Water Quality Impacts of Reservoirs

Task 4-Data Validation and Data Interface

WATER QUALITY IMPACTS OF RESERVOIRS

Task 4 – Data Validation and Data Interface

Prepared for

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA

December 2004

Burns & McDonnell Projects 35106 and 35405

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December 13, 2004

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> South Florida Water Management District
> Contract No. C-C20104P-WO02
> Water Quality Impacts of Reservoirs
> Final Task 4 Report
> Burns & McDonnell Projects 35106 and 35405

Dear Ms. Zhao:

Burns & McDonnell is pleased to present this report on the *Water Quality Impacts of Reservoirs, Task 4 – Data Validation and Data Interface*. This report is the final deliverable for the Water Quality Impacts of Reservoirs project, which was performed for the South Florida Water Management District (District) under Work Order No. 2 of Contract C-C20104P (C-C20104P-WO02).

In previous tasks for the Water Quality Impacts of Reservoirs project, Burns & McDonnell identified 36 candidate data sites that appeared to have potential for use as calibration data sets. For Task 4 of this study, we performed additional validation for the data associated with these candidate data sites. These data were collected at over 1,300 monitoring sites and contain sampling results for over 800 unique hydrologic, climatic and water quality monitoring parameters. In total, there are more than 3.5 million data points in these data sets. All of the data collected for this project have been delivered to the District and other researchers.

In order to make these data easily accessible to any interested parties, Burns & McDonnell also developed a web-based data interface for these data. This data interface, which will be hosted on the District's web server, will allow anyone with an Internet connection and a web browser to view or export any or all the data collected for this study.

We wish to express our thanks to you, Dr. Gary Goforth, Kathleen Pietro, and the other members of the District staff who participated in this study, for your helpful direction, advice and assistance during the preparation of this report. We also acknowledge the

contributions of our two subconsultants, Engineering and Applied Science, Inc. of Tampa and Wetland Solutions, Inc. of Gainesville, who collected most of the data used in this project. We are available at your convenience to discuss the details of this report.

Sincerely,

BURNS & McDONNELL

Galen E. Miller, P.E.
Associate Vice President

Gene L. Foster, P.E.
Project Manager

Water Quality Impacts of Reservoirs
Task 4 – Data Validation and Data Interface
(Contract C-C20104P-WO02)
Projects 35106 and 35405

INDEX AND CERTIFICATION

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Certification

I hereby certify, as a Professional Engineer in the State of Florida, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the South Florida Water Management District or others without specific verification or adaptation by the Engineer. This certification is made in accordance with the provisions of the Laws and Rules of the Florida Board of Professional Engineers under Chapter 61G15-29, Florida Administrative Code.

_____
Galen E. Miller, PE   Florida PE # 40624
Date: _____
(Reproductions are not valid unless signed, dated and embossed with Engineer's seal

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report section presents an executive summary of the Water Quality Impacts of Reservoirs (WQIR) study. This study was completed by Burns & McDonnell, with subcontractors Engineering & Applied Science and Wetland Solutions, under Contract C-C20101P-WO02 with the South Florida Water Management District (District). The goals, procedures and results of this study are described in the following sections.

ES.1 STUDY BACKGROUND AND OBJECTIVES

The long-term Everglades water quality goal is to achieve the phosphorus criterion in the Everglades Protection Area (EPA). Compliance with this standard will be achieved through a combination of source controls, stormwater treatment areas (STA), advanced treatment technologies (ATT), and regulatory programs, as outlined in the District's Long Term Plan (Burns & McDonnell, 2003).

In parallel with the District's water quality improvement initiatives that are necessary for compliance with the EFA, the U.S. Army Corps of Engineers (Corps) and District have developed the Comprehensive Everglades Restoration Plan (CERP). The CERP is a framework and guide to restore, protect and preserve the water resources of central and southern Florida, and includes more than 60 different elements. One of 11 initial CERP projects authorized under the Water Resources Development Act of 2000 is to construct a surface water storage reservoir within the Everglades Agricultural Area (EAA).

The project team for the EAA reservoir project is currently evaluating analytical models for use in projecting the quality of water that is released from this reservoir. The primary objective of this WQIR study is to acquire and analyze data sets that can be used to help calibrate these analytical models.

ES.2 PROJECT WORK PLAN

The work plan for the WQIR study was divided into four principal tasks. These tasks are listed below:

- Task 1 – Project Orientation Meeting

- Task 2 – Identification of Data Sites and Data Acquisition

- Task 3 – Analysis of Data Sets

- Task 4 – Data Validation and Data Interface

The work completed in Tasks 2 through 4 is described in the following sections.

ES.3 TASK 2 – IDENTIFICATION OF DATA SITES AND DATA ACQUISITION

Task 2 of the WQIR study involved the identification of favorable data sites and the acquisition of data for these sites. The work completed under Task 2 included several subtasks: identify preliminary data sites, screen preliminary data sites and select candidate data sites, collect data for candidate data sites, organize and analyze data for candidate data sites, and screen candidate data site and select potential data sites. These subtasks are described in the following subsections.

ES.3.1   Preliminary Data Site Inventory

Electronic land use/land cover (LULC) maps for the project study area were obtained from the three water management districts: South Florida Water Management District (SFWMD), St. Johns River Water Management District (SJRWMD), and Southwest Florida Water Management District (SWFWMD). These LULC maps were used to identify any water bodies in central or southern Florida with a surface area of at least 100 acres. This preliminary inventory process identified 622 water bodies that met the selection criteria. The distribution of these preliminary data sites is shown on Figure ES-1.

ES.3.2   Preliminary Data Site Screening

Because of the large number of possible data sites in the initial site inventory, a screening process was used to identify those data sites with the highest potential to yield calibration data sets. For this purpose,
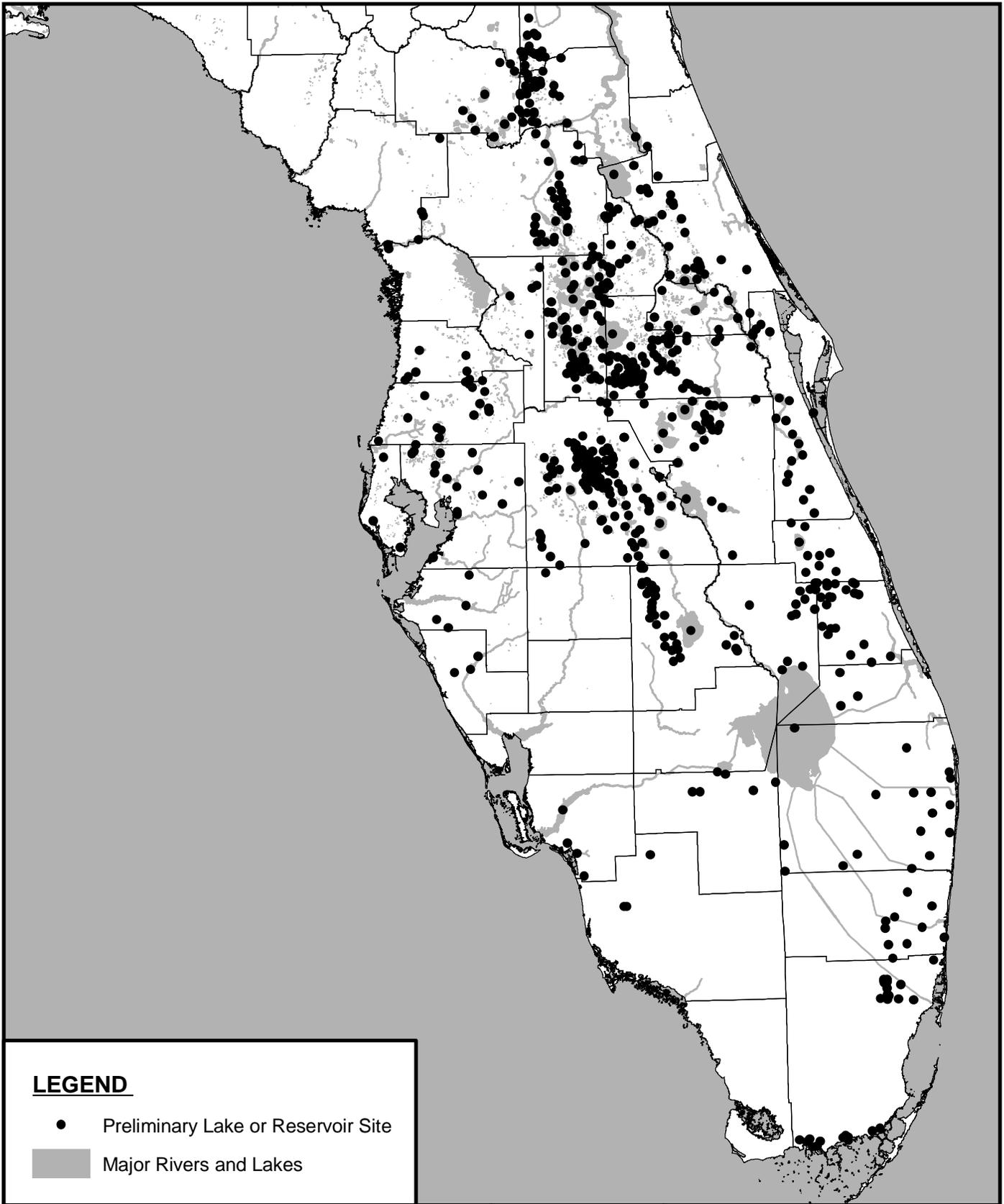
LEGEND

- Preliminary Lake or Reservoir Site

Major Rivers and Lakes

40   20   0   40 Miles

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Figure ES-1
PRELIMINARY SITE
INVENTORY

ideal systems will have several key characteristics: flow-through hydrology with a significant period of record, stage data, plant community data, and physical data (bathymetry or design depths).

Reducing the list of over 600 preliminary data sites to a reasonable number was done primarily through interviews with the most knowledgeable person or persons within each water management district or other agency. As a result of these interviews, a short list of 36 candidate water bodies was developed. The candidate data sites are listed in Table ES-1 and shown on Figure ES-2.

Table ES-1: Candidate Data Sites[a]

WMD	Candidate Data Sites by Water Management District		
SFWMD	Bonnet Lake	Lake Istokpoga	Lake Trafford
	Caloosahatchee River	Lake Josephine	Red Beach Lake
	FP&L Martin Co Reservoir	Lake Sebring	
SJRWMD	Blue Cypress WMA-East[b]	Lake George	Rodman Reservoir
	Blue Cypress WMA-West	Lake Harney	St. Johns MCA[c]
	Crescent Lake	Lake Jessup	St. Johns WMA
	Emeralda MCA	Lake Monroe	Sunnyhill Farm
	Kenansville Lake	Lake Norris	Taylor Creek Reservoir
	Lake Disston	Lake Washington	
SWFWMD	Keystone Lake	Lake Magdalene	Lake Thonotosassa
	Lake Calm	Lake Panasoffkee	Medard Park Reservoir
	Lake Carroll	Lake Parker	Tsala Apopka
	Lake Howard	Lake Seminole	

[a] Abbreviations: WMD–water management district, WMA–water management area, MCA–marsh conservation area.

[b] Also known as Sun Ag Reservoir.

[c] Also known as Brevard County Stick Marsh.

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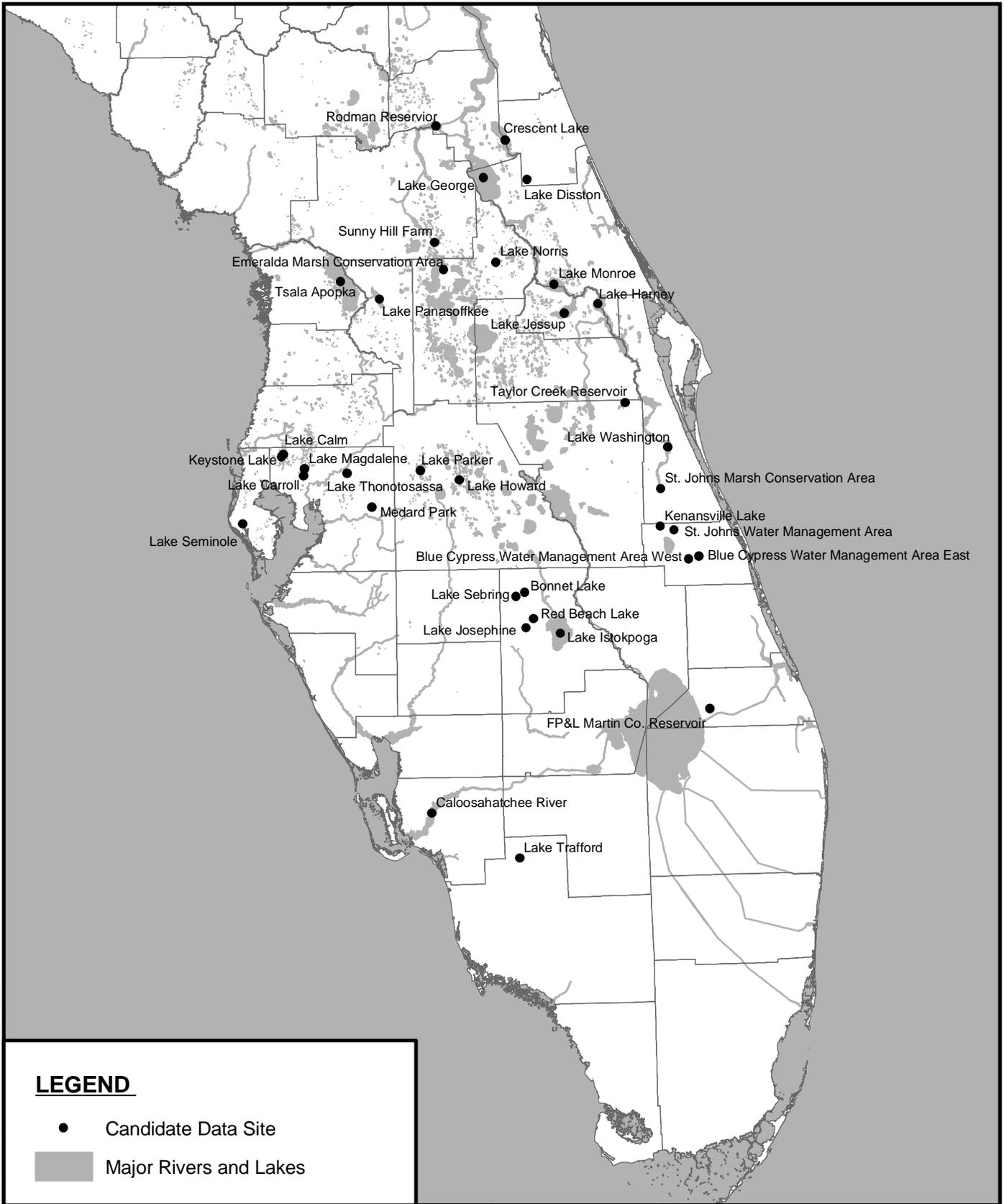
Figure ES-2
CANDIDATE DATA SITES

