality if water quality is an objective or part of a permit condition,
2) monitoring hydrology/hydraulics if hydrology/hydraulics is an objective or part of a permit condition,
3) monitoring ecology or biology with the duration clearly defined if ecology/biology is an objective or part of a permit condition. This includes but is not limited to:
    - monitoring the creation or restoration of on-site and/or project area of influence on ecological features or processes
    - monitoring the requirements of the Endangered Species Act or some other environmental regulation.

The Project-Level Monitoring Plan (PLMP) should include itemized activities, costs, and the corresponding budget in the Work Break-down Structure (WBS) for:

1) clearly defined durations, activities, and costs associated with development, coordination, and review of the monitoring and assessment plan during the PIR phase; and
2) activities and costs associated with monitoring implementation, such as monitoring implementation contracts and contract management, data management, QA/QC tasks, assessment tasks (data synthesis and reporting), and management coordination (showing linkages to other functional area plans, i.e., design [pilots/physical models], construction [pre-construction baselines, operational testing, permit required], and post-construction monitoring for permitting, operations and maintenance, and verifying restoration success).

It is recommended that the PLMP be presented in two parts: (1) an overall introduction of the entire project, and (2) plans for operational monitoring of hydrometeorological, water quality, bio/eco parameters required for permits for documenting restoration impacts and validating adaptive management actions identified in a project's adaptive management plan.

2.0 GUIDANCE

During development of the Monitoring Plan, the following guidance should be considered:

- **RECOVER Coordination:** In this case, the monitoring should be clearly justified in the PLMP. PLMPs must be coordinated closely with the system-wide monitoring led by RECOVER to ensure performance measures and targets selected by the project teams are consistent with the system-wide performance measures. In evaluating indicators of ecosystem response to management measures as part of a project, monitoring will utilize existing system monitoring and Standard Operating Procedures. Duplication of monitoring activities will be avoided. However, in some cases, project-level monitoring may need to fill temporal or spatial gaps for parameters monitored in the MAP in order to evaluate project-level effects. The PDT is responsible for coordinating with RECOVER and providing the PLMP for review and approval by RECOVER. This is to ensure consistency with the CERP programmatic goals and objectives and to avoid redundancy with RECOVER monitoring efforts. Any changes proposed by RECOVER must be justified and cost effective.

- **Quality Assurance Oversight Team (QAOT) Coordination:** The PLMP must identify how observation, measurement, sampling, and analysis will be conducted to achieve the Data Quality Objectives (DQOs). The PDT is responsible for coordinating with the QAOT on questions related to QA/QC, and providing the PLMP for review and approval by the QAOT. The QAOT review ensures that the PLMP has defined and justified sampling locations, parameters, matrices, methods, frequency, and appropriate standard operating procedures (SOPs) that will be utilized during execution of the monitoring plan. For additional information about QA and the role of the QAOT see CGM 41.
- **Reviews and Approval:** Prior to the Alternatives Formulation Briefing (AFB), the PDT shall coordinate the drafting of the PMLP with RECOVER and the QAOT. Prior to implementation of the PLMP, the final PLMP must be reviewed and approved by RECOVER and the QAOT. The appropriateness of a monitoring plan will be reviewed as part of the decision document review including agency technical review (ATR) and independent external peer review (IEPR), as necessary. Any scopes of work (SOW) for execution of the monitoring plan should also be provided to the QAOT for review and approval.
- **USACE Ecosystem Restoration Requirements:** Project-level monitoring must include the rationale for monitoring, including key project specific parameters to be evaluated and how the parameters relate to achieving the project goals, permit requirements, or make decisions about adjusting project operations, project implementation, or the next phase of the project, as outlined in the project's adaptive management plan. PLMPs should focus on directly measurable parameters such as those associated with volume of water stored, canal stage, volume of water released and compliance with water quality standards. It may also require monitoring of an ecological or biological endpoint, such as pre, during, and post-construction surveys for listed species, vegetation monitoring, and possibly exotic vegetation control. These indirect metrics can be subject to influences other than project actions. The use of monitored control sites should help to evaluate the impact of the project from exogenous influences (i.e., climate, anthropogenic impacts, natural variability).
- **SFWMD Environmental Monitoring Review Process Requirements:** The SFWMD Leadership requires all new monitoring projects conducted by SFWMD be reviewed by the District Chief's Advisory Team and the Leadership Team. An Environmental Monitoring Review form needs to be thoroughly completed and a concise PowerPoint presentation given at the Environmental Monitoring Review meetings to address questions related to 1) purpose of monitoring, 2) duration of monitoring, 3) project planning, and 4) project budgeting. The Environmental Monitoring Review form needs to be submitted at least one week prior to the meetings. Unbudgeted monitoring requests will also be required to follow the Environmental Monitoring Process prior to submitting a change control request.

- **Costs:** Monitoring and assessment activities prior to and during construction should include costs for sampling, project (contract) management and associated QA/QC costs, analysis, documentation, reporting, and entry of data into approved data storage. Any cost of monitoring performed during the period of construction shall be included in project construction costs and any cost of monitoring performed after the period of construction shall be included in project Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) costs. Every effort should be taken and documented to minimize monitoring costs over the life of the project. Project-level monitoring costs must be clearly identified in the PIR to ensure they are authorized by Congress. Monitoring costs for ecosystem restoration cannot be cost-shared longer than 10 years post-construction of a particular component. If required to be maintained beyond 10 years for a particular component, it will be 100% non-Federal.
- **Monitoring Plan Development Guidance:** Detailed guidance on the development of sampling and analysis plans, as part of the monitoring plan, is available from the USACE Engineering Manual (EM) 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, http://140.194.76.129/publications/ the SFWMD QS-SOP-004-01, and U. S. Environmental Protection Agency (EPA) QA/G5, *Guidance for Quality Assurance Project Plans*, http://www.epa.gov/quality/qs-docs/g5-final.pdf. Additional guidance for monitoring plan criteria is part of USACE guidance on implementation for WRDA 2007 section 2039 for ecosystem restoration projects and section 2006 for mitigation. The QAOT has developed a checklist (Appendix C and Attachment 1 of the QAOT-SOP-004, *Review of Project-level Monitoring Plans and Scopes of Works*, effective December 23, 2008 or a newer version if available). Quality Assurance System Requirements Chapter 11 provides guidance on the use of secondary data.
- **Monitoring Plan Templates:** Monitoring plan templates for water quality, hydrometeorological, and biological monitoring are contained in Appendix A.
- **Existing Monitoring Data:** Conducting an inventory of existing monitoring data for the project area is a critical step that will assist in identifying monitoring needs during the PIR phase. Some data sources are listed below:
    - DBHYDRO, the SFWMD hydrometeorological and water quality database http://www.sfwmd.gov/dbhydro
    - USGS http://waterdata.usgs.gov/nwis/, http://sofia.usgs.gov/ and http://water.usgs.gov/nawqa/
    - Legacy STORET http://www.epa.gov/storet/dbtop.html (data submitted to EPA prior to 1999)
    - Florida STORET http://storet.dep.state.fl.us/ (contains all data that is loaded to modernized STORET)
    - CERP Integrated Database (CID) -accessible through EGRET on CERPZone
    - Data from counties and local governments and
    - Data from non-governmental organizations such as Lakewatch http://lakewatch.ifas.ufl.edu/
    - Florida Fish and Wildlife Research Institute http://myfwc.com/research/gis/data-maps/
    - National Atmospheric Deposition Program http://nadp.sws.uiuc.edu/

- o Southeast Environmental Research Center (SERC) http://serc.fiu.edu/wqmnetwork/

2.1 Elements of a Project Level Monitoring Plan

This section details inputs for hydrometerological, water quality, and biological/ecological monitoring.

In general, the PLMP should:

1. Reference standardized procedures and guidelines that will be utilized rather than providing in-depth descriptions(i.e., Field quality manual, SOP for reviewing monitoring plans)
2. Include an organizational chart or table with lines of authority and responsibility
3. Provide a work schedule with critical milestones and a start and completion date
4. Justify design strategy and sampling locations
5. Discuss resource and time constraints
6. Include document revision numbers and dates
7. Discuss DQOs for representativeness, completeness, comparability, detection limits, precision, and accuracy of the plan
8. List minimum qualifications and special training for personnel
9. Describe and justify required non-standard analytical or sampling methods
10. Define maximum holding times by parameter and method
11. Define methods for sample processing (homogenization, filtration, splitting or compositing)
12. Identify chain of custody procedures
13. Include all relevant field forms, including sample custody forms
14. Identify the data repository including procedures for archiving
15. Detail the corrective action procedures for control limit exceedances.

Monitoring Plan (outlined as provided in the template)

The monitoring plan template will include at least two sections: one general introduction section and then sections that provide specifics of hydrometeorological, water quality, and/or bio/eco monitoring. Detail is provided in the actual template as guidance on what to put into each section.

1.0 INTRODUCTION
1.1 Project Description
1.2 Project Objectives
1.3 Active Mandates and Permits
1.4 Monitoring Components
    Project Baseline Monitoring
    Construction Monitoring
    Post-Construction Monitoring (Effectiveness Monitoring)
    Inventory of Existing Monitoring Networks
    Integration of Monitoring Components

1.5 Duration
- Project Initiation
- Modification or Termination Conditions

1.6 Monitoring/Sampling Locations and Naming Convention
- Geographic Location of Monitoring Stations
- Access and Authority

1.7 Project Reporting
- Frequency
- Content and Format
- Report Recipients and Broader Distribution
- Revisions and Modifications

1.8 Administration and Implementation of the Monitoring Plan
- Organization Structure and Responsibilities
- Program Implementation
- Partnerships
- Program and Protocol Review

1.9 Cost Estimates

2.0 HYDROMETEOROLOGICAL MONITORING

2.1 Data quality objectives

2.2 Monitoring Data Elements/Indicators
- Procedures and Methods
- Laboratory Qualifications
- Rationale for indicator selection
- Sampling frequency and duration
- Assessment Process and Decision Criteria (triggers and thresholds)

2.3 Data Collection
- Sample/Data Collection Standards and Ethics
- Sample Submission
- Chain of Custody
- Quality Control Samples
- Data Validation
- Raw Data
- Data Processing
- Data Storage and Archiving

2.4 Documentation
- Field Notes
- Field Instrument Calibration Documentation
- Corrections

2.5 Quality Assurance and Quality Control
- System for assessing data quality attributes
- Data quality qualifiers
- Field Audits

2.6 Data Analyses and Records Management
- Data Quality Evaluation and Assessment

2.7 Adaptive Management Considerations

3.0 WATER QUALITY (3.1 to 3.7 will match up with 2.1 to 2.7 above)
4.0 BIOLOGICAL/ECOLOGICAL (4.1 to 4.7 will match up with 2.1 to 2.7 above)
5.0 REFERENCES

2.2 Contracting Monitoring and Assessment Activities

Contracting of monitoring and assessment operations should be accomplished with the same requirements as work performed "in-house" by the sponsor agencies to ensure that all DQOs are met and consistency is maintained. Statements of work (SOW) should detail these requirements. Project managers should utilize technical expertise from both SFWMD and USACE monitoring units in reviewing SOWs. When practical, these units should serve as contract managers for monitoring and testing services.