Map labels (candidate data sites):

- Rodman Reservoir
- Crescent Lake
- Lake George
- Lake Disston
- Sunny Hill Farm
- Lake Norris
- Emeralda Marsh Conservation Area
- Lake Monroe
- Tsala Apopka
- Lake Harney
- Lake Panasoffkee
- Lake Jessup
- Taylor Creek Reservoir
- Lake Washington
- Lake Calm
- Keystone Lake
- Lake Magdalene
- Lake Parker
- St. Johns Marsh Conservation Area
- Lake Carroll
- Lake Thonotosassa
- Lake Howard
- Medard Park
- Kenansville Lake
- St. Johns Water Management Area
- Lake Seminole
- Blue Cypress Water Management Area West
- Blue Cypress Water Management Area East
- Bonnet Lake
- Lake Sebring
- Red Beach Lake
- Lake Josephine
- Lake Istokpoga
- FP&L Martin Co. Reservoir
- Caloosahatchee River
- Lake Trafford

LEGEND

- ● Candidate Data Site
- Major Rivers and Lakes

40   20   0   40 Miles

NORTH

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\\Gissrv\Projects\sfwmd\ARC\ArcDocs\Report\Task3\ES-2_Candidate_data_sites.mxd   October 22, 2004   10:20:28 AM
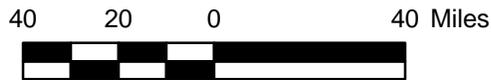
The District's Long Term Plan lists five specific water bodies that should be considered in the WQIR study. These are Lake Apopka, Lake Jessup, Brevard County Stick Marsh (St. Johns Marsh Conservation Area), Sun Ag Reservoir (Blue Cypress Water Management Area-East), and Lake Istokpoga. All of these water bodies, except Lake Apopka, were identified as candidate data sites. Lake Apopka was not considered to be suitable for use in this study because of its complexity. This lake has multiple inflow and discharge points, and a relatively static water level.

ES.3.3 Data Acquisition Process

Once the candidate data sites were identified, the available data for these candidate sites were obtained by the project team. The desired data types included morphometry, hydrologic data, plant community data, water quality data including pesticides and herbicides, climatological data, hydraulic properties, maps and design drawings, operating criteria, and construction and operating costs.

Much of the available numeric data, such as flow and water quality data, were acquired through Internet searches or directly from the respective data holders. Many reports and other references related to these data sites were also obtained.

After these data had been collected, a project database was developed using Microsoft Access 2002. The available time series data — primarily hydrologic, water quality and climatic data — were then imported into this database for ease in sorting, display and use in subsequent analyses. A graphical representation of the database schema is shown on Figure ES-3.

ES.3.4 Candidate Site Rankings

After review of the data collected for each candidate data site, each of these sites was rated based on its applicability for use as a calibration data set. At a minimum, the following data types were required at each candidate data site, along with a minimum average depth of three feet.

- Inflow and outflow water volumes
- Inflow and outflow phosphorus concentrations
- Stage data and stage-volume relationship

Figure ES-3: Database Schema
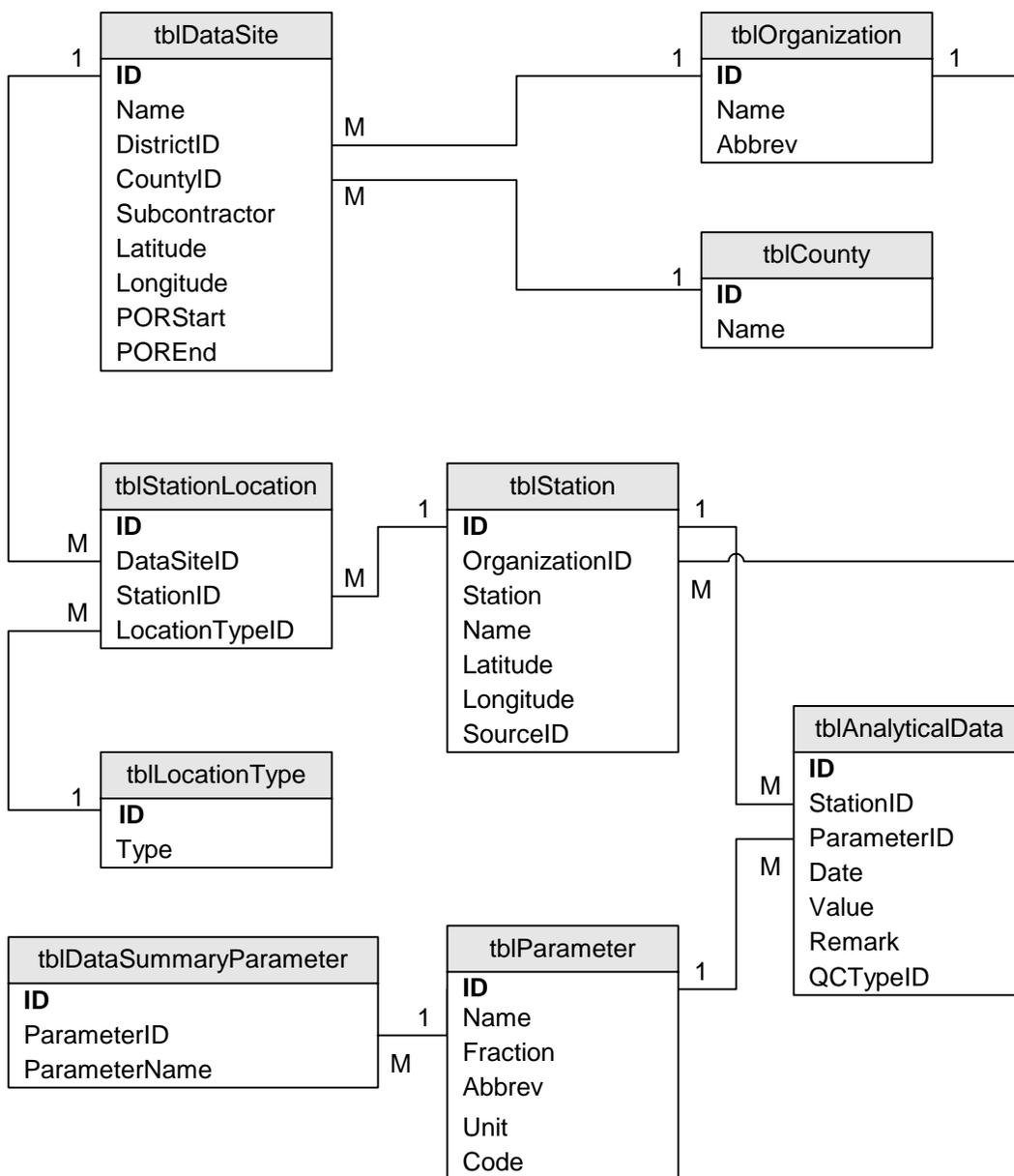
From review of data availability, a relative rating of good, fair or poor was assigned to each candidate data site. As a result of this review process, 8 sites were rated good, 13 sites were rated fair, and 15 sites were rated poor. The 15 poor-rated sites were found to be missing two or more critical data types and are considered to have little potential for use as calibration data sets. The 13 fair-rated sites were generally missing only one critical data type. If additional data relative to the missing data type were found or

collected, some of these 13 sites could prove useful for model calibration. Given the data available, the eight good-rated data sites were considered to be the best candidates for use as calibration data sets. These eight good-rated, or potential, data sites are listed below and shown on Figure ES-4.

- Crescent Lake
- Lake George
- Lake Harney
- Lake Istokpoga

- Lake Jessup
- Lake Thonotosassa
- Rodman Reservoir
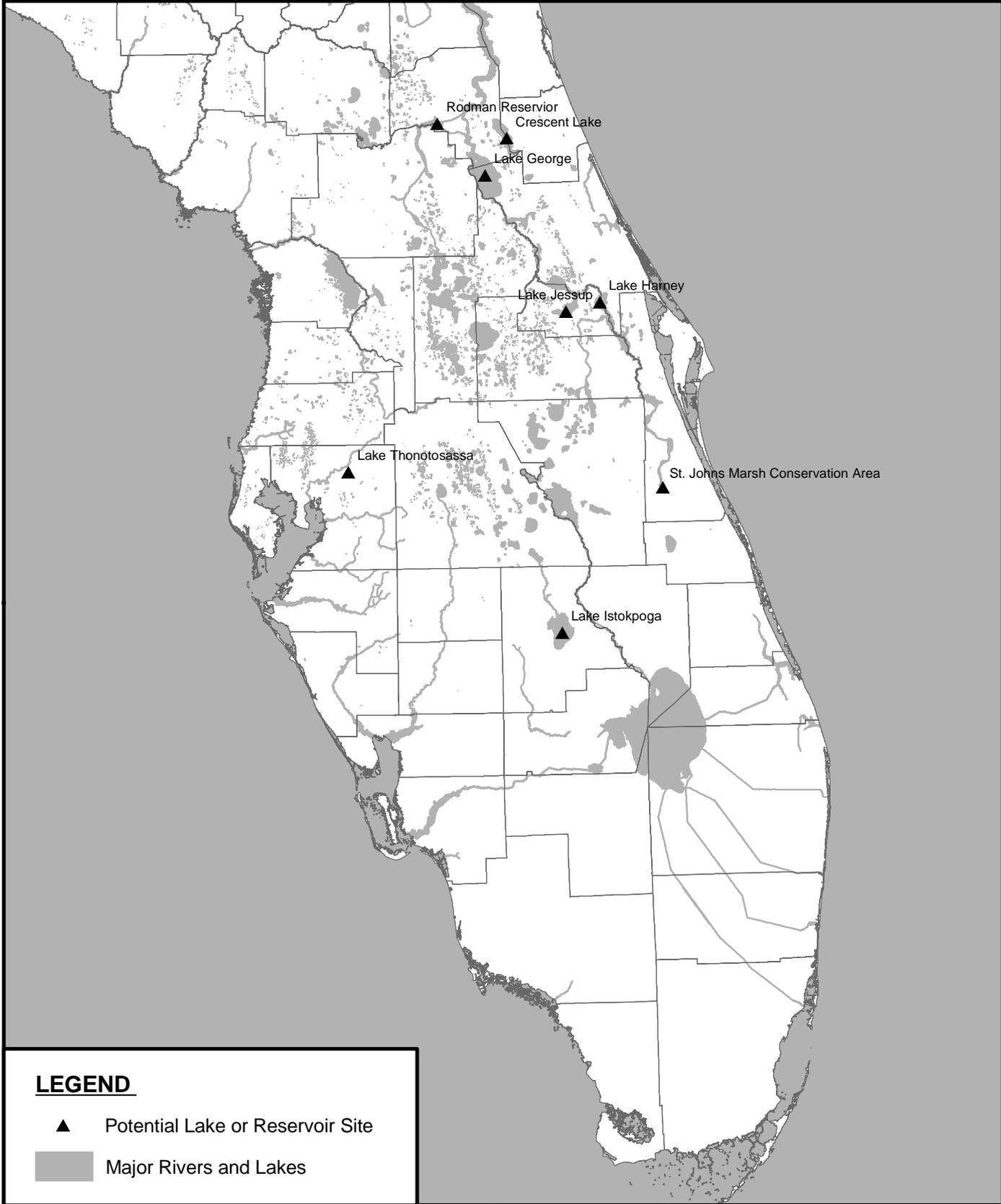- St. Johns Marsh Conservation Area

ES.4   TASK 3 – ANALYSIS OF DATA SETS

In Task 3 of the study, additional analyses were completed for the eight potential data sites only. These analyses included completion of several subtasks: data validation and summaries, water balances, phosphorus mass balances, and statistical analyses. These subtasks are described in the following subsections.

ES.4.1   Data Validation and Summaries

The data for the eight potential data sites were validated by completing three basic steps. The first step was to verify that the electronic data obtained for each data site were complete. This was accomplished by revisiting the original data source (typically available through the Internet) and summarizing the types of data and periods of record available from these sources. These summaries were then compared to the data collected previously to identify missing data.

The second step in the data validation process was to review non-electronic data. Many reference reports were collected for these data sites and these reports were reviewed to determine if they contained significant quantities of hydrologic or water quality data that had not already been obtained. Generally, no significant data were found during the reference review process.

Rodman Reservoir
Crescent Lake
Lake George
Lake Jessup   Lake Harney
Lake Thonotosassa
St. Johns Marsh Conservation Area
Lake Istokpoga

LEGEND

▲   Potential Lake or Reservoir Site

▮   Major Rivers and Lakes

40   20   0   40 Miles

NORTH

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Figure ES-4
POTENTIAL DATA SITES

The final step in the data validation process was to verify database imports. The data contained in the original electronic files provided for each data site were compared to the data in the project database to identify discrepancies such as missing or inaccurate data.

In tandem with the data validation process, the data for certain key parameters were summarized and graphed for each potential site. The key parameters included flow, total phosphorus concentrations, total nitrogen concentrations, pH, total calcium concentrations, and water levels and temperatures. The available data for these parameters were composited at three relative locations: inflow, outflow and interior. The resulting summaries and graphs aided the validation process by showing outliers and also helped select a period of record for subsequent analyses.

ES.4.2   Water Balances

A daily water balance was developed for each potential data site. The period of record for these water balances varied based on data availability, ranging from 6.5 to 22 years. For each day during the period of record, estimates of the following quantities were made.

- Surface area

- Gaged and ungaged inflow

- Gaged and ungaged outflow

- Precipitation gains and evaporation losses

- Lake elevation and depth

- Change in storage

- Imbalances

ES.4.3   Phosphorus Mass Balances

Using the water quantities develop for the water balances, a phosphorus mass balance was developed for each of the eight potential data sites. These phosphorus mass balances contain estimates of the following parameters for each day during the associated period of record.

- Inflow TP concentration and mass flux

- Wet and dry phosphorus deposition to the lake

- Outflow TP concentration and mass flux

- Net phosphorus retention

ES.4.4   Data Set Analyses

From the water and phosphorus mass balances developed for each of the eight potential data sites, the relationships between the retention of phosphorus and other lake characteristics were then investigated. Using average monthly data, the specific relationships considered are listed below.

- Phosphorus retention efficiency verses hydraulic loading rate

- Phosphorus settling rate verses hydraulic loading rate

- Phosphorus settling rate verses interior calcium concentration

- Phosphorus settling rate verses interior pH

- Phosphorus settling rate verses water temperature

- Phosphorus settling rate verses depth

ES.5 TASK 4 – DATA VALIDATION AND DATA INTERFACE

The final task in the WQIR study was to complete additional data validation and develop a web-based data interface. These subtasks are described below.

ES.5.1   Data Validation

The principal purpose of the data validation effort in Task 4 was to ensure, to the extent practicable, that all of the electronic data collected for the 36 candidate data sites were successfully imported into the project database. This goal was accomplished primarily by first re-importing all of the data for each candidate data site and then comparing these new data tables with the data already contained in the project database. Any discrepancies found were investigated and resolved.

Relatively few instances of bad data were discovered through this validation process but the more significant effort involved normalizing all of the data. In database terms, normalization refers to the goal

of not storing the same information twice, or conversely, not referring to the same data or type of data in more than one way. The most time consuming task during this data normalization process was to reconcile the various nomenclatures used to describe water quality parameters. Unfortunately, each data source used different terms to refer to like monitoring parameters and sometimes different units. For example, total phosphorus concentrations were reported in milligrams per liter and micrograms per liter with equal frequency.

After validation and normalization of the data, it was then necessary to eliminate duplicate data records. In some cases, the same monitoring data were obtained from different sources so it was necessary to eliminate duplicates. For example, a large volume of data was obtained directly from SJRWMD but many of these data were also available from EPA's STORET database.

ES.5.2   Data Summary

After completion of the data validation, normalization and cleanup effort, some basic statistics for the data were compiled. The data collected represent the following.

- 36 candidate data sites

- 18 Florida counties

- 24 collecting organizations (federal, state and local)

- 1,311 unique monitoring sites or stations

- 824 different hydrologic or water quality parameters

- 3,501,953 data points (unique combinations of monitoring site, data parameter and sample date)

ES.5.3   Data Interface

Burns & McDonnell has developed a web-based data interface for the data collected for the 36 candidate data sites. All of the WQIR study data are stored in a Microsoft Access database file but not all potential data users have this software application or are familiar with its use. Therefore, the principal design goal of the data interface was to make the data easily accessible to anyone with an Internet connection and web browser. The data interface has two principal purposes, which are to allow users to view data or to export data. The principal features of the data interface are described briefly below.

- Welcome Page: The welcome, or splash, page presents a brief introduction to the WQIR study and provides links to the main interface page and other online resources.

- Main Data Interface Page: This page provides the main interface to the WQIR data. From this page, users can filter the available data based on five factors: data site, data collection organization, relative station location, monitoring stations number/name, and data parameter. The selected data can then be viewed or exported. The main interface page also includes an interactive map that can be used to select data sites or monitoring stations. An example of the main data interface page is included in Figure ES-5.

- Data Export Page: The data export page provides users with the means to export complete data sets for a single candidate data site, all eight potential data sites, or all 36 candidate data sites.

- Help Page: The data interface also includes an extensive help page. This help page provides information on how to query for monitoring stations, how to view data, how to use the interactive

Figure ES-5: Data Interface Main Page

map, how to download data, helpful tips, and frequently asked questions.

ES.6 RECOMMENDATIONS

The data collected for the eight potential data sites and the data sets constructed from these data should prove useful for future model calibrations efforts; however, none of these data sites have proven to be very similar to the proposed EAA storage reservoir(s), which was one of the primary goals of the WQIR study. Some of the other candidate data sites are more similar to the proposed EAA storage reservoir but lack significant amounts of data. Therefore, further effort to identify and collect data for more similar water bodies (if available) is recommended. An outline of these recommended study efforts is presented below:

1. Most of the 36 candidate water bodies identified in Task 2 are natural lakes and very few are actually man-made impoundments. Additional efforts should be expended to identify man-made reservoirs and water management areas in central and south Florida that are physically and operationally similar to the proposed EAA storage reservoir(s).

2. For the man-made impoundments that were identified in Task 2, the study team's efforts to collect useful data for these impoundments were largely unfruitful. For these and any other representative impoundments identified in Item 1 above, site visits and interviews with the managers of these impoundments should be conducted. These site visits and interviews will attempt to better define the similarity of these water bodies to the proposed EAA storage reservoir(s). The questions asked and data collected will ascertain current operating rules, existing data collection activities, management challenges and lessons learned. If as expected, the existing data resources and ongoing monitoring efforts fall short of providing all of the data needed for model calibration, facility managers should be consulted about their willingness to authorize access for additional monitoring activities.

3. The information and data collected during the site visit and interview process would be used to rank the applicability of each data site investigated. The five top-ranked reservoirs or management areas should be selected for detailed monitoring. A brief technical report that presents the results of Items 1 through 3 should be prepared for review and comment by the District and other cooperating agencies.

4. After the list of recommended reservoirs is approved, a detailed monitoring plan should be developed for each of the five reservoirs or management areas. The monitoring plan will be designed to characterize each reservoir's hydrology, water chemistry, and biology. Monitoring should include estimation of all inflows and outflows, water level monitoring, estimates of storage volume, measurement of a wide variety of water quality parameters, plant community and cover mapping, and rapid assessment of wildlife populations. The draft monitoring plans for each reservoir will be submitted to the District for approval.

5. A minimum one-year sampling program is recommended for each of the selected reservoirs. As an option, the monitoring program can be extended for up to two additional years. All monitoring data should be imported into a database for easy retrieval and QA/QC checks. Annual monitoring reports will be prepared and submitted to the District.

6. At the end of the monitoring program, a final report should be prepared that summarizes the monitoring data and provides design guidance for future CERP reservoir design efforts. The final report should summarize all of the results and findings of the monitoring program and tie in related work from other published sources.

The additional study items described above should be initiated as soon as practicable so this information is available in a timely fashion to assist with future CERP reservoir design. With a one-year monitoring program, the total elapsed time for these additional studies is estimated to be 22 months, increasing to 46 months for a three-year monitoring program.

* * * * *

1 INTRODUCTION

1   INTRODUCTION

This report section presents a discussion of the background and objectives of the Water Quality Impacts of Reservoirs (WQIR) study, and a brief overview of the work performed in this study. This study was completed under Contract C-C20104P, Work Order No. 2 (C-C20104-WO02) with the South Florida Water Management District (District). The primary purpose of the WQIR study was to investigate the potential water quality impacts of the proposed Everglades Agricultural Area (EAA) storage reservoir(s). This report addresses Task 4, the fourth and final task under the WQIR study.

1.1   BACKGROUND

The long-term goal of Florida's 1994 Everglades Forever Act (EFA) is to ensure that all waters discharged to the Everglades Protection Area (EPA) meet the applicable water quality standards. The EPA includes Water Conservation Areas 1, 2A, 2B, 3A and 3B; Loxahatchee National Wildlife Refuge; and Everglades National Park. For the Class III waters in the EPA, the Florida Department of Environmental Protection (DEP) has established a numeric criterion for total phosphorus (TP) of 10 parts per billion (ppb), measured as a long-term geometric mean (Florida Statutes 373.4592). Compliance will be achieved through a combination of source controls, stormwater treatment areas (STA), advanced treatment technologies (ATT), and regulatory programs. Substantial progress in reducing phosphorus levels discharged to the EPA has already been made through the combined effects of regulatory programs in the EAA and construction of the STAs. Current projections suggest that the long-term flow-weighted average TP concentrations in discharges to the EPA will be approximately 35 ppb after all of the planned STAs are operational. However, additional measures will be necessary to ensure compliance with the applicable water quality standards.

The recommended approach to achieve additional water quality improvements is outlined in the District's Long-Term Plan for Achieving Water Quality Goals (Long-Term Plan) (Burns & McDonnell, 2003). The Long-Term Plan includes three primary components:

- Pre-2006 Projects: The pre-2006 projects include structural and operational modifications that can be supported by the current scientific and engineering knowledge base as well as continued operation, maintenance and monitoring of the STAs. Where feasible, these projects are to be implemented by the end of 2006. By themselves, these projects may or may not be successful in meeting the long-term water quality goals.

- Process Development and Engineering (PDE): The PDE activities are designed to expand the current scientific and engineering knowledge base. These initiatives include the following activities:
  - Further understand and optimize water quality performance in existing and proposed facilities
  - Facilitate integration with the Comprehensive Everglades Restoration Plan
  - Maintain and improve upon the contribution of source controls to overall water quality improvement goals
  - Investigate ways to accelerate the recovery of previously impacted areas in the EPA

- Post-2006 Strategy: Depending on the success of the pre-2006 projects in meeting the target water quality goals and new management strategies identified through the PDE activities, additional water quality improvement measures may be necessary.

In parallel with the District's water quality improvement initiatives that are necessary for compliance with the EFA, the U.S. Army Corps of Engineers (Corps) and District have developed the Comprehensive Everglades Restoration Plan (CERP). The CERP provides a framework and guide to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. The CERP evolved from a restudy of the Corps' Central & Southern Florida (C&SF) Project, which provides water supply, flood protection, water management and other benefits to south Florida (Corps of Engineers and South Florida Water Management District, 1999). Although the C&SF Project has performed these functions well, its construction and operation has also resulted in unintended adverse effects on the unique environment of south Florida, including the Everglades. The CERP includes more than 60 elements designed to mitigate for these adverse effects. The major components of the CERP can be segregated into 13 catagories (Corps of Engineers and South Florida Water Management District, no date):

1. Surface water storage reservoirs

2. Water preserve areas

3. Management of Lake Okeechobee as an ecological resource

4. Improved water deliveries to the estuaries

5. Underground water storage

6. Treatment wetlands

7. Improved water deliveries to the Everglades

8. Removal of barriers to sheetflow

9. Storage of water in existing quarries

10. Reuse of wastewater

11. Pilot projects

12. Improved water conservation

13. Additional feasibility studies

Completion of all the CERP projects is anticipated to take more than 30 years and cost an estimated $7.8 billion.

One of the 11 initial CERP projects authorized under the Water Resources Development Act of 2000 is construction of one or more surface water storage reservoirs within the EAA. Phase 1 of the EAA storage reservoirs project is scheduled for completion by 2009. The primary goals of this project are to:

- Reduce Lake Okeechobee regulatory releases to the estuaries and back pumping from the EAA into Lake Okeechobee by providing a temporary storage site for these waters

- Improve environmental releases to the Everglades through the temporary storage of water for release to meet dry season demand

- Provide flow equalization and optimization of treatment performance in the STAs by capturing peak storm runoff in the reservoir(s) and slowly releasing this stormwater to the STAs

- Improve flood control and regional water supply for agricultural interests within the EAA

1.2   STUDY OBJECTIVE AND SCOPE OF WORK

The project team for the EAA reservoirs project is currently evaluating analytical models for use in projecting the quality of water that is released from the reservoirs. The primary objective of the WQIR study is to acquire and analyze data sets that can be used to help calibrate these analytical models.

The WQIR study is being performed under Contract C-C20104P, Work Order No. 2 (C-C20104P-WO02) between the District and Burns & McDonnell Engineering Company, Inc. Burns & McDonnell has subcontracted portions of the work for this study to two Florida-based subconsultants. These subconsultants are Engineering & Applied Science, Inc. (EAS) of Tampa and Wetland Solutions, Inc. (WSI) of Gainesville.

The work to be completed under the WQIR study has been segregated into four primary tasks. These four tasks are described below.

1.2.1   Project Orientation Meeting

A project orientation meeting (Task 1) was held for the WQIR project on November 10, 2003, in the District's West Palm Beach offices. The purpose of this meeting was to finalize the project's work plan and schedule, and provide the project team with a list of data sources. District staff and the principal members of the Burns & McDonnell project team attended this meeting.