The SOW should be accessible to and written for both technical and non-technical readers during the contracting solicitation, award and administration phases. SOWs for laboratory analysis should be reviewed by people who are familiar with laboratory analysis to avoid errors or omissions that could result in ineffective contracting and/or loss of data. SOWs should specify what SOP will be used to collect the necessary monitoring data and the SOP should be approved by the project manager and QAOT. The QASR Chapter 4 provides guidance on the development of a SOW.

Contractual support is used for many projects to provide technical analyses and other professional services. It is important that the contractor understand the requirements for permit and assessment reporting. Any SOW that addresses monitoring by a contractor should conform to all applicable CERP CGMs and agency procurement policies.

3.0 Application

Effective the date of this memorandum, all projects managed under the CERP Program should use this guidance for monitoring and assessment. For projects that have already initiated monitoring activities or have entered into contracts for these services, the project manager, to the extent possible, should incorporate the intent of this guidance into those contracts and projects.

For questions or clarification regarding this guidance, contact one of the QAOT co-chairs.

APPROVALS:

Thomas M. Teets, AICP
Bureau Chief, Office of Everglades Policy and Coordination
South Florida Water Management District

DATE: 2 April 2012

Howard Gonzales, Jr.
Chief, Ecosystem Branch
Programs and Project Management Division
Jacksonville District
U.S. Army Corps of Engineers

DATE: 27 March 2012

Appendix A

Project Level Monitoring Plan Template

Template for Developing Project-level Monitoring Plans: Hydrometeorological, Water Quality, and Biological/Ecological Monitoring

For

[Project Name]

[Date]

(Approval date for Recover QAOT EMCT)

____

Authoring Organization's Representative **Date**
(Monitoring plan coordinator)

____

Lead USACE Project Manager **Date**

____

Lead SFWMD Project Manager **Date**

____

Representative, Local Sponsor (Monitoring Organization) **Date**

____

Representative, Federal Sponsor (Monitoring Organization) **Date**

____

Project Quality Assurance Officer **Date**

Distribution List
[Include the names of those who will/should receive a copy of this plan once it is finalized and any subsequent revisions.]

Table of Contents

[This section should contain lists of document sections included in this document]

List of Tables

[This section should contain lists of tables included in this document]

List of Figures

[This section should contain lists of figures included in this document]

Appendixes

[This section should contain lists of the appendixes included in this document]

Executive Summary

[This section should contain the executive summary of the Project-Level Monitoring Plan]

Acknowledgments

[This section should contain individuals and/or organizations that assisted in the preparation of this document]

Glossary/Acronyms

[This section should contain a list of any acronyms used in the document as well as any words not found in common usage, usually those specific to monitoring techniques and monitored parameters, e.g. matrix, quantification limit, etc.]

Table of Contents

1.0 INTRODUCTION

[A general project introduction will begin each type of monitoring plan.]

1.1 PROJECT DESCRIPTION

[The guidance contained in this document should assist in maintaining consistency in sampling locations, parameter lists and sampling frequencies as well as providing documentation of the project scope and an ongoing historical perspective. The following items should be included in the project description section:

- *A brief project description and general location information, including projects associated with or impacting this project.*
- *A brief project background or history.*
- *A description of basins or geographic areas affected.*
- *Purpose of project.*
- *Reason monitoring will be performed.*
- *A project location map.]*

1.2 PROJECT OBJECTIVES

[Describe the rationale of the monitoring program. Use specific language when stating objectives (if unknown, speak with Program Managers). How will this data be used (reports, publications, regulating agency assurance, legislative review, etc.)? For measured parameters or indicators, what do you hope to be able to resolve? Do not go into great detail on each parameter, but rather focus on general classes such as macronutrients, micronutrients, metals, pesticides, submerged aquatic vegetation, fish communities, etc. Reference other documents that show the linkages between the system components. Identify sources of natural variability and bias and how those variables will be reconciled.]

1.3 ACTIVE MANDATES AND PERMITS

The mandates, permits or agreements that govern the sampling requirements of this project are as follows: *[INSERT appropriate information]*

- *FDEP permit #****, initiated xx/xx/xxxx and expires on xx/xx/xxxx*
- *Settlement Agreement, xx/xx/xxxx*
- *Biological Opinion from the United State Fish and Wildlife Service*

[All mandates, Biological Opinions, and permits needed for the project will be included in this section of the plan. Discuss any state or Federal collections permits required for threatened/endangered species.]

1.4 MONITORING COMPONENTS

[The focus of the Project-level Monitoring Plan (PLMP) is primarily post-construction monitoring, in some vernaculars known as "Effectiveness Monitoring". However, other monitoring components are inextricably linked to the project and the interpretation of data indicative of the effectiveness of the restoration activities.]

Project Baseline Monitoring

[Describe any baseline monitoring associated with the project and how it will be used to interpret the monitoring data gathered as part of this monitoring plan.]

Construction Monitoring

[Before one can know that the response of the system is due to a restoration activity it must be determined that the project construction was indeed carried out to specifications. This is also referred to as "Implementation Monitoring". Document implementation monitoring, criteria for determining successful implementation, and how data will be used in the interpretation of effectiveness.]

Post-Construction Monitoring (Effectiveness Monitoring)

[Insert a brief description of effectiveness monitoring; categories of parameters or indicators, general performance measures and targets, etc. If it is determined that the monitoring component is trending towards demonstration of project goals and objectives, briefly describe how reductions in monitoring frequency, duration, locations, or parameters can be implemented as applicable. Since the remainder of the monitoring plan is devoted to this monitoring component, this section only serves as a short overview.]

Inventory of Existing Monitoring Networks

[In south Florida, an extensive monitoring system exists for purposes like operations and environmental assessment. Review of existing monitoring networks, especially around the proposed project area or its larger area of influence, will help decide how much the existing monitoring efforts can be used for the proposed project and how much new monitoring is needed.]

Integration of Monitoring Components

[Explain how the various monitoring components are or will be linked together in an adaptive management framework to determine whether the project is providing the intended response in the system.]

1.5 DURATION

[Define the project life-cycle. Specific monitoring dates and durations will be included in each specified type of monitoring (i.e., water quality, hydrometerological, bio/eco) and each monitoring component (i.e. baseline, construction, post-construction). Project-level monitoring may be initiated prior to project construction to establish appropriate baselines. The PLMP should identify how long each parameter should continue through the project life-cycle (design, construction, operations, and maintenance), and what decision criteria would trigger its

termination or refinement. For example, field tests may require more effort and higher initial monitoring costs, followed by reduced effort and costs after the field tests. As project-induced ecological responses become better understood, monitoring should be refined and narrowed in scope, to the extent possible, to more directly focus only on those parameters that are absolutely necessary to evaluate restoration performance. Information should be included on how project-level restoration performance monitoring will be reduced or eliminated if desired goals and objectives have been achieved, or at 10 years post-construction, whichever comes first. After 10 years, monitoring is generally no longer cost shareable. Information should be included on how project-level hydro-meterologic monitoring will fluctuate with the duration of operational tests and what is required for operating the project during the operations and maintenance (O&M) phase. Information on the time period for monitoring required by permit or consultations should be included as well.]

Project Initiation

The monitoring described in this document will be *[or was]* initiated on xx/xx/xxxx in response to *[INSERT description of construction, ecological, or other triggers.]*.

Modification or Termination Conditions

The monitoring described in this document will be *[modified or terminated]* on xx/xx/xxxx in response to *[construction, ecological response, or other triggers. Simple modifications can be placed here. Complex phased or tiered changes should be attached as separate plans and referenced. Describe how the monitoring plan may be modified based on unexpected/undesirable outcomes, fully successful restoration, funding constraints, etc. Project-level restoration performance monitoring will be reduced or eliminated if desired goals and objectives have been achieved, or at 10 years post-construction, whichever comes first. After 10 years, monitoring is generally no longer cost shareable. Project-level hydrometerological monitoring will fluctuate with the duration of operational tests and what is required for operating the project during O&M phase. Monitoring required by permit or consultations will occur for the time specified in those agreements.]*

1.6 MONITORING/SAMPLING LOCATIONS AND NAMING CONVENTION

[Selection of representative sampling locations is critical to the effectiveness of a monitoring plan in achieving its objectives. Locations should take into account flow, structure characteristics and use, instrument type, sampling technique, equipment needs, communications, safety, equipment maintenance, etc. Sampling locations should be defined as part of the Data Quality Objectives (DQO) process. Logistics (accessibility by vehicle, boat or helicopter,; travel time, power availability, security, sample shipping, etc.) also need to be considered based on the frequency of collection, sample holding time and the number of locations to be sampled on a specific sampling trip. Existing monitoring locations should be leveraged wherever possible. New locations should supplement those in the REstoration COordination and VERification *(RECOVER) Monitoring and Assessment Plan (MAP) so that information can be used to refine the system-wide hypotheses and models for adaptive assessment.]*

[If a new monitoring station is created, naming should be unique and consistent with the current nomenclature. If sampling is conducted to meet permit requirements, the project and its monitoring stations should be registered following the location nomenclature and registration protocols for new stations. Sampling stations will be registered in the Laboratory Information Management System (LIMS) (if applicable).]

There are a total of *[number of stations]* monitoring locations that will be used to supply data relative to this plan. *[Here you would insert general descriptions of sampling locations including the official station ID (could be in parenthesis or bold or a separate column). If hydrometeorological, water quality, and bio/eco sites are not co-located, the different types of monitoring sites should be shown on the same map using appropriate symbology for each type of site. The descriptions should be specific enough to allow the field team to reference them in combination with the map and lat/long.]* Monitoring locations will be registered in the LIMS where appropriate. The locations will be presented in figures along with a table including lat/long and a description of the type of monitoring.

Geographic Location of Monitoring Stations

[Describe where the project is located and include a figure illustrating the project area and sample locations. Sampling location reconnaissance should be conducted and GPS location data, digital photos and maps should be obtained. A table of station IDs, lat/long of the sampling locations (or x and y coordinates with appropriate datum) and a description of the type of monitoring at each station should e included. Accurate recording of locations for monitoring should comply with CGM 28, *Technical Specifications for CERP Geographic Information System (GIS) Data*. A spatial accuracy assessment should be performed on the sampling points by plotting them on a map to determine whether they are indeed the correct locations. *Depending on the type of monitoring a project requires, templates are available for use and are outlined below.]*

Access and Authority

[Describe site access authority, whether permission is needed and by whom, preferred methods of access, required entry permits, required keys, and special contacts (names and phone numbers). Describe any hazards or additional pertinent information associated with particular sites.]

1.7 PROJECT REPORTING

[This section should be written in consultation with RECOVER, project managers, and agency reporting units in order to make sure all requirements for the project and the program will be met.

Frequency

[State the frequency at which reports will be released, the period of data to be used (i.e., water year), and the due date. In permits issued to the District, the frequency of reporting is usually annually, published in the SFER. Reporting restoration performance success will be based on timing of expected change for specific parameters.]

Content and Format

[Describe what type of information will be included in reports and what format will be used (i.e., summary tables, graphs, maps, narratives, combinations of these). All reports should be delivered electronically at a minimum. Who will review the report before it is released?]

Report Recipients and Broader Distribution

[State the intended audience(s) for project reports and purpose of reporting findings (i.e., U.S. Fish and Wildlife Service – listed species monitoring results related to biological opinion criteria, Design Coordination Team – results on restoration success and/or performance issues requiring adjustments). Will a notice be issued when the report is available and copies can be obtained upon request? Who will be the contact person for obtaining copies of the report? What are the parameters and channels for broader distribution?]

Revisions and Modifications

[This section is reserved for future changes as they are made and should be referenced throughout the document as revisions occur. Sections should be added chronologically. As revisions are made, a note should be added to the corresponding section of the plan.]

1.8 ADMINISTRATION AND IMPLEMENTATION OF THE MONITORING PLAN

Training or Certification: The Monitoring Program Manager will identify any specialized training or certifications for required project personnel who are responsible for overseeing training and determining how this training will be provided. They will determine the personnel responsible for assuring training requirements are met, determine how training is documented, and where records of training are maintained.]

Organization Structure and Responsibilities

MONITORING PROGRAM MANAGER (OR PROJECT MANAGER)

The monitoring program manager is responsible for overseeing the monitoring procedures and determining Reporting Leads. This person will make sure all Leads and Managers are following procedure.

[Insert any additional text regarding program manager and responsibilities.]

Name
Address
Telephone
Email address

MONITORING FIELD PROJECT MANAGER

The field project manager for this project is *[INSERT: name]*. The field project manager is responsible for maintaining this document and making sure that any changes are well documented and communicated to the field staff and other parties as necessary.

Name

Address
Telephone
Email address

<u>MONITORING FIELD LEAD</u>
[The field lead is the direct supervisor of the staff doing the actual data collection. There may be a different lead for each type of monitoring: hydrometeorological, water quality, bio/eco. Describe the responsibilities of each field lead.]
Name
Address
Telephone
Email address

<u>ANALYTICAL LEAD/CONTRACT MANAGER</u>
[The analytical lead/contract manager is an employee who either supervises an in-house laboratory or manages an outsourced contract]:
Name
Address
Telephone
Email address

<u>QUALITY ASSURANCE LEAD</u>
[Describe the QA Officer's responsibilities and independence. The quality assurance officer should be a member of a third-party, neutral entity (i.e. not part of the sampling team).]
Name
Address
Telephone
Email address

<u>REPORTING LEAD</u>
[The Reporting lead is the employee or contractor assigned to reporting on this project's data analysis and documentation and assigned to review reports submitted by contractors. They should be the single point of contact for questions regarding the status of reports and information on how to obtain copies of reports.]

Program Implementation

[Based on the organization structure and responsibilities presented above, explain how the monitoring plan will be implemented and how each of the various leads interact. Who reports to whom?]

Partnerships

[Describe partnerships in place or that will be put in place to execute the monitoring plan. These could be other Federal or state agencies, universities, contractors, non-governmental organizations (NGOs), etc.]

Program and Protocol Review

[List the reviews that the monitoring plan has undergone (i.e. RECOVER, QAOT) and the reviews that are expected in the future (i.e. scope of work (SOW) review by the QAOT and any Standard Operating Procedures (SOPs) that need to be reviewed by the QAOT). Additionally, technical representatives of the respective monitoring units of the Federal and local sponsor should review SOPs and SOWs. Also list if there will be any periodic reviews (annually, biannually, etc), and by whom. Items that might be considered in a periodic review:

- *Are the right parameters or indicators being monitored?*
- *Are the SOPs appropriate, do they need to be modified, or new SOPs developed?*
- *Is the project management structure working effectively or are changes in roles and responsibilities required?*
- *Do the project results demonstrate the verity of conceptual models, restoration hypotheses, and restoration techniques utilized? If not, how will findings be utilized and findings made in monitoring program review?].*

1.9 COST ESTIMATES

[Give a breakdown of costs associated with each monitoring component (i.e., hydrometeorological, water quality, bio/eco). Guidelines for developing a monitoring program suggest that approximately 30% of the budget should be allocated to information/data management, so that information is not lost, results are communicated effectively, and adequate reporting takes place in a timely manner. Costs should be projected out as far as practicable into future years. Project-level monitoring costs must clearly be identified in the PIR to ensure they are authorized as part of the total project costs to be cost shared by Congress. Monitoring costs for ecosystem restoration cannot be cost-shared longer than 10 years post-construction of a particular component. If it is still required to be maintained for a particular component, it will be 100% non-Federal. Monitoring and assessment activities prior to and during construction should include costs for all of the activities described above (sampling, project (contract) management and associated quality assurance/quality control (QA/QC) costs, data storage, analysis, documentation, and reporting). Funding for instrumentation (automatic samplers, stage recorders and flow meters, etc.) as well as the associated infrastructure such as platforms, power, and telemetry should be included in the cost estimates for monitoring. Any cost of monitoring performed during the period of construction shall be included in project construction costs and any cost of monitoring performed after the period of construction shall be included in project OMRR&R costs. Every effort should be taken and documented to minimize monitoring costs over the life of the project, and should avoid duplication with the RECOVER MAP.]

NOTE: The following is a template for all three sub-monitoring plans – the same basic outline is used for each. Section 2: Hydrometeorological, Section 3: Water Quality, and Section 4: Biological/Ecological. The template is in chronological order – the general order of the monitoring.

HYDROMETEOROLOGICAL MONITORING [3.0 Water Quality Monitoring ; 4.0 Biological/Ecological Monitoring]

2.1 DATA QUALITY OBJECTIVES

[*Formulating project data quality objectives (DQOs) brings awareness to project participants of the minimum data quality required for a project. The DQO process is a tool used to define the type, quality, and quantity of data needed to make defensible decisions for a project. This process systematically defines the requirements for any field investigation and tolerable error limits. It also identifies the intended end use of the data, including decisions that may be supported based on the results of a project.*

The DQO process has both qualitative and quantitative components. The qualitative components encourage logical and practical planning for environmental data collection activities, while the quantitative components use statistical methods to design a data collection operation that will reduce the probability of making a incorrect decisions. Although the quantitative steps of the DQO process are important, investigators and decision makers may choose not to apply statistics (Administrative Procedures Quality Assurance Systems Requirements 10 March 2009) to every environmental field investigation. In some cases, the planning team may utilize only the qualitative steps of the DQO process during the investigation planning phases to generate authoritative data that may be used to confirm site characteristics. The DQOs should be defined for specified project performance and each parameter. However, if similar DQOs are targeted for parameter groups (e.g., hydrologic, meteorologic, water quality), then provide them for the groups. Typically, there are six DQOs to consider: detection limit, precision, accuracy, representativeness, comparability, and completeness. Explain how these DQOs were established. Were they derived in consultation with decision makers and those familiar with the level of uncertainty that is acceptable for ascertaining project success? *For example, a target DQO of 95% for completeness would mean that the number of samples successfully collected and analyzed should be at least 95% of the total number of samples collected]*

[Additional guidance is provided in Guidance for the Data Quality Objective Process (EPA/600/R-96/055) and a simplified version prepared by the QAOT (Guidance in Understanding and Developing the Data Quality Objectives, effective 15 August 2005): http://www.evergladesplan.org/pm/pm_docs/qaot/081505_qaot_dqo_process.pdf.]

2.2 MONITORING DATA ELEMENTS/INDICATORS

[Project-level monitoring plans should identify and justify what monitoring data are necessary for management decisions related to permit compliance, operations and maintenance, and adaptive management. For example, the project adaptive management plans will include

decision-criteria in the management options matrices for making adaptive management decisions, which will need to link to the monitoring parameters thresholds and/or triggers identified in the monitoring plan. For more information on monitoring plans and adaptive management, please refer to the CERP Adaptive Management Integration Guide, Section 3.6 - http://www.evergladesplan.org/pm/pm_docs/adaptive_mgmt/062811_am_guide_final.pdf.
Permits and project operations plans should also include the key decisions to be made. One will also need to take into account the need for certainty (higher probability of the right answer) and precision. One can either list the laboratory and field measurements here or combine it with the collection SOPs, Laboratory Methods and frequencies into one table.]

Procedures and Methods

[List the SOPs for sample collection and the SOPs and/or laboratory method that will be used to measure each parameter. Sampling methods should follow well-defined methodologies that have been approved by Federal and state regulatory agencies. For SOPs, provide the SOP number and title if available. If an SOP is approved by an agency or established by the QAOT but an alternative SOP is being used, provide the justification. If an established SOP is not available, begin working with the QAOT regarding the SOP immediately. The Quality Assurance Systems Requirements (QASR) manual defines analytical methods as well as sample collection and field observations methods that are appropriate for most CERP projects. Once the DQOs are established, the QASR should be consulted to identify the analytical methods that will meet the project objectives. Note - Laboratories evaluating or developing new analytical methods are subject to the same requirements to the extent practicable. In these cases, the laboratories must comply with the Florida Department of Environmental Protection (FDEP) Quality Assurance (QA) Rule, and ensure that the applicable requirements (quality control, documentation, etc.) in the National Environmental Laboratory Accreditation Conference (NELAC) standards are implemented and used to evaluate the results.]

*[Describe any **field instrumentation** that will be used to collect hydrometeorologic (water quality/biological) data. Outline any programming requirements executed prior to field deployment. Describe instrumentation that will be used for samples submitted to remote analytical laboratories.]*

[Laboratories performing work under CERP are encouraged to report data using ADaPT (Automated Data Processing Tool) software, Staged Electronic Data Deliverable (SEDD)(http://www.epa.gov/fem/pdfs/sedd_adr_imp_overview.pdf) or the Automated Data Review (ADR) software. This software aids in processing analytical data, validating format and completeness, checking the data quality, and complying with the method and data quality objectives for all analytical data submitted to sponsor agencies.]

[Each discrete sample should be assigned a unique sample identification number that ensures that it can eventually be retained as a unique database record linked to a specific location. All these activities regarding a sample should be documented in a format that

ensures that the resulting data are traceable and of known, acceptable, and documentable quality.]

Laboratory Qualifications

[In general, laboratories that analyze air, water quality, and soil/sediment samples for CERP must be certified by the Florida Department of Health Environmental Laboratory Certification Program (FDOH ELCP). Certification should be for the test method, analytes/parameters and matrix that are reported for the project. As specified by QASR Chapter 4.0, laboratories used for analysis of CERP environmental samples shall be pre-approved and subjected to comparative testing if available, such as the performance evaluations overseen by the QAOT. These requirements shall be defined in the laboratory's contract or work order with the contracting agency.]

Rationale for indicator selection

[This section should describe why specific parameters and frequencies were selected. Do not go into detail on each parameter, but rather focus on general parameter classes such as macronutrients, micronutrients, metals, pesticides, submerged aquatic vegetation, etc. Rationales can include compliance issues, Clean Water Act, etc, but should also explain how they relate to restoration activities (include conceptual diagrams if needed).]