1.2.2   Identification of Data Sites and Data Acquisition

In Task 2 of the WQIR study, the applicable water management districts and other data holders were contacted to identify existing lakes and reservoirs in the project area that may yield favorable data sets for model calibration. Through this research, the project team identified 36 candidate water bodies that appeared to have high potential for use as data sets. The available hydrologic, water quality and other relevant data for these candidate data sites were then collected. These data were imported into a project database for efficient organization and analysis. Through review of the data available for each candidate data site, 8 of the 36 data sites were selected for continued analysis in subsequent study tasks. Figure 1-1 shows the locations of the 36 candidate data sites and indicates the 8 sites selected as potential data sites. Readers are referred to the Task 2 report for additional discussion on the selection process for the 36 candidate data sites and the 8 potential data sites (Burns & McDonnell, 2004a).
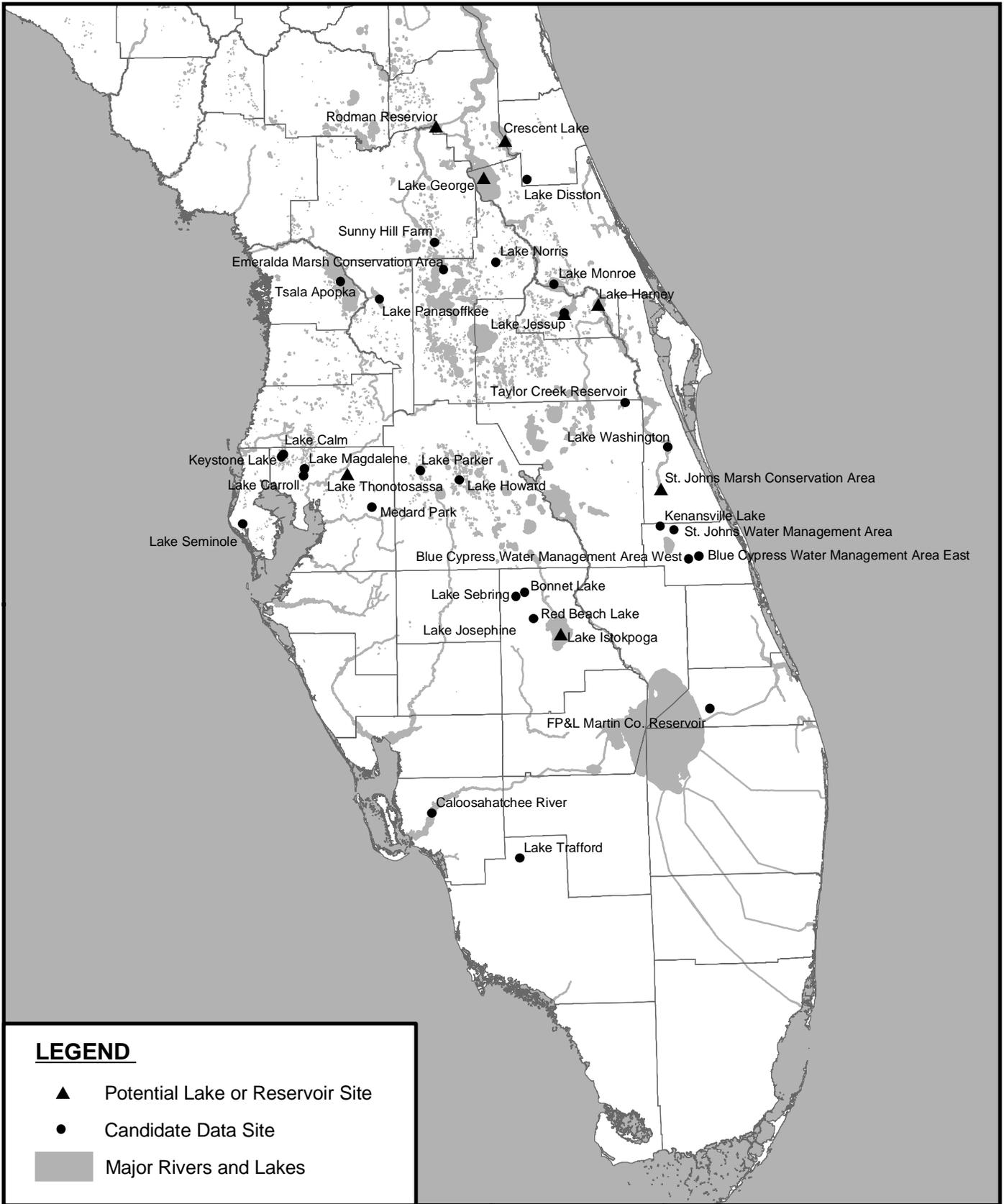
1.2.3   Analysis of Data Sets

The eight potential data sites were subjected to additional analyses in Task 3. For each of these data sites, Burns & McDonnell developed preliminary water and phosphorus mass balances. These water and mass balances provide daily estimates of the inflow, outflow, and retention of water and phosphorus in these lakes and reservoirs. From these balances, the relationships between phosphorus retention and various parameters such as hydraulic loading rate, pH, and calcium concentrations were also investigated. The analyses completed for the eight potential data sites area documented in the Task 3 report (Burns & McDonnell, 2004b).

1.2.4   Data Validation and Data Interface

The scope of work for the fourth and final task in the WQIR (Task 4) included completion of three principal subtasks:

- Data Validation and Delivery – Further validation of the data collected for the 36 candidate data sites and delivery of these validated data to the District

- Data Interface: Develop a web-based interface to the data collected for the 36 candidate data sites to allow easy access

- Final Presentation/Workshop – Prepare and deliver a final presentation/workshop that describes the results of the WQIR study and recommendations for future, additional studies

The data validation and delivery, and the data interface are the principal topics of this report.

Figure 1-1
CANDIDATE DATA SITES

LEGEND

▲ Potential Lake or Reservoir Site

● Candidate Data Site

Major Rivers and Lakes

40   20   0   40 Miles

NORTH

Burns & McDonnell
SINCE 1898

Rodman Reservoir
Crescent Lake
Lake George
Lake Disston
Sunny Hill Farm
Lake Norris
Emeralda Marsh Conservation Area
Lake Monroe
Tsala Apopka
Lake Harney
Lake Panasoffkee
Lake Jessup
Taylor Creek Reservoir
Lake Washington
Lake Calm
Keystone Lake
Lake Magdalene
Lake Parker
Lake Carroll
Lake Thonotosassa
Lake Howard
St. Johns Marsh Conservation Area
Medard Park
Kenansville Lake
St. Johns Water Management Area
Lake Seminole
Blue Cypress Water Management Area West
Blue Cypress Water Management Area East
Bonnet Lake
Lake Sebring
Red Beach Lake
Lake Josephine
Lake Istokpoga
FP&L Martin Co. Reservoir
Caloosahatchee River
Lake Trafford

\\Gissrv\Projects\sfwmd\ARC\ArcDocs\Report\Task3\Fig1-1_Candidate_data_sites.mxd   October 22, 2004 9:30:47 AM

1.3 ORGANIZATION OF THE REPORT

This report is organized into the following sections. Each of these sections is listed below along with a brief description of its contents.

- Executive Summary: An executive summary of the entire WQIR study

- Chapter 1 – Introduction: A description of the study's background, objectives and scope of work

- Chapter 2 – Data Validation and Delivery: The methods use to validate the collected data and the delivery formats are described in this chapter

- Chapters 3 – Data Interface: Chapter 3 contains documentation on the web-based data interface

- Chapter 4 – References: A list of the references cited in the report

- Appendix A – Delivery Format for Potential Data Sets: A detailed description of the contents of the Excel workbook files used for delivery of the potential data sets

- Appendix B – Data Interface Help Page: The text of the help page from the web-based data interface

- Appendix C – Export Data Page: A copy of the export data page from the web-based data interface

* * * * *

2 DATA VALIDATION AND DELIVERY

2 DATA VALIDATION AND DELIVERY

This report section describes the methodology that was used to further validate the data collected for the 36 candidate data sites and the formats used to delivery these data to the District.

2.1 DATA VALIDATION

The data collected for the candidate sites were obtained from a number of different sources, almost entirely in electronic form. The principal data sources were databases maintained by the following organizations.

- South Florida Water Management District (DBHYDRO)

- St. Johns River Water Management District (SJRWMD)

- Southwest Florida Water Management District (SWFWMD)

- Florida Department of Environmental Protection (Florida STORET)

- U.S. Environmental Protection Agency (STORET Legacy and STORET Modern)

- U.S. Geological Survey (NWIS)

- Hillsborough County (Watershed Atlas)

Applicable data for the 36 candidate sites were collected by the project team and then imported into a Microsoft Access database for subsequent analysis. The principal purpose of the data validation effort was to verify that, to the extent practicable, all of the data collected were successfully imported into the project database and that no errors were introduced during the importation process. The data validation effort included the following steps.

2.1.1 Daily Data

Some of the data collected for each data site were available on a daily basis. Generally, these daily data include the following:

- Stream flow or discharge

- Gage heights or water surface elevations

- Precipitation

- Pan evaporation

Because of the sheer volume of these data, checking each individual data value in the database against the corresponding source data was impractical. Therefore, these daily data were validated by first re-importing these data into the project database and then calculating separate annual totals (or averages) using the re-imported and original data. These annual totals were then compared to identify any discrepancies. The cause of any discrepancies was investigated and resolved.

2.1.2 Non-daily Data

Most of the water quality and similar data collected for each data site were derived from individual grab samples, often collected at irregular intervals. For the more significant data parameters, one-on-one comparisons were made for each sample between the source data and data in the project database. The more critical water quality parameters were assumed to include the following:

- Phosphorus (all forms)

- Nitrogen (all forms)

- pH (field or laboratory)

- Water temperature

- Total calcium

These one-on-one comparisons were completed both manually and via computer. The computer-assisted comparisons were completed by importing a second copy of the source data and then using database queries to make one-on-one comparisons between all data points. The non-daily data that were considered

to be less critical — those parameters not included in the list above — were also validated using the computer-assisted method.

2.1.3   Data Normalization and Cleanup

Importation of the source data into the project database was relatively straight forward and proved to be mostly error-free. Almost all of the errors discovered during the data validation process resulted from data normalization. In database terms, normalizing the data refers to the goal of not storing the same information twice or similarly, not using more than one term to refer to the same data or type of data.

The most challenging normalization task was to reconcile the various hydrologic and water quality parameter names. Each of the data repositories listed above has its own nomenclature for these parameter names or codes. As an example, Table 2-1 lists some of the various parameter names and units used to report total phosphorus (TP) concentrations. Even from the same source, this table shows that parameter names and/or reporting units are not always consistent.

Table 2-1: Nomenclature for TP Parameter Names

Source	Parameter Name	Parameter Units
STORET Legacy	PHOSPHORUS, TOTAL (MG/L AS P)	mg/L
STORET Modern	Phosphorus as P	µg/L
STORET Modern	Phosphorus	mg/L
USGS	Phosphorous, water, unfiltered, milligrams per liter	mg/L
SJRWMD	TP-T	mg/L
Florida STORET	Phosphorus as P	mg/L or µg/L
Hillsborough County	TP_ugl	µg/L

The other major cleanup task for the data was to eliminate duplicate records. In a number of instances, the same data were received from more than one source. For example, much (or perhaps all) of the data received directly from SJRWMD was also available from either STORET Legacy or STORET Modern. Once the monitoring sites and parameter names had been normalized, any duplicate records were eliminated from the database.

2.2 DATA SUMMARY

After completion of the data validation, normalization and cleanup effort, some basic statistics for the data were compiled. The data collected represent the following.

- 36 candidate data sites

- 18 Florida counties

- 24 collecting organizations (federal, state and local)

- 1,311 unique monitoring sites or stations

- 824 different hydrologic or water quality parameters

- 3,501,953 data points (unique combinations of monitoring site, data parameter and sample date)

Figure 2-1 shows the distribution of data points by data site. As shown, a considerable range exists with about 3,600 data points for Red Beach Lake and over 360,000 data points for Rodman Reservoir. Although not an absolute measure of data richness, the data sites with the most data are generally more useful for model calibration. In Figure 2-1, the bars for each data site are shaded based on the rating assigned to it in Task 2. This figure shows that out of the nine data sites with more than 200,000 data values, six of these were rated good and only one (Sunnyhill Farm) was rated poor.[1]

Equally as important as the gross number of data points is the number of data points by type (parameter). Figure 2-2 shows the distribution of data values for the more significant monitoring parameters. Not surprisingly, flow and water surface elevations, which are usually recorded daily, are the most numerous. The data for these three parameters account for approximately a third of the total data values. The principal water quality parameters are recorded much less often. The total number of data values for the ten most numerous parameters comprise 2.5 of 3.5 million total data points, or about 71 percent of the total number. Over three quarters of the 824 parameters, particularly those representing pesticides and herbicides, have less than 100 data records each.

---

[1] Sunnyhill Farm received a poor rating because it lacks significant flow-through hydrology and therefore, has few records of inflow and outflow volumes. Forty percent of the data values for this site are climatic data (rainfall, pan evaporation and air temperature).