Sampling frequency and duration

[Frequency of sampling has significant impacts on data representativeness and cost. This section should describe why certain sampling frequencies and durations were selected for the parameters. It may not be necessary to go into detail on each parameter, but rather focus on general parameter classes such as hydrologic and meteorologic. Sampling frequency should be defined as part of the DQO process and be reflected in project permit requirements. Sample frequency should be selected so that data are representative of actual conditions including extreme values, capture natural variability, estimate temporal changes, and provide sufficient information for the detection of changes or differences of management concern, thus meeting the project's DQOs. The goal is to select a sampling frequency that yields estimates of important statistical parameters (i.e., mean, variance, frequency) within prescribed degrees of accuracy, precision, and reliability. The selection of sampling frequencies should balance these considerations so that generated data are sufficient to meet project objectives and remain cost-effective, i.e., "biweekly if flowing, otherwise monthly". Sampling that has been previously completed or ongoing within the project area shall be considered when determining monitoring sites, duration, and frequency. The goal is to optimize monitoring, therefore, if existing information is available, building upon existing information is important in the overall goal of monitoring for CERP projects. If previous monitoring sites are available, the project shall use these to avoid duplicative monitoring data. Specific guidance for determining appropriate sampling frequencies is given in the QASR.]

Assessment Process and Decision Criteria (triggers and thresholds)

[How often will assessments take place and for what purpose? Are there any trigger levels that would cause the agency or others concern, or would require a response? For example, cite state or federal water quality standards. For assessments related to Adaptive Manager refer to guidance on project assessments found in the CERP Adaptive Management Integration Guide - section 3.7 http://www.evergladesplan.org/pm/pm_docs/adaptive_mgmt/062811_am_guide_final.pd]

2.3 DATA COLLECTION

Sample/Data Collection Standards and Ethics

Every person performing field sampling must commit to following project specific requirements, field SOPs, QASR requirements, and other instructions as issued, to ensure that samples collected are of acceptable quality and are legally defensible.

Sample Submission

[Hydrometeorological – is unlikely to have this section, but will have the data processing section below.]

Water Quality –

Requirements for sample handling, custody and analysis holding times are detailed in the *SFWMD's Chemistry Laboratory Quality Manual or FDEP SOP-001/01 [or identify another reference]*.

Samples are submitted according the requirements outlined in the *[SFWMD's Field Sampling Quality Manual or identify another reference]*.

Biological/Ecological: Outline how samples will be submitted.]

Chain of Custody

[The header sheet, also called a Chain of Custody (COC) must accompany all samples submitted to internal or external laboratories. A COC form documents the possession of the samples from the time of collection to receipt in the laboratory. A COC form will be utilized and must be signed by the collector before it is relinquished to the laboratory. This form will identify: project, the number and types of containers, the mode of collection, the collector, time of collection, preservation, requested analyses, collection agency, sample identification number, sample site, sample date, sample time, sample type, weather, sample depth, matrix code, collection span, and in situ measurements. The form must be legible, accurate and complete. If a COC form will not be utilized explain why. More information on COC, its importance, and sample forms can be found at http://www.epa.gov/apti/coc/.]

Quality Control Samples

Quality control samples will comply with Section 5.8 of the QASR manual, Florida Department of Environmental Protection (FDEP) requirements (DEP-SOP-001/01, DEP-SOP-002/01), and those developed in the DQO process. *[INSERT frequency and quantity of samples for field blank (FB), pre-cleaned* *equipment blank (EB), field cleaned equipment blank (FCEB), trip blank (TB), field duplicates (FD) or replicate sample (RS) and split sample (SS).]*

All requirements in the FDEP's Quality Assurance Rule should also be followed.

Data Validation

[Describe the procedures used for assuring that raw data are validated. Are range checks used to test for outliers? Are locations plotted on maps to make sure the correct coordinates were collected? The use of ADaPT, SEDD, ADR or other verification software should be noted here. The use of these systems will also ensure that the qualifiers make it into electronic data storage. The QASR chapter relating to the type of monitoring being performed (i.e. hydrometeorological) will have additional information and guidance on verification and validation.]

Data validation will occur in the field as well in the laboratory as outlined below.

Responsibilities of the Field Project Manager
The field project manager will review header sheets, field notes, and calibration documentation as well as the entry of these items into the database. The field project manager will approve the electronic version of the data. The field project manager will ensure the field notes were filled out according to protocol and ensure they are stored properly in Documentum.]

Responsibilities of the Sampling Team
[The validation procedures for field collected data differ from those used for "standard" analytical laboratory parameters due to the use of different instruments and techniques, but the principles are the same: data are evaluated against the QC criteria and DQOs defined in the QASR and/or the monitoring plan. SOWs *for collecting data should require data submitted by contractors be validated, meet the DQOs and QA/QC procedures and be in a format that is readily incorporated into a shared data environment.]*

The sample team will review and validate the sampling data collected during the course of the sampling event. This includes header sheets, field notes, and calibration sheets. Data that are deficient are qualified to indicate that the data should be used with caution. The sample taker's signature indicates that the data have been reviewed and validated.

Responsibilities of the Laboratory
[If the laboratory enters field data into the database, then the laboratory will review the data for completeness and accuracy.]

Raw Data

[For the purposes of this section, raw data are defined as any of the parameters that have been collected from a field location and have not been processed or undergone any QA/QC. Note what will be done with these raw data files – will they be kept?]

Data Processing

[Some field and laboratory instruments produce electronic data streams that must be processed to generate final data. Data processing procedures may include the use of specific manufacturer calibration factors and formulae. Data processing procedures and formulae should be defined and documented in equipment protocols, organizational manuals, and/or organizational SOPs. Biological, meteorological, hydrologic, hydraulic, and remote sensing data should undergo data processing and QA/QC procedures outlined in the QASR prior to storage in the shared data environment (i.e., DBHYDRO and/or CERP Zone database). If gaps in meteorological, hydrologic and hydraulic data are filled, established procedures should be used and documented for generating data estimates.]

Water Quality: Prior to data validation, the laboratory will provide electronic data using ADaPT EDD, ADR or SEDD software [*identify any other software required for the project*]. After the data validation process, all data are archived in DBHYDRO *[or CID/EGRET]* and maintained so that it can be retrieved and all information relative to a sampling event reviewed. [*The SFWMD DBHYDRO database should be the repository for all water quality, hydrologic, well construction, geophysical, and lithologic data. The CERP Integrated Database (CID) on CERPZone should be the repository for all other data.*]

Data Storage and Archiving

[Long-term maintenance and management of digital information are vital to all PLMPs. Maintaining and managing digital data, documents, and objects that result from projects and activities is the responsibility of all parties involved. Following CGM54 will help ensure the continued availability of crucial project information and permit a broad range of users to obtain, share, and properly interpret that information.]

Data will be entered into DBHydro. If data are not suitable for DBHydro they will be entered into the CERP Integrated Database (CID) on CERPZone through the Morpho interface.

[List where the data will be stored, who will be responsible for data entry and how soon after collection/analysis it will occur.]

2.4 DOCUMENTATION

[This section contains the minimum guidelines and requirements for field documentation. This section is written for the purpose of standardizing the field reportable data and dialogue so that the users can more readily access, comprehend, and utilize those data. Field documentation must be sufficient and clear to allow tracking of provenance and custody for any sample

collected or any measurement performed. Accuracy, consistency, and legibility are key factors that will enhance the utilization of the field data. If specific forms will be used, instead of a field notebook, then copies of the forms should be included as appendices to the PLMP.]

For all documents the following standards should apply:

- Print text, do not use cursive handwriting.
- Dates should be recorded as MM/DD/YYYY.
- Time should be recorded in 24-hour format using local time.
- Logs and notes should be recorded on site and at the time of collection.
- Entries are to be made in waterproof ink.
- Samplers should be properly trained.

[For more details see the appropriate QASR chapter.]

Field Notes

Relevant field observations will be noted in a bound waterproof notebook that is project specific. The following information will be entered into the field notes: project name, frequency, trip type, date, collectors, responsibilities, weather, preservation/acids, labs submitted to, sample ID, site ID, time collected, and sample type. Additional comments on observations, equipment cleaning, maintenance, and calibration will also be recorded.

Field Instrument Calibration Documentation

Records of field instrument calibration will be kept and FDEP, South Florida Water Management District (SFWMD) or USACE SOPs for calibration will be followed. *[Note, these are minimum requirements; the exact requirements of the calibration are dependent on the model of probe, the parameters measured, the range of parameters expected, and the range of parameters encountered.]*

Corrections

[If sample collectors, the laboratory, or the project manager discover errors in any of the field notes, header sheets, or calibration sheets, corrections may be required.]

Corrections to header sheets, field notes, or calibration sheets will only be made by staff who participated in the production of the document. Changes will be made by striking through the error, writing the correction, initialing and dating the change. On occasion a detailed explanation of the error may be required.

2.5 QUALITY ASSURANCE AND QUALITY CONTROL

System for assessing data quality attributes

[Describe all activities that will be used to assess the quality of the data and whether the DQOs are being met. These activities may include laboratory audits, use of performance evaluation materials (PEMs), National Institute for Standards and Testing (NIST)

standard reference materials, field audits, reference samples, field procedural blanks, reference sites, training, certifications, etc. If DQOs are not met, explain what corrective actions will be taken, e.g., reanalysis, resampling, flagging the data, etc.]

Data quality qualifiers

[Data quality refers to the level of uncertainty associated with a particular data point or value. This is assessed by examining the quality of collection and analysis, determining compliance to method and regulatory requirements, determining whether both field and laboratory analytical results meet the DQOs, and any other background information affecting data quality. Data not meeting the data quality objectives must be qualified using standard FDEP qualifier codes (F.A.C. 62-160) or other codes appropriate for the organization or agency.]

Field Audits

Audits will be performed according to the QASR Manual. Reports will be reviewed by the project manager. Reports will describe the frequency, type, and responsibility for conducting field and laboratory audits. The authority of the auditor to stop work will also be defined, along with how and to whom the audit findings are reported, processed and distributed.

2.6 DATA ANALYSES AND RECORDS MANAGEMENT

[*For the purposes of this PLMP, data analysis is defined as the processes by which monitoring and other observations are turned into meaningful information. We have defined "data analysis" broadly to include all evaluations of data after the data are collected and entered into an electronic file. Thus, data analysis includes quality control checks that occur during summarization and exploratory data analysis and extends through to analytical procedures leading to conclusions and interpretations of the data. Some field and laboratory instruments acquire electronic data streams that must be processed to generate final data. Data processing procedures may include the use of specific manufacturer calibration factors and formulae. Data processing procedures and formulae should be defined and documented in equipment protocols, organizational manuals, and/or organizational SOPs. Biological, meteorological, hydrologic, hydraulic, and remote sensing data should undergo data processing and QA/QC procedures outlined in the QASR prior to storage in the shared data environment (i.e., DBHydro and/or CID). If gaps in meteorological, hydrologic and hydraulic data are filled by interpolation procedures, established procedures should be used and documented for generating data estimates. NOTE: storage of data is governed by CGM 54 and the data management appendix of a project's PMP. Specific formats for the data are available on CERPZone.org or through the SFWMD for DBHydro. Questions regarding data management in general should be directed to the CERP Data Management program managers.*]

Data Quality Evaluation and Assessment

[The data quality assessment (DQA) process uses scientific and statistical data evaluation procedures to determine if the data are of the right type, quantity, and quality to support their intended use. The DQA process is discussed in the QASR Chapter 11

and detailed methods are described in EPA QA/G9R, Data Quality Assessment: A Reviewer's Guide (EPA, 2006a) http://www.epa.gov/quality/qs-docs/g9r-final.pdf. The Science Policy Council has defined general data quality assessment factors (EPA, 2003) http://www.epa.gov/osa/spc/pdfs/assess2.pdf) that should be considered during the DQA process. These include soundness, applicability and utility, clarity and completeness, uncertainty and variability, and evaluation and review.]