Figure 2-1: Number of Data Points by Data Site
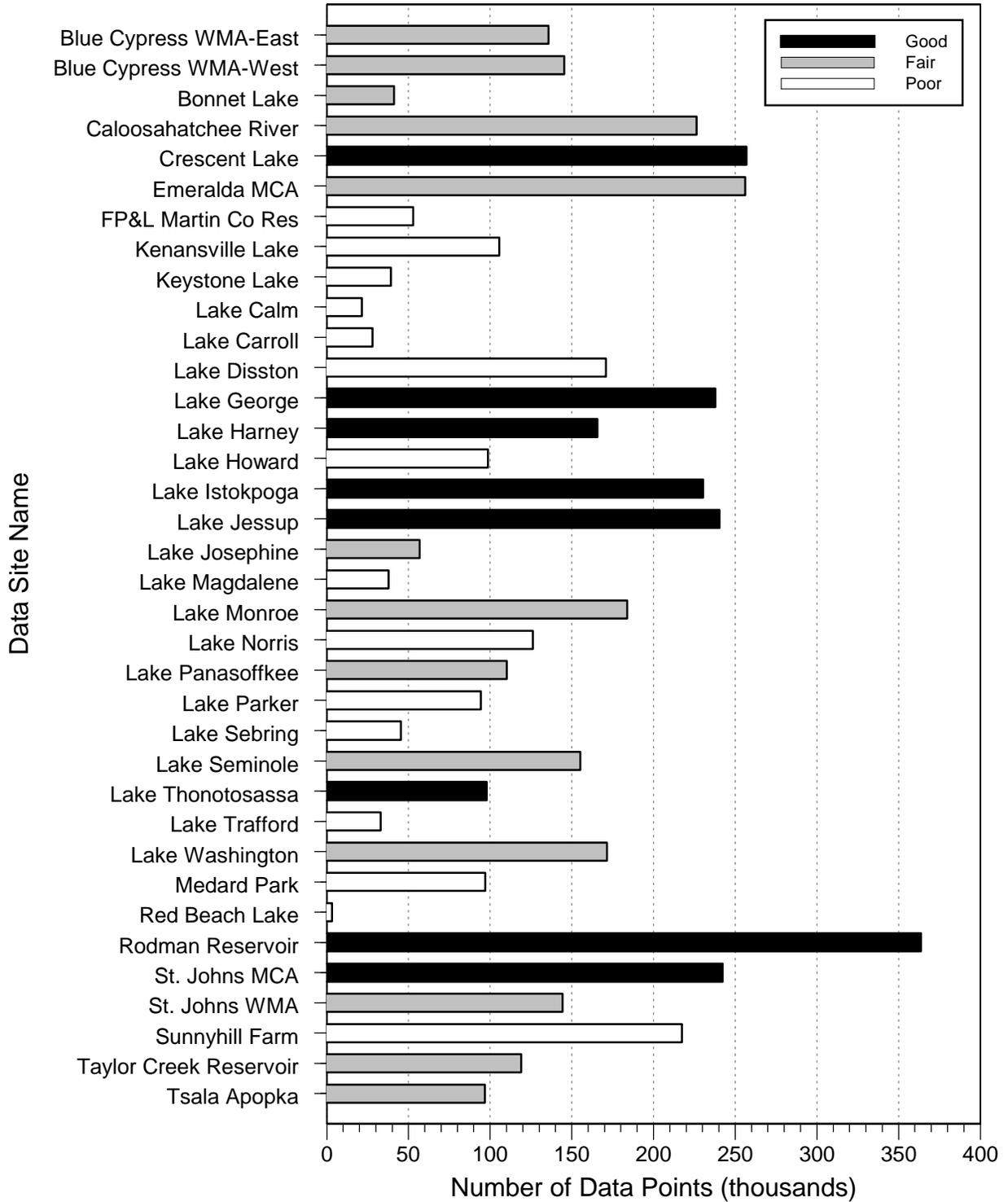
Figure 2-2: Number of Data Points for Key Monitoring Parameters
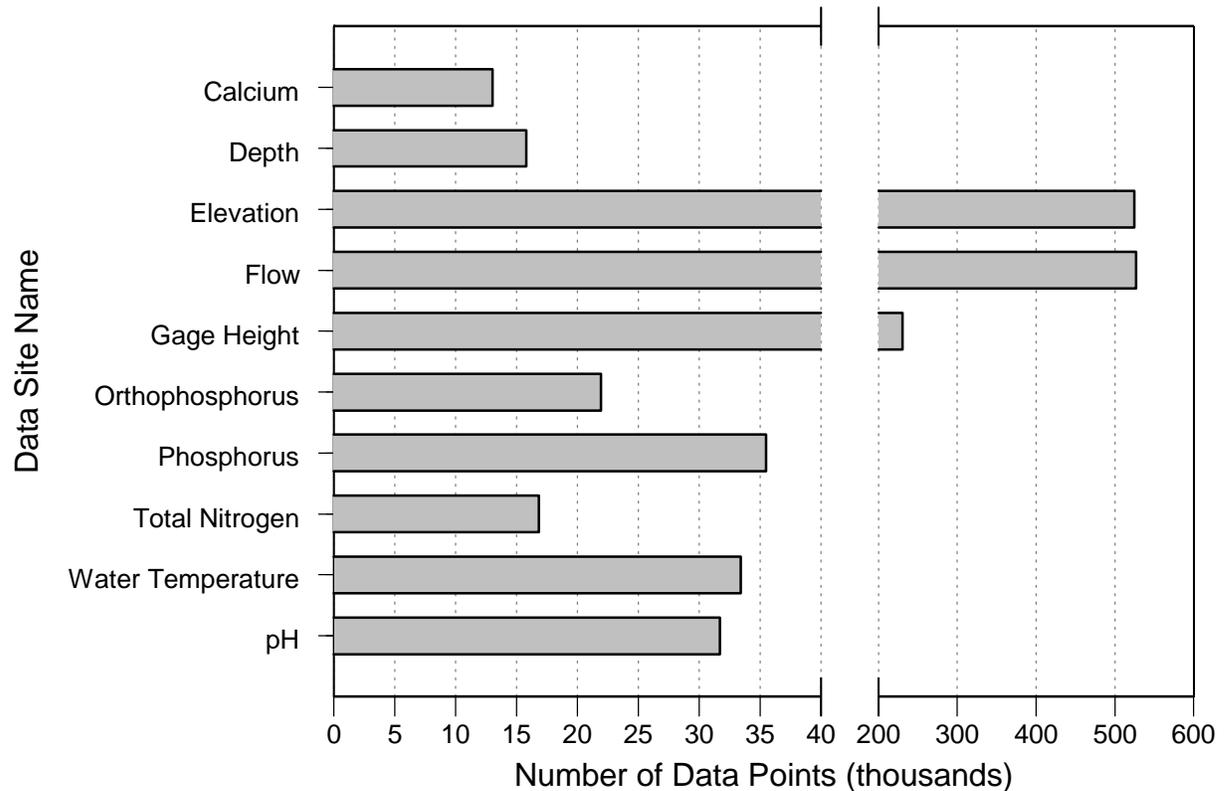
2.3   DELIVERY OF DATA SETS

The data collected in this project were delivered in two phases with the data for the eight potential data sites provided first and the complete data inventory later.

2.3.1   Potential Data Sets

In order to make the data for the eight potential data sets (listed below) available to other researchers as soon as possible, these data sets were validated first and delivered separately in early September 2004.

- Crescent Lake
- Lake George
- Lake Harney
- Lake Istokpoga

- Lake Jessup
- Lake Thonotosassa
- Rodman Reservoir
- St. Johns Marsh Conservation Area

The data for the potential data sites were delivered in the form of Microsoft Excel workbook files, with one workbook for each data site. Each of these Excel workbooks contained several worksheets with differing types of data. These separate worksheets and their contents are described below.

- Monitoring Stations: The station number and name, collecting agency, relative location, latitude and longitude for each monitoring site associated with the given data site

- Flow: The recorded daily flow data for each data site

- Water Surface Elevations: Recorded water surface elevations within the lake or reservoir, or at an associated stream gage

- Gage Heights: For monitoring sites located at U.S. Geological Survey stream gaging stations, the associated gage height records

- Rainfall: Recorded daily rainfall at nearby climatic stations

- Pan Evaporation: Daily pan evaporation data recorded at the nearest climatic station

- Water Quality: Individual water quality records (station, parameter and date) associated with the given data site

- Water Balance: The daily water balance developed for the data site

- Phosphorus Balance: The daily phosphorus mass balance for the data site

More detail on the contents of these Excel workbooks is provided in Appendix A

2.3.2 Candidate Data Sites

The data for all 36 candidate data sites were delivered in the form of a Microsoft Access (version 2002) database file. This database contains all of the data collected during this project, including those for the eight potential data sites. The principal data tables contained in the project database are described briefly below.

- Data Site: The Data Site table (tblDataSite) contains a single record for each of the 36 candidate data sites investigated in this study task. The data columns in this table include the data site name and location, and codes that identify the water managment district and county where the site is located.

- County: A list of the Florida counties included in the project study area is contained in the County lookup table (tblCounty).

- Organization: The Organization lookup table (tblOrganization) contains the names of the different agencies that collected the data contained in the project database along with a standard abbreviation for each of these agencies.

- Station: Each of the monitoring sites, or stations, represented in the project database is listed in the Station table (tblStation). This table contains columns for the station number, name, latitude, longitude, and codes for the collecting organization.

- Location Type: The Location Type lookup table (tblLocationType) contains the standard names for each relative location type (inflow, outflow, interior, etc.).

- Station Location: The Station Location table (tblStationLocation) is a cross reference table (many-to-many relationship) that identifies the monitoring stations associated with each candidate data site. For each of these data site-monitoring station pairs, this table also indicates the location of the station relative to that water body: That is, is it an inflow station, outflow station, interior station, or external station?

- Parameter: A standardized list of data parameters is included in the Parameter table (tblParameter). In addition to the parameter name, this table contains data columns for standard abbreviations and data units.

- Analytical Data: The Analytical Data table (tblAnalyticalData) contains all of the actual time series data. This table includes data columns that contain identification numbers for the respective monitoring station and data parameter along with the sample date, data value and any associated remarks.

- Data Summary Parameter: The Data Summary Parameter table (tblDataSummaryParameter) is an auxiliary table that contains a list of the more important data parameters that were included in the data summary reports for each candidate data site.

- Water Balance: The daily water balances developed for each of the eight potential data sites are contained in the Water Balance table (tblWaterBalance).

- Phosphorus Balance: The Phosphorus Balance table (tblPhosphorusBalance) contains the daily phosphorus mass balances for each of the eight potential data sites.

A graphical representation of the database schema is shown in Figure 2-3. This figure shows each database table and the fields in each table. The connecting lines between tables show the relationships between tables and the specific fields involved in these relationships. These relationships are all of a single type: one-to-many. A one-to-many (1:M) relationship indicates that for each single record in the table on the one side of the relationship, there may be many related records in the other table. For example, each individual monitoring station record in the Station table (tblStation) may have many related sampling data stored in the Analytical Data table (tblAnalyticalData).

<p align="center">* * * * *</p>

Figure 2-3: Database Schema
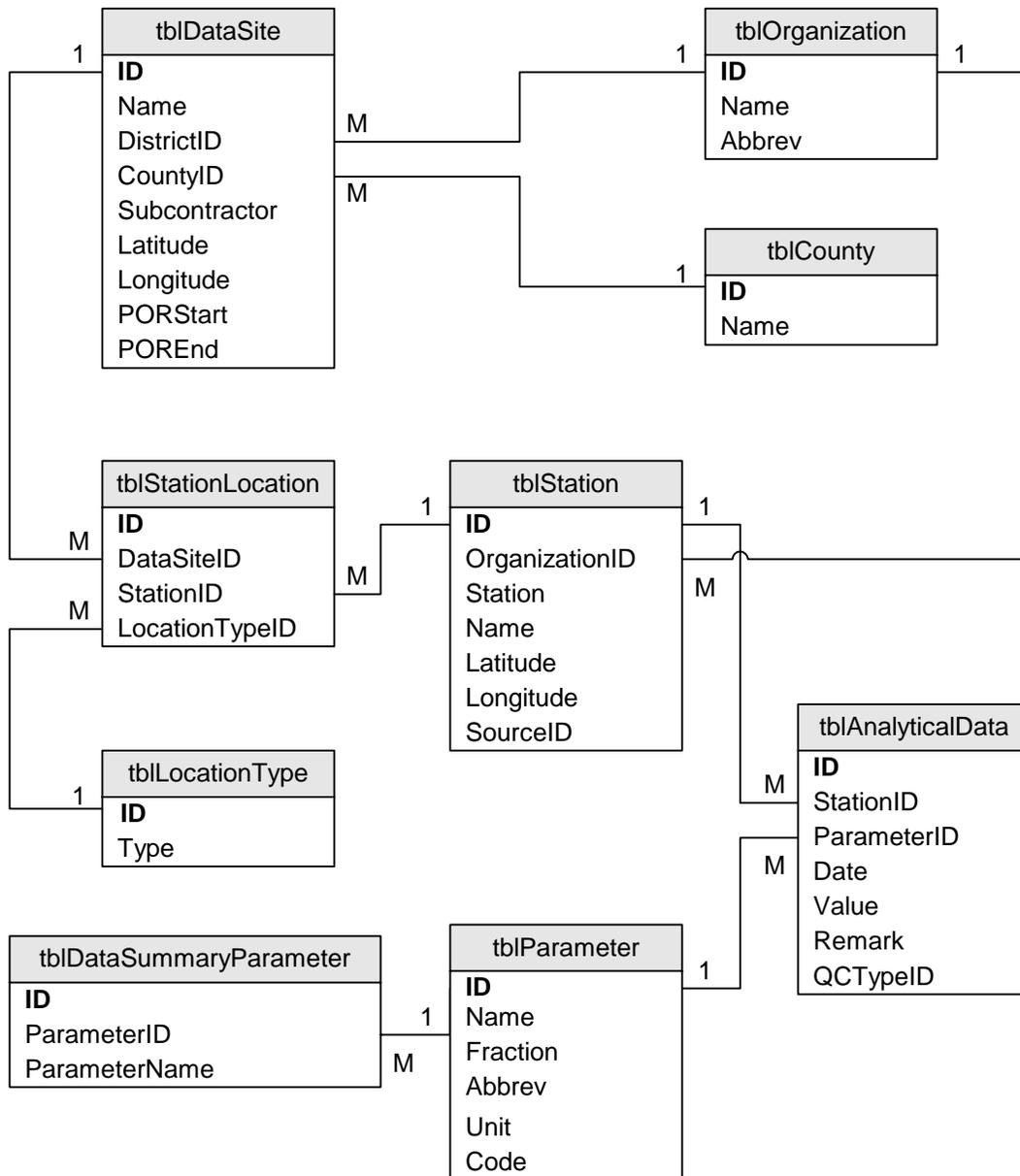
3   DATA INTERFACE

3 DATA INTERFACE

Burns & McDonnell has developed a web-based data interface for the data collected for the 36 candidate data sites. The WQIR website will be hosted on the District's Internet web server and afford interested parties easy access to the data collected for this project. All of the WQIR study data are stored in a Microsoft Access database file (Section 2.3.2) but not all potential data users have this software application or are familiar with its use. Therefore, the principal design goal of the data interface is to make the data easily accessible to anyone with an Internet connection and web browser. The principal features of the data interface are described in the balance of this report section.

3.1 WELCOME PAGE

The WQIR data interface will be accessible through the District's web site at http://www.sfwmd.gov. The specific web address, or universal resource locator (URL), for the data site has not yet been determined. Once a user selects the appropriate link for this data interface, a welcome (splash) page will be displayed. This welcome page will be similar in appearance to the one shown in Figure 3-1. The welcome page will contain a brief overview of the WQIR study, and links to the actual data interface and other online resources.

3.2 MAIN DATA INTERFACE PAGE

The main page for the WQIR data interface will be accessible through links provided on the welcome page described above. This main interface page will provide users with access to all of the features of the data interface, including the ability to filter, view and export the project's data. A picture of the main data interface page is shown in Figure 3-2. The key features of the main data interface page are described below.

Figure 3-1: Data Interface Welcome Page

3.2.1 Select Lake List Box

In the upper left corner of the main page is a data site selection list box under the heading "Step 1: Select Lake." This list box lists all 36 of the candidate data sites and allows users to filter the data by selecting one or more of these sites. By default, with no individual sites selected, the data for all lakes are available. Once the user has selected one or more data sites, the Map Lake button can be clicked to highlight these selections on the map, which occupies the right half of the main page. The Clear button below this site list box can be used to remove all prior selections.

Figure 3-2: Data Interface Main Page

3.2.2 Select Organization List Box

Below the Select Lake list box is the Select Organization list box, titled "Step 2: Select Organization." This list box allows users to filter the data based on the collecting organization. One or more of the organizations in this list box can be selected or users can chose the default, which is to return all data without regard to the collecting organization. The Clear button below the organization list box can be used to remove all prior selections.

3.2.3 Select Relative Location List Box

For each data site, all of the associated monitoring stations have been classified as inflow, outflow, interior or external stations. Users can filter their selection by chosing one or more of the relative location shown in the relative location list box, titled "Step 3: Select Relative Location." By default, if the user makes no selections in this list box, all monitoring stations are available. To clear any previous selection, users can click the Clear button below this list box.

3.2.4   Show Stations Command Button

In the lower left corner of the main page is a command button titled "Step 4: Show Station by Steps 1-3." This button will dynamically populate the stations list box based on any filters specified in Steps 1 through 3.

3.2.5   Monitoring Station List Box

To the right of the first tier of list boxes is the monitoring station list box, titled "Step 5: Select Monitoring Station." This list will be populated with a list of monitoring stations that meet the criteria specified in the first three list boxes, if any. If no selections are made in Steps 1 through 3, then all of the available monitoring stations will be listed in this box. If users wish to further filter the data, they can select one or more monitoring stations in this list box. The Map Stations button below this list box will highlight any stations selected on the map. The Clear button below this list box will clear any previous selections.

3.2.6   Select Parameter List Box

The final list box on the main interface page is the parameter list box, titled "Step 6: Select Parameter." This list box will filter the monitoring data based on the parameters selected in this list box. As with the other list boxes, users can select one or more parameters from this list box. This list box has three filtering options, which are controlled by the radio buttons shown below the list box. With the All button selected, all 800+ monitoring parameters will be listed in this list box. The Top 10 radio botton will filter the parameters listed in this box to the few parameters that are most common. The last radio button, Stations, will dynamically filter the parameter list based on the monitoring stations already selected. That is, only the data parameters available for the station or stations selected will be shown. The Stations radio button is selected by default. The Clear button below the parameter list box can be used to remove all prior selections. If no specific parameters are selected, the data for all available parameters will be returned.

3.2.7   Query Water Quality Data Command Button

The command button titled "Step 7: Query Water Quality Data" will retrieve the monitoring data based on any filtering selected by the user in the prior steps. Using the radio buttons provided, users have the option of viewing or exporting the selected data. If the user selects the Export radio button, an Excel spreadsheet will be generated that contains just the data requested. Exporting complete data sets will be

described later. When viewing data (the default), users can chose to see the raw data, which lists each individual sample result, or a statistical summary. Figure 3-3 shows an example listing of dissolved oxygen data for one station at Crescent Lake. In this example, there are only three data points for dissolved oxygen at this station but it is possible to generate queries that return thousands or even tens of thousands of records. Users wanting view large amounts of data are encouraged to export the data first and then use Excel, Access or some other application to view these data. If users select a statistical summary, the interface will display only the number of records, mean, minimum, maximum and standard deviation of the available data points for each parameter and station selected.

Figure 3-3: Viewing Raw Data

3.2.8   Interactive Map

Users can also use the map that occupies the right half of the main interface page to select data sites and/or specific monitoring stations. Selections made on the map are reflected in the appropriate list boxes on the left side of the data interface page. At its full extent, only the 36 candidate data sites are visible on the map but as users zoom in farther, the actual outlines of the various lakes and monitoring station locations will become visible. The toolbar located in the extreme upper right corner of the map allows users to zoom in, zoom out, pan, select individual features or draw a rectangle to select multiple features.

3.3   DATA EXPORT PAGE

As described above, users can build and execute a custom query to either view or export data but exporting data in this manner is suitable only for small data sets. The recommended approach for all but the smallest data sets is to export the data for an entire lake or reservoir, or for groups of these data sites from the data export page. From the main data interface page, users can access this page be selecting the Export Data link on the extreme upper right side of the main page. A partial view of this page is shown in Figure 3-4; a complete copy can be found in Appendix C. From this export page, users can export the data associated with any one of the 36 candidate data sites, the data for all 8 of the potential (good-rated) data sites, or the entire WQIR data set.

All of the datasets are stored on the server as compressed zip files to minimize the time required to download them. One or more files are contained in each zip archive file. The file type(s) within these archives varies depending on the volume of data in each data set. When practicable, the data sets are saved as Excel workbook files but the worksheets in these files are limited to 65,536 rows each. Over 70 percent of the data sites have more than 65,000 analytical data values so these data sets are delivered as delimited text files. The data for the entire WQIR data set can also be downloaded in the form of a Microsoft Access database file.

In addition to the raw analytical data, there are some other types of data available for export. These include those listed below.

- The water and phosphorus balances for the eight potential data sites

- Maps for each of the 36 candidate data sites

- Time series graphs for key monitoring parameters at the eight potential data sites

3.4   HELP PAGE

Although the data interface is intended to be fairly self-explanatory for regular Internet users, the data interface also includes an extensive help page. This help page addresses the following topics.

Figure 3-4: Data Export Page

- How to query for monitoring stations

- How to view the water quality data

- How to use the map

- Downloading data

- Tips on how best to use the web site

- Frequently asked questions

- Why did the web page redirect me here?

A copy of the data interface help page is included in Appendix B.

<p style="text-align:center">* * * * *</p>

4 REFERENCES

4   REFERENCES

This report section contains a list of the references cited in this report.

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Appendix A

DELIVERY FORMAT FOR POTENTIAL DATA SETS

September 10, 2004

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Office of Modeling–Interagency Modeling Center
South Florida Water Management District
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> South Florida Water Management District
> Contract No. C-C20104P-WO02
> Water Quality Impacts of Reservoirs
> <u>Subtask 4.1 – Data Validation and Delivery for Potential Data Sets</u>

Dear Ms. Zhao:

The fourth and final task under the Water Quality Impacts of Reservoirs (WQIR) project is segregated into six individual subtasks. This letter report documents the work completed under the first of these subtasks, Subtask 4.1–Data Validation and Delivery for Potential Data Sets.

BACKGROUND

The primary goal of the WQIR project is to collect hydrologic and water quality data sets for water bodies in Central and South Florida that can be used to help calibrate analytical models. In Task 2 of the study, the project team identified 36 candidate water bodies that appeared to have the necessary characteristics to meet this goal. After additional analysis, 8 of the original 36 candidate water bodies were identified as the best data sites based on data availability. The eight good-rated data sites were designated potential data sites. The potential data sites are listed below:

- Crescent Lake
- Lake George
- Lake Harney
- Lake Istokpoga
- Lake Jessup
- Lake Thonotosassa
- Rodman Reservoir
- St. Johns Marsh Conservation Area

In Task 3, Burns & McDonnell developed daily water and phosphorus balances for these eight water bodies and used these balances to explore the relationships between phosphorus retention and other hydrologic and water quality parameters.

The first subtask in Task 4 (Subtask 4.1) is to deliver the raw data collected for the eight potential data sites and the related water and phosphorus balances to the District and others so these data can be used for model calibration. The balance of this letter describes the work done to validate these data and their delivery format.

DATA VALIDATION

The data for the eight potential data sites were collected from a number of sources, such as SFWMD and the other water management districts, U.S. Environmental Protection Agency, Florida Department of Environmental Protection, U.S. Geological Survey, and National Oceanic and Atmospheric Administration. Virtually all of these data were obtained in an electronic format and then imported into the project's Access database.

The importation of the data to the Access database was complicated by the differing formats and nomenclatures used by each source. In particular, each source had its own terms for most water quality parameters. For example, five alternative parameter names and units used to refer to total phosphorus concentrations are listed below:

- STORET Legacy: PHOSPHORUS, TOTAL (MG/L AS P)
- STORET Modern: Phosphorus as P, mg/l
- SJRWMD: TP-T, mg/L
- Hillsborough County: Phosphorus, mg/l
- Hillsborough County: TP_ugl

In order to be useful, these data had to be normalized so that like data types were referenced the same way in the database. In this manner, like data could be combined or compared effectively regardless of source. The other complicating factor was that we sometimes got the same data from two different sources so duplicates had to be eliminated.

The net effect of these complicating factors was that some importation errors were inevitable. To ensure that data for these data sites was as complete and error free as practicable, validation procedures were implemented. The specific validation steps completed are described below.

Daily Data

Some of the data collected for each data site were available on a daily basis. These data generally included the following types: flow, gage height or water surface elevation, precipitation, and pan evaporation. These data were validated by first calculating separate annual totals (or averages) using the raw data and data in the project database. These annual totals were then compared to identify discrepancies. The cause of any discrepancies was then determined and corrected. Very few actual errors were identified for these daily data, with the most common being simple data duplication.

Non-daily Data

Most of the water quality and similar data collected for each data site were derived from individual grab samples, often collected at irregular intervals. For the most important data parameters, one-on-one comparisons for each sample between the raw and imported data were conducted. The most important data parameters were assumed to include phosphorus, nitrogen, pH, water temperature, and calcium. The balance of the data collected for each data site were compared as described above for daily data, by first calculating annual totals and then comparing these totals to identify discrepancies. The most common errors identified with these data types was again duplicate data and incorrect unit conversions.

DELIVERY FORMAT

Once the data validation steps were completed, the data for each of the eight potential data sites were exported from the Access database into Excel workbooks, with a separate workbook for each data site. Within each Excel workbook, separate worksheets were created for each class of data: monitoring stations, flow, water surface elevations, gage heights, rainfall, water quality data, water balance, and phosphorus balance. Because Excel worksheets are limited to a maximum of 65,536 rows, the data for some classes had to be segregated into two worksheets. The contents of these worksheets for each data class are described below, with the assigned worksheet name shown in parentheses.

Monitoring Stations (Stations)

One row is included for each of the monitoring stations applicable to the data site in question. The data columns provided are listed below:

- Site ID: Common site number used to identify the data site in the database
- Site Name: Data site name
- Station ID: Common station identification number used to identify the monitoring station in the database
- Agency: Name of the agency or organization responsible for collecting the data for the monitoring station
- Station: Station number or code name assigned by the responsible agency
- Station Name: Assigned monitoring station name
- Relative Location: Location of the monitoring station relative to this data site (inflow, interior, outflow, etc.)
- Latitude: Station's latitude if available (decimal degrees north latitude)
- Longitude: Station's longitude if available (decimal degrees west longitude)

Flow (Flow)

Flow data were generally recorded daily so one row exists for each mean daily flow value at each related gaging station. The data columns provided are listed below:

- Site ID: Common site number used to identify the data site in the database
- Parameter: Parameter name (Flow)
- Units: Parameter units (cfs–cubic feet per second)
- Station ID: Common station identification number used to identify the monitoring station in the database (same as provided for related station in Stations worksheet)
- Agency: Agency abbreviation
- Station: Station number or code name assigned by the responsible agency
- Date: Flow date
- Value: Mean daily flow value
- Remarks: Any applicable remark codes

Water Surface Elevations (WSElev)

Water surface elevation data were typically derived from the associated gage height readings. Because the gage datum at many gages is at sea level, the elevation and gage height readings on a particular day are often identical. The data columns provided are listed below:

- Site ID: Common site number used to identify the data site in the database
- Parameter: Parameter name (Elevation)
- Units: Parameter units (ft.–feet)
- Station ID: Common station identification number used to identify the monitoring station in the database (same as provided for related station in Stations worksheet)
- Agency: Agency abbreviation
- Station: Station number or code name assigned by the responsible agency
- Date: Recording date
- Value: Mean daily water surface elevation
- Remarks: Any applicable remark codes

Gage Heights (GageHeight)

For U.S. Geological Survey stream gaging stations, gage height data are used to generate the associated flow estimates. The data columns provided are listed below:

- Site ID: Common site number used to identify the data site in the database
- Parameter: Parameter name (Gauge Height)
- Units: Parameter units (ft.–feet)
- Station ID: Common station identification number used to identify the monitoring station in the database (same as provided for related station in Stations worksheet)
- Agency: Agency abbreviation
- Station: Station number or code name assigned by the responsible agency
- Date: Recording date

- Value: Mean daily gage height
- Remarks: Any applicable remark codes

Rainfall (Rain)