[*Reporting on mercury and pesticides or other toxicants should be done under the supervision of professionals with a record of published research in these areas using approved guidance such as the QASR Manual and CGM 42 Toxic Substances Screening Process - Mercury and Pesticides*.]

2.7 ADAPTIVE MANAGEMENT CONSIDERATIONS

[*Explain how the data will be interpreted and used as feedback to determine the effectiveness of the restoration activity. Describe what corrective actions should be taken if performance measure targets are not met. What procedures will be utilized to determine whether the correct parameter is being measured, and at the right frequency and duration? How much time is expected before a change is expected to be observed in the system? Are critical thresholds, whether beneficial or negative, anticipated in system characteristics or potential restoration response? Are stochastic events or less frequent recurrence events needed to obtain desired restoration results, or could such anticipated events confound achievement of restoration targets? Discuss use of rate trends rather than absolute levels as decision criteria. What criteria must be met to declare the project a success? What is the governance structure for adaptive management and supporting monitoring decisions?]*

WATER QUALITY

[The Water Quality section will follow the same annotated outline as in Section 2 of this PLMP template for preparing the water quality monitoring section. Note that items specific to water quality are noted in Section 2.]

BIOLOGICAL/ECOLOGICAL

[The Biological/Ecological section will follow the same annotated outline as in Section 2 of this PLMP template for preparing the water quality monitoring section. Note that items specific to biological/ecological are noted in Section 2.]

REFERENCES

CERP Guidance Memorandum

South Florida Water Management District – Jacksonville District, U.S. Army Corps Of Engineers

CGM NUMBER-REVISION: 42.01

EFFECTIVE DATE: July 21, 2010

CATEGORY: Water Quality

SUBJECT: Toxic Substances Screening Process - Mercury and Pesticides

DESCRIPTION:

This memorandum provides guidance to both Jacksonville District, U.S. Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD) staffs on screening for toxic substances, such as mercury and pesticides, in CERP projects.

The purpose of this CERP Guidance Memorandum is to provide project managers and teams with a uniform scheme for (1) screening project alternatives for the likelihood of unacceptable impacts from toxic substances; and (2) detecting project-related impacts of toxic substances and monitoring their mitigation. The scheme is adaptive and is intended to apply scarce resources where most needed.

It uses guidance developed by the SFWMD for District projects. This document is attached as Appendix A and, as guidance, can be used for projects co-sponsored by the USACE and SFWMD. It does not replace environmental site assessments that are usually the responsibility of the local sponsor nor does it imply USACE participation in any required remediation which is the responsibility of the local sponsor.

GUIDANCE:

Appendix A presents the details of the tiered process for screening each phase of a CERP project: Phase I addresses toxicant monitoring and assessment during the development of the Project Implementation Report (PIR), project design and construction; Phase II involves monitoring activities during project start-up or stabilization; and Phase III addresses activities during project operation. Each Phase has two or more tiers. Each tier begins with minimal sampling and testing. It progresses to more complex assessments as site conditions warrant.

For example, Phase I, Tier 1 assesses existing baseline data, requiring additional monitoring only if there is a gap in data needed to establish the baseline. Tier 2 consists of screening bulk sediment concentrations against basin-wide conditions and fish collection upstream, downstream and, where water bodies are found, within the project footprint. If Tier 1 baseline monitoring indicates that risk from mercury or other toxic substances is acceptable based on basin-wide conditions, the project remains in Tier 1 and only minimal monitoring is required upon start-up (Phase II).

Conversely, projects that exceed action levels in Tier 1 proceed to Tier 2, which requires additional monitoring to guide the development of alternatives. Projects in Tier 2 would require expanded monitoring at start-up. If, due to schedule or other considerations, the project proceeds to the operation phase without Tier 1 baseline monitoring, it does so at risk, automatically defaulting to a higher level of operational monitoring requirements.

The same approach, procedures, and decision logic are applied to the other phases of the project. If results from routine operational monitoring exceed a specified action level, follow-up tests are triggered to support further project decisions and adaptive management. Conversely, if the routine monitoring establishes the absence of a toxic substances problem over a specified time interval, the frequency of monitoring is first reduced and then eliminated altogether.

Federal government policies related to hazardous, toxic and radioactive wastes (HTRW) (RCRA, CERCLA and ER 1165-2-132) present issues involving the Corps participation in cost sharing and longevity of participation in monitoring. These issues need to be dealt with on a project by project basis, either within the Project Cooperation Agreement (PCA) or subsequently by project managers as the need arises. In some cases, HTRW issues will need to be resolved at a higher level.

APPLICATION:

Effective immediately the guidance provided in Appendix A of this CGM will be used to by USACE and SFWMD project managers and the staff of both agencies to screen projects for mercury and pesticide toxicity.

SFWMD contacts are listed at the end of Appendix A. The USACE contact for this CGM is Lisa Gued (904-232-1793, Lisa.R.Gued@usace.army.mil).

CERP Guidance Memorandum

South Florida Water Management District – Jacksonville District, U.S. Army Corps Of Engineers

CGM NUMBER-REVISION: 42.01

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DATE: Aug 3? 2010

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Appendix A

A Protocol for Monitoring Mercury and Other Toxicants

INTRODUCTION

This document is intended to guide in the design of monitoring and assessment plans for mercury (Hg), pesticides, and other toxicants for South Florida Water Management District (District or SFWMD) projects. Because Hg is a regional problem in South Florida, it should be a consideration in all plans. As discussed below, although other toxicants are often found dispersed in various media throughout South Florida (e.g., water, sediment, biota), concentrations do not frequently exceed critical levels that are thought to result in toxicity. Therefore, risk from exposure to other toxicants tends to be a more localized concern than for mercury. More importantly in this context, the risk from changes related to the Comprehensive Everglades Restoration Plan (CERP) increasing the likelihood that wildlife will be exposed to these constituents, to a level that is toxic, also tends to be a localized concern. Accordingly, monitoring other toxicants should be considered on a case-by-case basis. It is not the intent of this plan to substitute for environmental site assessments (ESA) that are conducted on acquisition tracts. The District has an excellent record in conducting ESAs, site-specific environmental risk assessments (ERA), and implementation of corrective actions, where appropriate. This guidance has been prepared in consultation with and, where possible, will be implemented in coordination with the District's program for assessing the environmental liabilities associated with land transfer. However, the potential for anomalous methylmercury (MeHg) production is not considered during the ESA and thus must be assessed separately. With regard to other toxicants, the guidance provided here should prove useful in cases where:

- an ESA identified dispersed low-level contamination of toxicants and there is a need to reduce uncertainties, i.e., better define spatial or vertical distribution,
- where lands were purchased by other public/private entities, but may not have been subjected to the same level of ESA as current transfers,
- there has been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee), or
- where other toxicants have previously been identified as a concern on public lands (i.e., possibly as a result of stormwater runoff).

Results from the monitoring and assessment plan, in combination with information generated during land transfers, are intended to provide state and federal regulatory and trust oversight agencies with reasonable assurance that the project will not cause or contribute to an unacceptable increase in the risk of toxic effects to aquatic or terrestrial resources. As discussed below, the current numerical water quality standard (WQS) for total mercury (THg) is not protective of human or wildlife health. Consequently, assessments will need to place greater weight on protecting designated beneficial uses, i.e., recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. This will also be true for other toxicants that can be released suddenly from flooded soils and/or that have the potential to biomagnify. In addition to numerical water quality standards, assessments will need to consider Line 62 of chapter 62-302.530, Florida Administrative Code (F.A.C.), that states that substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals shall not be present. In addition to state requirements, federal legislation that may be pertinent include the Comprehensive Environmental Response, Compensation and Liability Act, the Endangered Species Act, and/or, the Migratory Bird Treaty Act. This guidance uses a phased, multi-tiered approach that is intended to commit information gathering, assessment and remedial resources in proportion to the likelihood of harm by following a logical and cost-effective procedure. The plan covers three phases of a project: (I) Baseline Collection and Assessment, (2) Monitoring during the Three Year Stabilization Period, and (3) Routine Operational Monitoring (Post-Stabilization). The plan includes decision criteria (i.e., if - then statements) and adaptive managements strategies to respond to a number different of scenarios. If an identified threshold of concern (i.e., action level) is crossed, then Tier 2 expanded monitoring and risk assessment would be triggered to determine the cause and guide appropriate adaptive management decision making regarding short-term corrective actions and long-term operational optimization. The intent of this approach is to allow monitoring efforts to smoothly ramp down or up, as appropriate.

This general plan is intended to accommodate diverse projects by providing a framework that can be tailored to a project's specific design. For example, a monitoring and assessment plan for a wetland restoration project would likely differ substantially from a plan for a Stormwater Treatment Area (STA) or reservoir. While it is anticipated that this guidance will serve as a frame of reference for future permit-mandated monitoring, incorporation of all, some, or none of its elements into a permit is at the discretion of the responsible authorities.

Mercury

Although atmospheric loading is often the dominant proximate source of inorganic mercury to many water bodies, the complication lies in the relationship between influx of inorganic mercury and the amount that"is methylated by sulfate-reducing bacteria (SRB) following deposition. The latter process is of fundamental concern because MeHg is the more toxic and bioaccumulative form that can build up in the food chain to levels harmful to" humans and other fish-eating animals, particularly in ecosystems with complex, lengthy food chains. Accordingly, a monitoring and assessment plan must be able to detect increased amounts of MeHg in the project area or downstream waters, either through sedimentary release of THg or MeHg, or through increased net Hg methylation. Although there are some constraints in predicting outcomes, the following factors are thought to be associated with increased MeHg production, particularly when in combination with certain site conditions (i.e., sediment biogeochemistry that is, as yet,
less well-defined):

- Increased proportion of source water from direct rainfall relative to surface water runoff (explanatory note: rain contains elevated levels of bioavailable inorganic Hg, particularly during summer; whereas, surface water runoff has already lost Hg through evasion back to atmosphere, sorption and deposition, and biological uptake);
- Elevated levels of oxidized sulfur compounds (e.g., sulfate, etc.) in inflows or sediments (explanatory note: used as electron acceptor by SRBs);
- Drawdown - drying followed by rewetting (explanatory note: allows constituents in the sediments/soils to oxidize); or
- Large bioavailable carbon source (explanatory note: feeds SRBs).