- Site ID: Common site number used to identify the data site in the database
- Parameter: Parameter name (Rainfall)
- Units: Parameter units (in.–inches)
- Station ID: Common station identification number used to identify the monitoring station in the database (same as provided for related station in Stations worksheet)
- Agency: Agency abbreviation
- Station: Station number or code name assigned by the responsible agency
- Date: Recording date
- Value: Total daily rainfall
- Remarks: Any applicable remark codes

Water Quality (WaterQuality)

- Site ID: Common site number used to identify the data site in the database
- Parameter: Parameter name
- Units: Parameter units
- Station ID: Common station identification number used to identify the monitoring station in the database (same as provided for related station in Stations worksheet)
- Agency: Agency abbreviation
- Station: Station number or code name assigned by the responsible agency
- Date: Recording date
- Value: Result value
- Remarks: Any applicable remark codes

Water Balance (WaterBalance)

- Site ID: Common site number used to identify the data site in the database
- Date: Date of water balance estimate
- Area: Water surface area (acres)
- Gaged Inflow: Recorded daily inflow to data site (acre-feet)
- Ungaged Inflow: Estimated ungaged inflow to data site on date (acre-feet)
- Precip: Rainfall depth on date (inches)
- Precip Vol: Rainfall volume on data (acre-feet)
- Evap: Estimated daily lake evaporation (inches)
- Evap Vol: Estimated daily evaporation losses (acre-feet)
- Gaged Outflow: Recorded daily outflow from data site (acre-feet)
- Ungaged Outflow: Estimated ungaged outflow from data site on date (acre-feet)

- Elevation: Estimated water surface elevation (feet)
- Depth: Estimated mean water depth (feet)
- Storage Change: Change in storage volume (acre-feet)
- Imbalance: Calculated imbalance in water balance terms (acre-feet)

Phosphorus Balance (PhosphorusBalance)

- Site ID: Common site number used to identify the data site in the database
- Date: Date of phosphorus balance estimate
- Area: Water surface area (acres)
- Inflow Conc: Flow-weighted inflow phosphorus concentration (mg/L)
- Inflow Flux: Estimated inflow mass loading on date (grams)
- Deposition: Sum of estimated wet and dry atmospheric deposition on date (grams)
- Outflow Conc: Flow-weighted outflow phosphorus concentration (mg/L)
- Outflow Flux: Estimated outflow mass flux on date (grams)
- Retention: Calculated net retention of phosphorus in water body on date (grams)

The Excel workbooks for each of the eight data sites plus this letter are contained on the enclosed CD-ROM. If you have any questions about these data, please do not hesitate to call me.

Sincerely,

Gene L. Foster, P.E.
Project Manager
(816) 822-3167

Enclosure

Appendix B

DATA INTERFACE HELP PAGE

Help information is divided into the categories identified below. Click any of the links to navigate directly to that particular Help section.

1. How to query for Montioring Stations

2. How to view the Water Quality Data

3. How to use the Map

4. Downloading the Data

5. Tips on how best to use this Web Site

6. Frequently Asked Questions (FAQ)

7. Why did the Web Page Redirect Me Here?

1. How to query for Monitoring Stations

There are two methods to query Monitoring Stations: (1) By Selecting Lakes, Organizations, Relative Location Types, and Parameters via the ListBoxes, or (2) By Selecting via the map.

Method 1: Query Stations using Listboxes

Since Monitoring Stations are related to Lakes, Organizations, Relative Location Types, and Water Quality Parameters, the web site has divided each into distinct lists or ListBoxes. The web site indicates how to query for Monitoring Stations in a series of Steps. Note, that the ordering of Steps is only provided as a means to help orient the user in using the web site, and therefore, it is not necessary for the user to follow the order of the Steps once the user is familiar with how the web site operates. This is evident in that Monitoring Stations will only be queried when the user clicks the "Show Stations" button and until then, the user can modify the selections in the ListBoxes.

Note that all listed items are considered selected if the user has not made any individual selections in the ListBox. This is part of the web site design to minimize user efforts in selecting items since in many cases, the user will want to use all listed items in a given ListBox when querying for Monitoring Stations.

To clear any selected items listed, click the "Clear" button below the desired ListBox.

Parameters can be listed by: "All","Top 10", or by selected "Station"(s). The web site defaults to listing the Parameters by "Station". To change the listing, click either the "All","Top 10", or "Station" circle below the ListBox. Note, that when you have "Station" selected, the list parameters will automatically update each time you change your selection in the Monitoring Station ListBox (Sampled Parameters vary between Monitoring Stations).

List Parameters By: ○ All ● Top 10 ○ Station

Click here for some Query examples.

Method 2: Query Stations using the Map

The Map is another way to interact with the data, and like the ListBoxes, it can be used to query Monitoring Stations. There are two Map tools that allow you to select both Lakes and Monitoring Stations. After selecting in the map, any selected Lakes will be highlighted in the

tools that allow you to select both Lakes and Monitoring Stations. After selecting in the map, any selected Lakes will be highlighted in the Lakes ListBox and any selected Monitoring Stations, including those pertaining to the selected Lakes, will be listed in the Monitoring Station ListBox. Selected Lakes are highlighted in lighter red, while selected Monitoring Stations are highlighted in darker red.

You can also have the Map show what Lakes and Monitoring Stations are selected in the ListBoxes. Below the Lakes ListBox, there is a "Map Lake" button. After selecting any number of lakes in the ListBox, click this button and the Map will zoom to the selected lakes, highlighting them in red. In addition, below the Monitoring Stations ListBox, there is a "Map Station" button. Similar to the "Map Lake" button, after selecting any number of Monitoring Stations in the ListBox, click this button and the Map will zoom to the selected Monitoring Stations, highlighting them in red.

Note, that some of the selected lakes or Monitoring Stations could be geographically far apart, and therefore are hard to see in the Map. If this occurs, reduce the number of selected items and try again. A good workflow is to select a particular lake, zoom the map to it, and then pan or move around in the map to find the desired Monitoring Stations.

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2. How to view the Water Quality Data

Water Quality data are displayed according to what Monitoring Stations and Water Quality Parameters are selected. Note that if you have not selected any listed Stations or Parameters, than all listed items are used to query the Water Quality data. It is better to only use a few Stations, at most, especially if you are using all Parameters, since the number of Water Quality records could be quite large and therefore, take a long time to process.

Once you have made your selections in Step 5 for Monitoring Stations and Step 6 for Parameters, you can then click on the "Query Water Quality Data" button in Step 7.

You will also notice that you have the two options: View and Export (View is the default). What this means is that you can either view your queried records in a table on the web page or you can export the queried records to Microsoft Excel or a Tab-Delimited Text file (TDF) for download. (MS Excel only supports up to 65,500 records so if your query returns more than 65,500 records, the format will be TDF.) In addition, you can view/export the "Raw Data" (all individual tabular records) or "Summary" data (statistical summary of all records for each sampled water quality parameter for each Monitoring Station). The statistics include: Min Date, Max Date, Count, Mean, Standard Deviation, Min Value, and Max Water Quality Value.

The following is an example of the generated table (using the "View" option) from querying the "Highlands-Bonnet-1" Monitoring Station using all "Top 10" parameters. You will notice that just above the table, you can see how many records were returned from the query, which is 36 in this example. Also notice that each of the Field Names is displayed as a hyperlink. This means that when you click on a particular Field Name, the table will be re-sorted using only that particular Field Name. When the table is first generated by default, it is sorted by the following fields (in order): Station, Parameter, and then Date.

Here you can view or export (download) the Water Quality data based on your selections in Steps 1-6. Please note that if you have not selected any listed Stations and Parameters, then all that are listed will be queried for view/export. Since the datasets are very large, it is recommended that you select only a few stations at a time, especially if you are querying for all Water Quality parameters. For viewing larger datsets, click on the above

Queried Monitor Station Water Quality Data - Returned 36 records

Query Water Quality Data

SITE ID	SITE NAME	PARAMETER	UNITS	STATION	STATION NAME	DATE	VALUE	REMARKS
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	11/29/1998	0.0450	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	12/27/1998	0.0360	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	12/6/1999	0.0470	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	1/8/2000	0.0380	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	2/10/2000	0.0380	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	3/17/2000	0.0480	
3	Bonnet Lake	Phosphorus, Total as P, water, unfiltered	mg/L	HIG-BONNET-1	Highlands-Bonnet-1	4/11/2000	0.0550	

The following is an example of generating the same table as indicated above, except this time using the "Export" option. You will notice that this is a standard Microsoft window prompt for downloading a file. The table has been exported to MS Excel since the number for records was less than 65,500. If the number of records had exceeded 65,500, then the file format would have been txt. Notice that with this window prompt, you can "Open" or "Save" the file. If you select "Open", the table will open in a new window. If you select "Save", then you will be prompted to name and save the file on your hard drive or network.

Some files can harm your computer. If the file information below looks suspicious, or you do not fully trust the source, do not open or save this file.

File name: StationData.xls

File type: Microsoft Excel Worksheet

From: localhost

Would you like to open the file or save it to your computer?

[Open]   [Save]   [Cancel]   [More Info]

☑ Always ask before opening this type of file
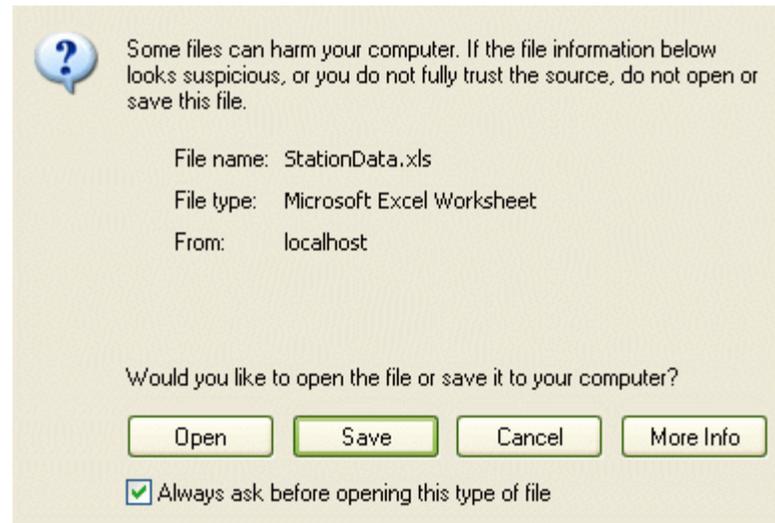
3. How to use the Map

The map is an optional way to interact (query/analyze) with the water quality data. The map data include: Monitoring Stations (displayed as red points), Data Sites or Lakes (displayed as dark blue polygons), other water bodies (displayed as light blue polygons), streams (displayed as light blue lines), Water Management Areas (displayed as a dark grey outline), and County Boundaries (displayed as black dashed lines).

Some of the map data have zoom tolerances, which means that the data will not be visible until the map is zoomed in to a particular scale. An example of this is the Monitoring Station data. You will not be able to see any Monitoring Stations (ie red dots) until you zoom in fairly close on a particular data site. The reason for this is that the data becomes indistinguishable at small scales (ie the red dots overlap each other) and the labels are quite long (since they include both the Station ID and Name description). When you first view the map, it will only show the Data Sites (Lakes) and Water Management Areas. Some of the Data Sites are small so you may have to zoom in some to see them.

You will notice that in the upper right corner of the map there are seven icons displayed horizontally. These are the map tools that allow you to interact and change the current map view. They look as follows:

Moving in order from left to right, the tools are as follows: ZoomIN, ZoomOUT, Pan, Zoom to Full Extent, Clear Selection, Select By Point, and Select By Rectangle. You should also notice, that when you place your mouse cursor over an icon, you will see a description of the tool in the status bar of your Internet browser (Note, make sure your status bar is visible). To activate a particular tool, just left click on the icon with your mouse cursor. Some tools require that you further left click on the map after first activating them. You will notice these because after you activate them, the icon will have a red border to indicate to you that it is currently activated. Once activated, that tool will react whenever you click on the map. Some tools, however, will react immediately when you click them. This will be apparent in the tools' description, mentioned below.

ZoomIN, ZoomOUT, Pan, and Zoom to Full Extent are all tools that will change the current view or scale of the map. All but the Zoom to Full Extent tool will require you to click on the map after activating them. ZoomIN has two options: you can left click once on the map and the map will center at the point that you clicked and then zoom in by a factor of two. The other ZoomIN option is to drag a zoom rectangle by holding down the mouse button as you move the cursor across the map. As you move, you will notice a red outlined rectangle follow your cursor. This rectangle will be the area that the map zooms to once you release the mouse button. ZoomOUT will zoom out by a factor of two at the point that you click. Pan will center the map where you click. Zoom to Full Extent will automatically zoom the map back to its original starting viewpoint when you activate the tool (You will not see any red border around the icon since you do not have to further click on the map).

The remaining tools, which are the select tools, allow you to query and further interact with the data. You have two options for selecting: Select By Point or Select By Rectangle. The difference is obvious, in that, you should use the Select By Point tool when you want to make precise selections, such as selecting one Lake or Monitoring Station. Since these tools require you to click on the map, you will notice a red border around the icon when you activate the tool. The Select By Rectangle operates like the ZoomIN when trying to define your selection rectangle. The only features that you can select from are the Data Sites (Lakes) and Monitoring Stations.

You will notice that after you select one or more of the features, the map will update and those features you selected, will be highlighted in red (transparent red for Data Sites and normal red for Monitoring Stations). Also, notice that if you selected any Data Sites, then they will be highlighted in the ListBox and if you selected any Monitoring Stations, they will be listed in the ListBox. Note, that if you select any Data Sites, the Monitoring Stations that are associated with that Data Site will also be listed. As you can see, this offers another method to query Data Sites and Monitoring Stations. If you want to remove the red highlighted selected features, then just activate the Clear Selection Tool and the map will refresh showing those features back as their normal colors. Also, note that if you click on a Monitoring Station that resides over a Data Site, then only the Monitoring Station will be selected. This is important because if you are zoomed out quite far and you click on a Data Site, the Data Site may not be selected because you actually clicked on a Monitoring Station. Zoom in if this occurs.