The goal is to prevent these factors from combining to produce a mercury methylation hot spot both in the short term (known as the "first-flush effect") and the long term (known as the "reservoir effect"). For additional details, see evolving conceptual model presented in the Fink et al., 1999; Stober et al., 2001; Harris et al., 2004; Atkeson and Axelrad, 2004.

The Florida Department of Environmental Protection (FDEP) has recognized that the current Florida numerical water quality criterion of 12 nanograms of total mercury (THg) per liter (ng/L) in water is of limited use, because fish consumption advisories have proven necessary for waters meeting the state criterion (Atkeson and Parks, 2002). Likewise, the U.S. Environmental Protection Agency (USEPA), also recognizing the limited utility of its recommended water quality criterion for the protection of human health, recently published guidance on a new criterion expressed not as a water-column concentration of mercury, but as a concentration of mercury in fish tissue (0.3 milligrams per kilogram (mg/kg) in fish tissue; USEPA, 2001). Biomonitoring mercury provides several advantages. First, MeHg occurs at much greater concentrations in fish tissues relative to surrounding water, making chemical analysis more accurate, precise, and cost effective.

Second, organisms integrate exposure to MeHg over space and time, while corresponding water concentrations may vary by a factor of two or more over a period of hours. Finally, the tissue Hg concentration in fish is a true measure of its bioavailability and provides a much better indicator of possible exposure to fish-eating wildlife and humans than the concentration in water. Because it is cost-effective, this generic plan has a biomonitoring program as a key component. The long-term goal is to reduce tissue Hg concentrations in predatory fish to levels that do not exceed USEPA guidance values for the protection of both human health and wildlife (for guidance values to protect wildlife, see USEPA, 1997). However, it should be recognized that the Everglades has a preexisting, widespread mercury problem (i.e., fish from most areas currently exceed one or more predatory protection criteria) and that many of the influential factors controlling MeHg production are beyond the scope of individual projects. Accordingly, use of USEPA's guidance criterion as a "risk-based" action level is not appropriate in the short term. Instead, monitoring and assessment plans will track the status and trends of mercury bioaccumulation to ensure that it does not significantly increase over baseline levels. This monitoring and assessment plan incorporates action levels or triggers for decision points based on existing reference or baseline conditions (i.e., annual basin-wide arithmetic average or percentile concentration for all basins pooled). For purposes of pooling related data, the basin will be operationally defined based on the physiography and land uses of the watershed, category of water body (e.g., wetland, slough, open lake, etc.), and the data set available at that time. Ideally, the data set would allow for comparisons between similar habitat or sediment types. However, near-term projects may not have this option and may need to collect reference samples (especially where data on similar sediment types are unavailable) or use surrogate data collected at Stormwater Treatment Areas or Water Conservation Areas under the Everglades Forever Act Permits for comparative purposes.

Other Toxicants

Potential impacts to wildlife from exposure to toxicants other than mercury (e.g., organic pesticides or trace metals) continue to be a problem. This is of particular concern in Florida because of its complex stormwater management system from both urban (e.g., lawns, golf courses, "street dust") and agriculture, high groundwater table, and significant usage of a wide variety of pesticides and fertilizers. Fertilizers (including organic and biosolids) are a concern because several studies have measured heavy metals (e.g., cadmium, lead, nickel, and copper) in mineral ores and the resulting fertilizers (USEPA, 1999). Like mercury, many other toxicants, including relic (e.g., DDT, DDE, toxaphene, etc.) and new (e.g., atrazine, alachlor) pesticides, have been found to be atmospherically deposited from both local and global sources (for details, see Eisenreich et al., 1981; Goolsby et al., 1993). Consequently, source identification can be challenging.

Owing to their absorptive capacity, soils and sediments typically act as a sink for these contaminants. As long as these soils/sediments maintain the capacity to store and thus immobilize the potential toxicant, the effects are significantly reduced. However, any alteration in the environment (e.g., flooding, anoxia and redox, microbial processes, pH changes) can suddenly reduce the sediment's storage capacity, which in turn can result in serious environmental damage (see "Chemical Time Bomb" concept in Stigliani et al., 1991).

Pesticides have been detected in sediments and surface water at District structures at various times (Miles and Pfeuffer, 1997; Pfeuffer and Matson, 2003; Pfeuffer and Rand, 2004). Likewise, pesticide residues have been found in fish and wildlife from certain locations in the central and southern Everglades (USGS National Water Quality Assessment Program at http://fl.water.usgs.gov/Abstracts/fs110_97_haag.html; Rumbold et al. 1996, Spalding et al. 1997, Rodgers 1997, Fernandez et al. 2003). Recently, a bird kill in excess of 800 birds occurred on Lake Apopka, possibly as a result of pesticide poisoning, after former farmlands were flooded (http://floridaswater.com/lakeapopka/). The monitoring and assessment plan for other toxicants often takes advantage of the mercury monitoring program, as in many cases, additional work simply involves splitting samples.

MONITORING AND ASSESSMENT FRAMEWORK

1. Phase 1 - Baseline Collection and Assessment

This section describes activities conducted during the initial stages of a project. Phase 1 tests are meant to provide information regarding the likelihood that a given alternative may have a problem with mercury or other toxicants in the future, i.e., so that managers may avoid those sites or operational features. In other words, these tests are meant to control the risk to the District that the constructed facility will have negative consequences. In some cases, a Project Manager may opt to carry out these activities prior to site selection (i.e., on short-listed sites) to provide additional information to guide in the selection process. If site selection has already occurred, then a Project Manager may elect to carry out these tests to assist in selecting the final design (e.g., footprint or operational features). As previously stated, it is not the intent of this plan to substitute for ESAs that are conducted on acquisition tracts. Results of those assessments are routinely reviewed and receive necessary approvals from the U.S. Fish and Wildlife Service; and are provided to the FDEP. Accordingly, where an ESA has recently been completed, baseline collection and assessment of toxicants other than Hg is not a general recommendation beyond the Phase 1 - Tier 1 task of compiling and reviewing existing data. Although these tests are a general recommendation for mercury, it should be understood that due to current limitations in predicting methylation potential, results of these tests should not be the sole factor in making site or design selection. Nonetheless, information gathered during this phase of the project will be crucial in developing the final monitoring plan and as baseline for future, post-construction cause-and-effect assessments.

1.1 Phase 1 - Tier 1: Compilation and Review of Available Data

The first step in any project is to compile and review all available data (e.g., ESA, DBHYDRO - http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_menu, Battelle Monitoring Data

Inventory, results of the District's pesticide network (http://my.sfwmd.gov/portal/pls/portal/portal_apps.repository_lib_pkg.repository_browse?p_option=browse&p_perspectives=24896012&p_mode=all) collected from the project footprint and surrounding area. With regard to other toxicants, data should be reviewed to answer the following questions:

- If part of a land transfer, who was the responsible agency and what was the level of ESA performed (i.e., Phase I or 2)?

- Did the ESA identify contaminants of concern?

- Were any corrective actions taken and was there follow-up sampling?

- Was there dispersed low-level contamination of toxicants (i.e., that did not exceed the requirements for corrective action)?

- Has there been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee) and, if so, what chemicals may have been used in the interim?

- If public lands, have toxicants been previously identified based on surface water, sediment or fish monitoring?

Answers to these questions will guide in developing an abbreviated analyte list for subsequent monitoring.

In areas that have been extensively studied, projects may have adequate baseline datasets and may not require any additional data before developing the Phase 2 monitoring and assessment plan. Alternatively, where data gaps exist or where the preponderance of the baseline data demonstrate a potential problem, additional sampling (i.e., under Phase 1 - Tier 2 or Tier 3) may be necessary.

1.2 Phase 1 - Tier 2: Field Sampling

1. 2.a Soil/Sediment

To describe conditions within each project, it is recommended that soil/sediment cores be collected from five locations within each operable unit (i.e., OU - each independently operated treatment train of an STA or reservoir) or each 1,000-acre parcel, whichever is smaller. At each location or site, three cores from the 0-to-4 cm horizon are to be collected and composited as a single soil sample. To conserve resources at large projects, sub-samples or aliquots from each of the soil samples from the five different locations can be pooled to form a single supercomposite sample for each OU or 1,000 acres. In this two-staged sampling approach, the analyses of the supercomposite representing the entire OU or 1,000 acres can be used as a screening mechanism to identify if additional, individual analysis are need to be performed (on each of the individual soil/sediment samples). Accordingly, remaining material from each soil sample will be archived separately for up to one year to allow for possible future analysis.

If the site was flooded and sediments had been saturated for some period of time (i.e., in excess of a month) with water comparable to future source water, then sediments may be immediately analyzed for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe). Alternatively, if soils were collected from a dry site (i.e., orange grove, range land, etc.), then baseline concentrations will not reflect future flooded conditions (i.e., potential for MeHg production or first flush). Accordingly, soil/sediment must first be incubated with source water (i.e., surface water containing ambient concentrations of sulfate and dissolved organic carbon mixed with rainwater containing bioavailable inorganic Hg) for a period to evaluate this potential for first flush and future MeHg production. This test (i.e., beaker-scale microcosm test) will use fresh soils (i.e., the supercomposite from above) and ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg), and will be run under static conditions, with frequent renewal. Upon completion of the test, sediments will be collected and analyzed for THg, MeHg, moisture content, TOC, TS, and TFe.

If deemed necessary, based on the discussion above, soil/sediment samples (wet or dry) could also be split and analyzed for toxicants of concern identified either through an ESA, available water quality (WQ) database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although this coarse sampling would likely miss possible "hot spots" (e.g., fuel loading or pesticide mixing zones), which should have been detected during the ESA (when cores were collected from 5-acre subparcels and composited for randomly selected 50-acre parcels), this level of detail should be sufficient to characterize dispersed contaminants.

The objectives of screening for toxicants are (1) to prevent direct toxicity, either acute or chronic, and (2) to prevent the biomagnification of toxicants from reaching unacceptable levels that would pose a threat to upper trophic level wildlife. To achieve the first objective, toxicants would be evaluated against effects-based, numerical sediment quality assessment guidelines (SQAGs for sediment dwelling organisms, MacDonald Environmental Sciences Ltd. and United States Geological Survey, 2003). In cases where the effects-based SQAG did not assess the potential for adverse effects on aquatic organisms due to the resuspension of sediments or partitioning of contaminants into water (i.e., using elutriates or pore water), soils may be subjected to a synthetic precipitate leaching procedure (SPLP; USEPA Method 1312; also see Brannon et al., 1994) using ambient source water to elute the column and the resulting elutriate assessed based on Chapter 62-302, F.A.C. (and other references contained in Pfeuffer and Matson, 2003); exceedances would trigger Tier 3 assessments. To achieve the second objective, bioaccumulative toxicants would also be evaluated against established bioaccumulative-based SQAGs, if available (MacDonald Environmental Sciences Ltd. and United States Geological Survey, 2003).

A project would stop and reevaluate the ESA (if completed) and/or proceed to Phase 1 – Tier 3 Bioaccumulation Tests and Dynamic Modeling if:

- concentrations in sediments exceeded the appropriate SQAG,
- concentrations in sediments exceeded a value reported in the ESA or a level that was determined to be critical in a site-specific risk assessment, or
- the concentration in the elutriate exceeded a WQS in Chapter 62-302, F.A.C.