On a final note, you should notice the "Map Lake" and "Map Station" buttons below their subsequent ListBoxes. When you click these buttons, the map will zoom to the extent of the selected items. Therefore, this provides a quick and easy way to view a certain Data Site or Monitoring Station on the map.

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4. Downloading the Data

Since there are a large amount of data in this study, a page is provided to download all of the data in various subsets. This may be the best option if you are interested in analyzing the majority of the data or even just the water quality parameters sampled from the Monitoring Stations of only one data site or lake. It will also be more efficient than trying to use the web site to dynamically query large datasets since the queries can be fairly slow due to millions of water quality records.

There are many options in downloading the data since not all analysts will want all of the data, especially since the comprehensive data file downloads are quite large. The downloads are organized on the page, ranging from comprehensive to specific datasets. There are four download sections named: All, Data Type, Potential Sites, and Candidate Sits. The All section includes downloads for acquiring all of the data, which is all of the tables, graphs, and maps in the study. The Data Type section includes downloads for only acquiring certain types of data, such as only tables, only the graphs, or only the maps. The Potential Sites section includes downloads for only the specific data pertaining to the eight Potential Sites, and likewise, the Candidate Sites section includes downloads for data specific to the 36 Candidate Sites.

To download the data, just click on any of the hyperlinks. Once clicked, you will be prompted with a dialog to save the file on your client computer or network. The format of the data is as follows. The MS Access database is version 2002. Individual Tables exist in MS Excel or Tab-Delimited Text (TDF) format, depending on the number of records (Ms Excel only supports up to 65,500 records). The Graphs and Maps exist in Adobe Portable Document Format (PDF) so you will need an Adobe Acrobat Reader to view them. All download files have been compressed using WinZip and exist in the ZIP format, which means you will need software that can decompress ZIP files, such as WinZip.

For information about the data, click here or view the entire report by clicking here. The following is a screen shot of the download All section.

Download All Data

Option	Data Description	Tabular Data Format	File Download
1	All Tabular Data, Graphs, and Maps	MS Access database (v2002)	Download (91.5 Mb)
2	All Tabular Data, Graphs, and Maps	MS Excel, Tab-Delimited Text	Download (51.3 Mb)

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5. Tips on how best to use this Web Site

Tip #1: Use a small number of Monitoring Stations to query for Water Quality

When querying the Water Quality data, try to use a small number of selected Monitoring Stations, especially if you are querying for All Water Quality parameters. Essentially you should consider the numbers of Monitoring Stations and Water Quality parameters as inversely proportional (ie The more Monitoring Stations you have selected, the less Water Quality parameters you should have selected and vice versa). If you are interested in querying larger datasets, it is best to go to the "Export Data" web page, where you can download all of the data, in various subsets and formats.

Tip #2: You do not have to manually select all items in a given ListBox.

In order to facilitate the ease of querying for Monitoring Stations and/or Water Quality data, the web site has been designed to treat all listed items in a given ListBox as selected. This is practical given that there are many instances when the user will want to use all listed items in the queries. For example, a common query would be to show all Monitoring Stations for a specific lake, such as Bonnet Lake, regardless of Organization, Location Type, or relevant Water Quality Parameters. To perform this query, the user would only have to select Bonnet Lake in the Lakes ListBox and then click the "Show Stations" button. The user would not have to select all of the items in the other ListBoxes because it is assumed that all are selected, unless the user has specifically selected any of the items. This intuitive feature simplifies the querying process.

6. Frequently Asked Questions (FAQ)

Q. What is the purpose of this web site?

This web site allows users to view and download the water quality data sampled for all Monitoring Stations in the study.

Q. Where do I begin?

The web site outlines a series of steps to help orient you in querying and viewing the data. The goal is to view the sampled water quality for each of the Monitoring Stations. Therefore, the steps will help you first select Monitoring Stations and then to view the Water Quality data based on the selected Water Quality Parameters. For more information, click here.

Q. What types of data can I view?

The web site allows you to view Lakes, Organizations, Monitoring Stations, Water Quality Parameters, and the sampled Water Quality values. You can download this data, as well as, phosphorus and water balance data, graphs, and maps generated for the study.

Q. What format is the data in?

The entire dataset can be downloaded as a Microsoft Access database (v2002). In addition, the individual data tables can be downloaded in either Microsoft Excel or Tab-Delimited Text (TDF) file formats. Note, that if the number of records in a given table exceeds 65,500, then the table will only be available as Tab-Delimited Text since the number of records exceeds the maximum supported by Microsoft Excel. Graphs and maps exist in the Adobe Portable Document File (PDF) format.

Q. Can I download the data?

Yes, all of the data can be downloaded in various subsets and formats. For more information, click here.

Q. Do I have to use the Map?

No, the Map is an optional way to interact with the data. Its main purpose is to put the Monitoring Stations in context with the study area and related data. It can also be used to query Monitoring Stations and Lakes. Click here for more information.

Q. How do I select all items in a given ListBox?

All items listed in a ListBox are selected automatically so you do not have to manually. This will make you more efficient in performing your queries. If you have specifically selected one or more items listed in a ListBox, then only those selected items will be used in the query. To clear items you have selected, click the "Clear" button below each ListBox. Click here for more information.

Q. Why did no Monitoring Stations show up in the ListBox?

Remember that when you click the "Show Stations" button, the web site will first get the selected items from the Lakes, Organizations, Relative Location Types, and Parameters' ListBoxes. These selected items will then be used to query for the relevant Monitoring Stations. Therefore, first check the selections you have made in those ListBoxes and remember that all items are used in the query, unless you have specifically selected one or more in each ListBox. Also, check the Parameters' ListBox because the ListBox can list either "All" or the "Top 10" Parameters, and only those items listed and selected will be used in the query.

Q. Why did the web site take so long to display the Water Quality data?

There are millions of Water Quality records in the database and there could be high traffic on the Internet or on SFWMD's web servers. It is best to try to use the web site to dynamically query for small datasets, such as using one or a few Monitoring Stations. If you need to query larger datasets, you are probably better served going to the Export Data page, where you can download all of the data. Click here for more information on querying Monitoring Stations.

Q. Where can I find more information regarding the study?

Click here to view the Water Quality Impacts of Reservoirs (WQIR) report.

Click here for information about the collected water quality data.

Click here to find information about SFWMD's Water Quality Monitoring program.

Or contact Yanling Zhao, Ph.D. at yzhao@sfwmd.gov.

7. Why did the Web Page Redirect Me Here?

Top of Page

If your query was too large, the web page may have timed-out based on the web server settings, which is why you were redirected to this section in the Help page. Some of the datasets have millions of records so it is best to keep your queries relatively small, using only a few Monitoring Stations for each query. If you need more information on how better to query, click here or if you are just interested in obtaining all or large sets of the data, then go to the "Export Data" page by clicking here.

If you are still being redirected here, even when you are using small queries, then you should probably restart your Internet Browser. This will help refresh the communication between your browser and the web server that contains this web site.

This web site utilizes browser cookies to maintain state information as it is passed between your client computer and SFWMD's web servers. This is required since the web site allows you to query various datasets and needs to maintain this information through multiple

servers. This is required since the web site allows you to query various datasets and needs to maintain this information through multiple requests. This is only of concern if you are unable to use this web site (ie query and view the different water quality datasets). If you are having trouble and are unsure about cookies, click here for information regarding cookies or click here for how to enable cookies by Internet browser type and version.

Export Data Page

Top of Page

Appendix C

EXPORT DATA PAGE

Florida Lake Reservoir Water Quality Database - Export Data Home Help Database

All of the data are available for download and are organized from all encompassing to very specific datasets in the categories of: All, Data Types, Potential Sites, and Candidate Sites. Many downloading options are provided because the datasets have very large file sizes. This way you can download all of the data at once or various specific datasets of interest.

The MS Access database is version 2002. Individual Tables exist in MS Excel or Tab-Delimited Text (TDF) format, depending on the number of records (Ms Excel only supports up to 65,500 records). The Graphs and Maps exist in Adobe Portable Document Format (PDF) so you will need an Adobe Acrobat Reader to view them. All download files have been compressed using WinZip and exist in the ZIP format, which means you will need software that can decompress ZIP files, such as WinZip.

Download All Data

Option	Data Description	Tabular Data Format	File Download
1	All Tabular Data, Graphs, and Maps	MS Access database (v2002)	Download (91.5 Mb)
2	All Tabular Data, Graphs, and Maps	MS Excel, Tab-Delimited Text	Download (51.3 Mb)

Download Specific Types of Data

Data Type	Data Availability	Data Format	File Download
Analytical Data	All 36 Candidate Sites	MS Access database (v2002)	Download (79.1 Mb)
Analytical Data	All 36 Candidate Sites	MS Excel, Tab-Delimited Text	Download (33.8 Mb)
Phos/Water Balance	All 8 Potential Sites	MS Excel	Download (5.1 Mb)
Graphs	All 8 Potential Sites	Adobe Portable Document Format (PDF)	Download (5.3 Mb)
Maps	All 36 Candidate Sites	Adobe Portable Document Format (PDF)	Download (7.3 Mb)

Download Data Specific to the 8 Potential Sites

Site Name	Data Description	File Download
All 8 Potential Sites	Analytical Data, Phos/Water Balance,Graphs, Maps	Download (22.1 Mb)
Crescent Lake	Analytical Data, Phos/Water Balance,Graphs, Map	Download (2.6 Mb)
Lake George	Analytical Data, Phos/Water Balance,Graphs, Map	Download (2.7 Mb)

Lake Harney	Analytical Data, Phos/Water Balance,Graphs, Map	Download (2.5 Mb)
Lake Istokpoga	Analytical Data, Phos/Water Balance,Graphs, Map	Download (2.5 Mb)
Lake Jessup	Analytical Data, Phos/Water Balance,Graphs, Map	Download (3.2 Mb)
Lake Thonotosassa	Analytical Data, Phos/Water Balance,Graphs, Map	Download (1.5 Mb)
Rodman Reservoir	Analytical Data, Phos/Water Balance,Graphs, Map	Download (4.2 Mb)
St John's Marsh Conservation Area	Analytical Data, Phos/Water Balance,Graphs, Map	Download (2.9 Mb)

Download Data Specific to the 36 Candidate Sites

Num	Site Name	Data Description	File Download
1	Blue Cypress WMA East	Analytical Data, Map	Download (0.8 Mb)
2	Blue Cypress WMA West	Analytical Data, Map	Download (0.8 Mb)
3	Bonnet Lake	Analytical Data, Map	Download (1.6 Mb)
4	Caloosahatchee River	Analytical Data, Map	Download (1.9 Mb)
5	Crescent Lake	Analytical Data, Phos/Water Balance, Graphs, Map	Download (2.6 Mb)
6	Emeralda Marsh Conservation Area	Analytical Data, Map	Download (1.7 Mb)
7	FP&L Martin County Reservoir	Analytical Data, Map	Download (1.8 Mb)
8	Kenansville Lake	Analytical Data, Map	Download (0.6 Mb)
9	Keystone Lake	Analytical Data, Map	Download (1.4 Mb)
10	Lake Calm	Analytical Data, Map	Download (0.8 Mb)
11	Lake Carroll	Analytical Data, Map	Download (1.1 Mb)
12	Lake Disston	Analytical Data, Map	Download (0.9 Mb)
13	Lake George	Analytical Data, Phos/Water Balance, Graphs, Map	Download (2.7 Mb)
14	Lake Harney	Analytical Data, Phos/Water Balance, Graphs, Map	Download (2.5 Mb)
15	Lake Howard	Analytical Data, Map	Download (0.6 Mb)
16	Lake Istokpoga	Analytical Data, Phos/Water Balance, Graphs, Map	Download (2.5 Mb)

17	Lake Jessup	Analytical Data, Phos/Water Balance, Graphs, Map	[Download (3.2 Mb)](#)
18	Lake Josephine	Analytical Data, Map	[Download (2.1 Mb)](#)
19	Lake Magdalene	Analytical Data, Map	[Download (1.4 Mb)](#)
20	Lake Monroe	Analytical Data, Map	[Download (1.4 Mb)](#)
21	Lake Norris	Analytical Data, Map	[Download (0.7 Mb)](#)
22	Lake Panasoffkee	Analytical Data, Map	[Download (0.7 Mb)](#)
23	Lake Parker	Analytical Data, Map	[Download (0.6 Mb)](#)
24	Lake Sebring	Analytical Data, Map	[Download (1.7 Mb)](#)
25	Lake Seminole	Analytical Data, Map	[Download (0.9 Mb)](#)
26	Lake Thonotosassa	Analytical Data, Phos/Water Balance, Graphs, Map	[Download (1.5 Mb)](#)
27	Lake Trafford	Analytical Data, Map	[Download (1.1 Mb)](#)
28	Lake Washington	Analytical Data, Map	[Download (0.9 Mb)](#)
29	Medard Park	Analytical Data, Map	[Download (0.5 Mb)](#)
30	Red Beach Lake	Analytical Data, Map	[Download (0.4 Mb)](#)
31	Rodman Reservoir	Analytical Data, Phos/Water Balance, Graphs, Map	[Download (4.2 Mb)](#)
32	St. Johns Marsh Conservation Area	Analytical Data, Phos/Water Balance, Graphs, Map	[Download (2.9 Mb)](#)
33	St. Johns WMA	Analytical Data, Map	[Download (0.9 Mb)](#)
34	Sunnyhill Farm	Analytical Data, Map	[Download (1.3 Mb)](#)
35	Taylor Creek Reservoir	Analytical Data, Map	[Download (0.6 Mb)](#)
36	Tsala Apopka Lake	Analytical Data, Map	[Download (0.9 Mb)](#)

Note: Tabular Data exist in Microsoft Excel format, or TDF (Tab-Delimited Text) files if the record number exceeds 65,500, which is the maximum number of records supported by Microsoft Excel.