Although bioaccumulation-based SQAGs have been developed for a limited number of toxicants, there is no chemical-specific SQAG for mercury. Consequently, there is no screening-level benchmark sediment THg or MeHg concentration that can be used to confidently predict whether a site will become a "MeHg hotspot". However, data collected over the last nine years by various agencies working in the Everglades offer some limited capability as a reference (or baseline) to predict the potential for excessive MeHg production. Accordingly, as one of several potential tools for alternatives analysis, it is recommended that soil/sediment conditions of the site be assessed for MeHg production potential through comparisons with this reference database. If absolute concentrations of MeHg, or %MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediment from an OU exceeds the 90% upper confidence interval for within basin sediments or, if not available, the 75th percentile concentration (or %MeHg) for all basins, then the potential exists for excessive MeHg production and, accordingly, it is recommended that the project proceed to Phase 1 - Tier 3.

As previously discussed, a great deal of uncertainty remains surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Accordingly, as discussed in the following section, it is recommended that resident fish also be collected to assess current MeHg production and bioaccumulation.

1. 2.b Fish Tissues

At a minimum, fish samples from multiple trophic levels should be collected upstream and downstream of each project. Specifically, a sample of at least 100 mosquitofish *(Gambusia spp.)* should be collected from each location and composited into a single sample for THg analysis. Additionally, individual sunfish [sample size (n) should be greater than or equal to 5; whole-body] should be collected from each location and analyzed for THg. Where habitat will support largemouth bass *(Micropterus salmoides)* and there is a possibility of future recreational harvesting, bass should also be collected and individually analyzed for THg (n should be greater than or equal to 5; fillets). Because virtually all (> 85 %) of the mercury in fish muscle tissues is in the methylated form (Grieb et al., 1990; Bloom, 1992; SFWMD, unpublished data), the analysis of fish tissue for THg, which is a more straightforward and less-costly procedure than for MeHg, can be interpreted as being equivalent to the analysis of MeHg.

To reduce variance (i.e., due to species related differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill *(Lepomis macrochirus)* ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches); however, other lepomids (first priority being given to spotted sunfish, *L. punctatus,* due to similar trophic status) or sizes are to be collected if efforts fail to locate targeted fish. If neither sunfish nor bass are present, then consideration should be given to sampling other species.

In addition, if possible (i.e., if flooded), mosquitofish should also be collected randomly from multiple locations from each OU or 1,000 acres (total should exceed 100 mosquitofish) and physically composited to from a single mosquitofish sample representative of the entire OU.

Body burdens in upstream and downstream fish do not provide predictive capabilities for alternatives analysis; however, this data set will be a crucial baseline for trend analyses following initiation of flow-through operation. Alternatively, ambient fish from the interior or footprint do provide some predictive capabilities for alternatives analysis. If these mosquitofish demonstrate excessive levels of MeHg bioaccumulation that exceed the 90% upper confidence level of the basin-wide annual average (reference basin will be defined for each specific project) or the 75th percentile concentration for the period of record for all basins, then it is recommended that the project proceed to Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling.

If deemed necessary, based on the discussion above, fish samples could also be split and analyzed for bioaccumulative toxicants identified either through an ESA, available WQ database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although it is recognized that under certain circumstances a taxa other than fish may be more appropriate biological sentinels depending on toxicant and risk assessment endpoint, this will require a thorough justification.

If levels of other toxicants in tissues exceed recognized background tissue concentrations (USGS National Water Quality Assessment Program, etc.) or benchmarks established in ecological risk assessments completed as part of the ESA, then the project would stop and reevaluate the ESA or proceed to Tier 3 Bioaccumulation Tests and Dynamic Modeling.

1. 3. Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling

Tier 3 assessments during Phase I Baseline Collection and Assessment are triggered if one of the following action levels is exceeded:

- If absolute concentrations of MeHg, or average %MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediments from an OU exceeds the 90% upper confidence level of within the basin average, or if not available, the 75th percentile concentration (or %MeHg) for all basins;
- If concentrations of other toxicants in soils/sediments exceeded benchmarks established in ecological risk assessments completed as part of the ESA, or exceeded an appropriate SQAG, or the concentrations in the elutriate exceeds Chapter 62-302, F.A.C.; or
- If ambient fish collected within the project boundary demonstrate excessive bioaccumulation that exceeds: 1) the critical tissue benchmark used to establish SQAGs or in site-specific risk assessments or, 2) 90% upper confidence level of the basin-wide annual average, or if not available, the 75th percentile concentration for all basins.

Before proceeding to full Tier 3 sampling or modeling, the following steps are recommended to better define spatial extent of problem (i.e., to focus future efforts and thus conserve resources).

Step 1. Run analytical chemistry on the five individual soil samples that comprise the supercomposite that exceeded the trigger.

Step 2. Resample mosquitofish at a finer scale (i.e., 1 sample per 200 acres) within the OU or 1,000 acres for which the Tier 1 composite sample exceeded the trigger.

1.3.a Bioaccumulation Tests

As previously discussed, uncertainties remain surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Depending on soil conditions (e.g., concentration of TOC, TS, or TFe) bulk concentrations could substantially overestimate the fraction of MeHg actually bioavailable to aquatic animals living on or in surficial soils and thus the short-term MeHg bioaccumulation potential.

To reduce this uncertainty, a standardized laboratory determination of MeHg bioaccumulation (ASTM 1688-00a, EI706-00el, or equivalent; also see Ingersoll et al., 1998; Nuutinen and Kukkonen, 1998) may be carried out using soils collected from multiple locations within the footprint of the proposed component; supercomposite from above or individual composites (if area has been defined by sediment concentrations). Because most of the cost of this test is associated with the collection of soil/sediments, a Project Manager may opt to collect sufficient soil/sediments for this test during Tier 1 sampling.

The bioaccumulation test will use soils/sediments and ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg) and will be run under static conditions with frequent renewal. Current standard protocols utilize infaunal invertebrates (e.g., *Lumbriculus variegatus,* a freshwater benthic worm) and are non-feeding exposures. Therefore, assessment of food chain transfers (biomagnification) require modeling (i.e., in this case to mosquitofish or sunfish) using biomagnification factors (BMFs) from the peer-reviewed literature, if basin-specific data are unavailable. A probabilistic bioenergetics-based food chain model may be used if a valid, applicable BMF cannot be obtained (e.g., Norstrom et al., 1976; Rodgers, 1994; Korhonen et al., 1995; Schultz et al., 1995).

If Tier 3 Bioaccumulation Tests and Modeling is triggered by toxicants other than Hg on a site that has recently undergone an ESA or ERA, then the Project Manager should reevaluate early model runs and rerun with additional data. Where a SQAG (either effects-based or bioaccumulation-based) has not been identified, or in cases where an exceeded SQAG is thought to be overly conservative, it is recommended that a standardized laboratory bioaccumulation test be performed (ASTM 1997a, 1997b, or equivalent; also see Ingersoll et al., 1998).

1.3.b Modeling

If Phase 1 - Tier 2 evaluations or Tier 3 bioaccumulation tests demonstrate the potential for excessive MeHg production and bioaccumulation over a substantial portion of the project footprint (hence, the need to define spatial extent, as discussed above), then it is recommended that the Everglades Mercury Cycling Model (E-MCM) or comparable model be used during alternatives analysis. Preferably, model output should be considered both in terms of site selection and operational design. However, due to the current limitations in the predictive strength of the E-MCM, results of the management scenarios simulated must be considered as possible, rather than probable outcomes (Harris et al., 2004), and should not be the sole factor in site selection.

Consultants under contract to the District's Land Acquisition Department have developed and routinely use several different models for evaluating biomagnification and ecological risk from exposure to other toxicants. If resulting risk estimates (either based on uptake or critical tissue concentrations) are deemed acceptable, the project would proceed and initiate Phase 2 - Tier 1 monitoring. On the other hand, if risk is deemed to be unacceptable, then the Project Manager would proceed to determine potential remedial actions/alternatives to reduce exposure and risk.

2. Phase 2 - Monitoring During Three-Year Stabilization Period

This section describes a general monitoring and assessment plan to be conducted on projects after initial flooding and through the first three years of operation.

2.1 Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

2.1.a Water

Until a new criterion is promulgated, monitoring THg (and MeHg) in surface water will likely be required by permit to demonstrate compliance with Chapter 62-302, F.A.C. Accordingly, for components that are expected to require a permit, an unfiltered surface water sample (n = 1) should be collected in accordance with Chapter 62-160, F.A.C., at the inflows and immediately upstream of the outflows of each project on a quarterly basis and analyzed for THg, MeHg, and if not included under routine WQ monitoring, sulfate. In addition, flow will be monitored at the inflow and outflow to allow for load estimation to and from the project (it should be recognized that quarterly sampling would allow for only rough estimation of loads).

This data set will provide crucial information regarding assessment measures (i.e., annual outflow loads of THg and MeHg should not be significantly greater than inflow loads), including atmospheric loading; load estimates should include confidence intervals that describe uncertainty in measures of flow and concentration (e.g., field and analytical precision) and resulting from interpolation (note: assessment protocol to be negotiated with permitting authority). Failure to satisfy this assessment measure would trigger Tier 2 Expanded Monitoring and Risk Assessment.

It is recommended that other toxicants identified during Phase 1 - Tier 1 data review (i.e., based on ESA, DBHYDRO, Pesticide Network, and Battelle Monitoring Data Inventory) be included on the analyte list for quarterly water-column sampling. Because of the concern for potential acute toxicity, the initial sample collection should occur prior to flow through operation. Subsequent sampling would occur at the same frequency as mercury monitoring and be assessed using a similar performance measure (i.e., outflow load should not be significantly > inflow load, including atmospheric load). Because of differences in the anticipated time frames under which sedimentary release are thought to occur (i.e., relative to MeHg that may have time lag associated with changes in biogeochemistry and microbial methylation driven by water quality, especially in sandy soils), monitoring for other toxicants would cease after one year if action levels are not exceeded within that time. Exceedance of WQS in Chapter 62-302 F.A.C. would trigger Tier 2 Expanded Monitoring and Risk Assessment.

2. 1.b Soil / Sediment

Soil / sediments will not be collected under Phase 2 - Tier 1 monitoring.

2.1.c Fish Tissues

At a minimum, samples of fish from multiple trophic levels should be collected from each OU and from a single downstream site for each project. Specifically, within one month following initial flooding and quarterly thereafter, mosquitofish should be collected from multiple locations (at least 100 fish) within each OU and physically composited into one (spatially-averaged) sample and analyzed for THg (note, a single aliquot should be analyzed per composite). Mosquitofish were selected as a primary sentinel species because of their widespread occurrence in the Everglades, ability to invade newly flooded areas, and because of their relatively small home range and short life span. Mosquitofish are known to bioaccumulate MeHg, metals, such as lead, zinc, selenium and cadmium, and pesticides including but not limited to DDT, endosulfan, and toxaphene (Schaper and Crowder, 1976; Williams and Giesy, 1978; Denison et al., 1985; Nowak and Sunderam, 1991; Kumar and Chapman, 2001; Sepulveda et al. 2003; Wu, 2004).These characteristics make the mosquitofish a potentially excellent indicator of short-term, localized changes in a toxicant's bioavailablity.

On an annual basis, sunfish (n should be greater than or equal to 5) should be collected and individually analyzed (whole-fish) for THg. Sunfish were selected because of their widespread occurrence (especially bluegill) and because they are a preferred prey for a number of fish-eating species. Where habitat supports largemouth bass and there is a possibility of future recreational harvesting, bass should also be collected (n should be greater than or equal to 5) and individually analyzed (fillets) for THg. Largemouth bass can be used as an indicator of potential human exposure to mercury. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches); however, other lepomids (due to similar trophic status, first priority being given to spotted sunfish) or sizes are to be collected if efforts fail to locate targeted fish.

Due to their relatively longer life spans and larger home ranges, sunfish and largemouth bass integrate their exposure over a larger spatial area and longer time frame. Accordingly, caution should be exercised when assessing levels in these fish in recently flooded (or intermittingly flooded) marshes. Under those circumstances, more weight should be placed on levels in mosquitofish which, as stated previously, integrate exposure over a shorter period of time.

If after one year of monitoring, sufficient data are collected to demonstrate that conditions within the different OUs are equivalent, collection of large-bodied fish can be reduced to one OU and one downstream site. Alternatively, if OUs are shown to differ in terms of average concentration in mosquitofish, project managers may elect to sample large-bodied fish from the OU with the highest observed concentration and assess results as "worst case". However, in either case, mosquitofish collections would continue from all OUs.

This data will then be used to evaluate the following assessment measures: 1) Hg in any (quarterly) mosquitofish composite should not exceed the 90% upper confidence level of the basin-wide average or, if basin-specific data are lacking, exceed the 75th percentile concentration for the period of record for all basins; 2) annual average THg levels in fishes should not increase progressively over time or become elevated to the point of exceeding the 90% upper confidence level of the annual basin-wide average, or if basin specific data are lacking, exceeding the 75th percentile concentration for the period of record for all basins. Exceedance of any of these action levels would trigger Phase 2 - Tier 2 Expanded Monitoring and Risk Assessment.

It is recommended that bioaccumulative toxicants identified during the Phase I - Tier I data review (i.e., based on information contained in the ESA, available WQ database, or previous land uses) be included on the analyte list for fish tissues collected during the first year of the stabilization period, if analytical procedures exist (for list of possible analytes by matrix, see Table 1). For toxicants other than mercury, more weight may need to be placed on whole-body residues in mosquitofish and sunfish (that will include organs that may preferentially accumulate other toxicants) to assess ecological risk than levels in fillets of largemouth bass. Furthermore, it should also be recognized that under certain circumstances taxa other than fish may be more appropriate biological sentinels depending on the toxicant and the risk assessment endpoint. For example, preliminary discussions have taken place regarding the possible use of the apple snail *(Pomacea paludosa)* to biomonitor potential copper exposure to the endangered snail kite*(Rostrhamus sociabilis plumbeus)*. However, a thorough justification will be required in any plan that targets species other than mosquitofish, sunfish, or bass.

Tissue levels of other toxicants should not increase significantly over time or become elevated to the point of exceeding: 1) the critical tissue benchmark used to establish SQAGs or developed during site-specific risk assessments; 2) the 90% upper confidence level of the annual basin-wide average, or if not available, exceeding the 75th percentile concentration for all basins. Exceedance of these action levels would trigger Phase 2 – Tier 2 Expanded Monitoring and Risk Assessment.

Table 1. List of pesticides with currently available analytical methods (for the specified matrix) for possible inclusion in Phase 1 - 3.

pesticide	surface water	sediment	fish
chlorinated (phenoxy acid) herbicides			
2,4-D	X	X	-
2,4,5-T	X	X	-
2,4,5-TP (silvex)	X	X	-
urea herbicides and imidacloprid			
diuron	X	X	-
linuron	X	X	-
imidacloprid	X	-	-
organophosphorus and nitrogen pesticides			
alachlor	X	X	-
ametryn	X	X	-
atrazine	X	X	X
atrazine desethyl	X	-	-
atrazine desisopropyl	X	-	-
azinphos methyl (guthion)	X	X	-
bromacil	X	X	-
butylate	X	-	-
chlorpyrifos ethyl	X	X	X
chlorpyrifos methyl	X	X	-
demeton	X	X	-
diazinon	X	X	-
disulfoton	X	X	X
ethlon	X	X	X
ethoprop	X	X	X
fenamlphos	X	X	-
fonophos	X	X	-
hexazinone	X	X	-
malathion	X	X	-
metalaxyl	X	-	-
methamidophos	-	X	-
metolachlor	X	X	-
metribuzin	X	X	X
mevinphos	X	X	-
monocrotophos	-	X	-
naied	X	X	-
norflurazon	X	X	X
parathion ethyl	X	X	-
parathion methyl	X	X	-
phorate	X	X	X
prometryn	X	X	-
simazine	X	X	X

pesticide	surface water	sediment	fish
organochlorine pesticides			
aldrin	X	X	X
alpha BHC	X	X	X
beta BHC	X	X	X
delta BHC	X	X	X
gamma BHC (lindane)	X	X	X
carbophenothion (trithion)	X	X	-
chlordane	X	X	-
cis-chlordane	-	-	X
trans-chlordane	-	-	X
chlorothalonil	X	X	-
cypermethrin	X	-	-
o,p'-DDD	-	-	X
p,p'-DDD	X	X	X
o,p'-DDE	-	-	X
p,p'-DDE	X	X	X
o,p'-DDT	-	-	X
p,p'-DDT	X	X	X
dicofol (kelthane)	X	X	-
dieldrin	X	X	X
alpha endosulfan	X	X	X
beta endosulfan	X	X	X
endosulfan sulfate	X	X	X
endrin	X	X	X
endrin aldehyde	X	X	-
heptachlor	X	X	X
heptachlor epoxide	X	X	X
methoxychlor	X	X	X
mirex	X	X	X
permethrin	X	X	-
toxaphene	X	X	X
PCB-1016	X	X	-
PCB-1221	X	X	-
PCB-1232	X	X	-
PCB-1242	X	X	-
PCB-1248	X	X	-
PCB-1254	X	X	-
PCB-1260	X	X	-
trifluralin	X	X	-
cis-nonachlor	-	-	X
trans-nonachlor	-	-	X

- not analyzed

Compounds in italics have a **Surface** ***Water Quality Class I or III criterion (FAC 62-302)***

2.2 Phase 2 - Tier 2: Expanded Monitoring and Risk Assessment

Phase 2 - Tier 2 is triggered if one of the following action levels is exceeded:

- If a WQS (in Chapter 62-302, F.A.C.) is exceeded; or
- If annual outflow loads of THg or MeHg are determined to be significantly greater than inflow loads (based on an uncertainty analysis of loading estimates, e.g., precision in measuring analytes and flow, interpolation over quarter); or
- If Hg in any (quarterly) mosquitofish composite exceeds the 90% upper confidence level of the basin-wide average or, if basin-specific data are lacking, exceeds the 75th percentile concentration for the period of record for all basins; or
- If annual average Hg levels in a given fish species become elevated to the point of exceeding the 90% upper confidence level of the basin-wide average, or if basin-specific data are lacking, exceeding the 75th percentile concentration for the period of record for all basins; or
- If annual average levels of a residue in a given fish species increase progressively over time (i.e., two or more years) ($p < 0.1$); or
- If residue levels of other toxicants in fish become elevated to the point of exceeding the critical tissue benchmark used to establish SQAGs or developed in risk assessments.

The following steps will be taken if any action level in Phase 2 - Tier 2 is triggered:

Step 1: Notify permitting authority;
Step 2: Resample media (e.g., water or fish) that triggered Tier 2;

If results of Step 2 (i.e., re-sampling of media that triggered Tier 2) demonstrate that the anomalous condition was an isolated event, the permitting authority will be notified that the project will revert back and continue with Phase 2 - Tier 1 monitoring. Alternatively, if results of Step 2 reveal the anomalous condition was not an isolated event, proceed to Step 3.

Step 3: Expanding monitoring program as follows:

- Increase frequency of mosquitofish collection from quarterly to monthly.
- If Tier 2 was triggered by excessive loading or exceedance of a WQS at common outflow, then begin sampling discharges at outflows of each OU or independent treatment train to better define spatial extent of problem. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).
- To further define spatial extent of problem, collect multiple mosquitofish composites from within the OU or treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if problem is improving or worsening), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, TOC, TS, and TFe) over a given period of time (e.g., 2 to 4 months). At these same locations and times, collect pore water samples and analyze for THg, MeHg, and

sulfides, or if no acceptable pore water protocol has been developed, acid-volatile sulfide (AVS) on solids.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the E-MCM or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 3 will also include the notification of the permitting authority that anomalous conditions are continuing. The permitting authority and the permittee may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions to (1) reduce exposure and risk (e.g., signage for human health concerns, reduce fish populations, reduce forage habitat suitability); if risk of acute toxicity – immediate drawdown of an OU and reevaluation of ESA [Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health]; and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).

In developing this adaptive management plan, the permitting authority may conduct a publicly noticed workshop to solicit comments from the permittee, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Phase 2 - Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the permitting authority and the permittee would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3. Phase 3 - Operational Monitoring

3.1 Phase 3 - Tier 1: Routine Operational Monitoring from Year 4 to Year 9

If after the first three years of monitoring neither downstream loading nor residue levels in fishes exceed action levels in the preceding two years, then (1) surface water sampling would be discontinued, (2) frequency of mosquitofish collection would be reduced to semiannually, and (3) frequency of large-bodied fish collection would be reduced to one collection event every three years. If not met within the first three years, criteria would be re-evaluated annually based on preceding two-year period.

3.2 Phase 3 - Tier 2: Expanded Monitoring and Risk Assessment

Phase 3-Tier 2 is triggered if one of the following action levels is exceeded during operation:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or any (semi-annual) mosquitofish composite exceeds the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeds the 75th percentile concentration for the period of record for all basins; or
- If triennial monitoring of large-bodied fish (i.e., in years 6 and 9) reveals tissue Hg levels in fishes have statistically increased progressively over time (i.e., two or more years) or have become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeded the 75th percentile concentration for the period of record for all basins.

3.3 Phase 3 - Tier 3: Routine Operational Monitoring After Year 9

On the other hand, if fishes collected under Phase 3 Operational Monitoring have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring under RECOVER. However, Project Managers are cautioned that action levels may be revised at a future date.

CONTRACTOR SELECTION CRITERIA

Given the inherent difficulties of ultra-trace monitoring, it is crucial that any contractor selected to carry out field collection has demonstrated prior performance or be trained by District staff and has a stringent quality assurance/quality control (QA/QC) program in place. Likewise, the analytical lab must also demonstrate prior performance in ultra-trace analysis, have a stringent QA/QC program (including inter-laboratory comparisons) and be capable of achieving desired method detection limits.

REPORTING REQUIREMENTS

The District shall submit an annual report to the permitting authority that summarizes the most recent data and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

CONTACTS

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