Appendix 1-4: Final Report of the Peer Review Panel for the *2005 South Florida Environmental Report*

With the exception of reformatting some information for better readability, the Chapter 1 appendices were not edited or spellchecked by the SFER production staff. They appear as posted on the District's WebBoard.

FINAL REPORT

Of the Peer Review Panel Concerning the

2005 South Florida Environmental Report

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Submitted October 15, 2004

INTRODUCTION

The responsibility of this Panel was to review and prepare questions on the draft of the *2005 South Florida Environmental Report* (SFER), dated September 2004. In addition, the Panel's responsibilities included the consideration and inclusion of input from the public workshop conducted September 21-23, 2004, where relevant. This Report summarizes the Panel's findings regarding the key facts presented during the workshop and conclusions and recommendations on the subjects raised by the report authors and public participants.

The Report and this peer review are part of an open Panel review and public hearing to ensure that all involved are given an opportunity to be part of an open deliberation before a Panel of objective experts.

Constructive criticism of the SFER programs and projects were sought from the Panel. However, this review by its very nature and constraints is not designed to evaluate detailed aspects of research and monitoring. The Panel's task was to determine if the appropriate scientific models and applications were employed, if all relevant data were used, and if the SFER findings were a logical consequence of the science and the data.

In reviewing the draft SFER, the general questions that the Panel addressed included:

1. Does the draft document present a defensible scientific account of data and findings for the areas being addressed? Is the synthesis of this information presented in a logical and complete manner?
2. Are the findings and conclusions supported by "best available information" or are there gaps or flaws in the information presented in the main body of the document? What additions, deletions or changes are recommended by the Panel to enhance the validity and utility of the document?
3. Are there other interpretations of the data and findings that should be considered and presented to decision makers? Is there available information that has not been considered by the authors?
4. Are there data summaries and analyses that should be included in future, annual peer reviewed reports to the Governor and Legislature?

General Panel Response to the Draft Report

The draft *2005 South Florida Environmental Report* is generally well written and well considered. The move from an Everglades Report to a more comprehensive discussion of all South Florida water systems was welcome. The responses of authors to review comments during the public workshop were generally direct and sufficient. The Panel found the presentation at this year's workshop to be stimulating and helpful.

The *2005 South Florida Environmental Report* is an initial effort to present an integrated overview of water management in South Florida – an overview that includes the four major features of South Florida:

- Kissimmee River and the Upper Chain of Lakes
- Lake Okeechobee
- The Everglades; and
- Coastal Ecosystems.

The report also integrates the three major institutional settings that guide South Florida's water management and ecosystem restoration efforts:

- Legal requirements;
- Scientific foundation; and
- Governmental arrangements.

Given the extensive coordination requirements involved in integrating over geographic areas and institutional arrangements, the *2005 South Florida Environmental Report* represents a major step forward in improved water management. It also represents a major challenge to those who collect data, develop information, support decision making and establish policy.

The SFER Format

The 2005 SFER Peer Review Panel admires the initiative in moving water management reporting to a 'next level' in its 2005 SFER. The Panel also greatly respects the challenges facing the professionals involved in preparing the report. The Panel's comments, while probing and questioning, recognize the large step taken with the 2005 SFER and are offered in a constructive effort to move the reporting process toward success in producing scientifically sound data and information in support of efficient and effective water management decision-making in South Florida.

The organization of the report attempts to meet a number of competing objectives. The Panel recognizes that some chapters serve to satisfy legal objectives, while others serve to report on critical aspects of water and ecosystem management in South Florida. In a broad general comment, the Panel notes that Chapter 2 addresses criteria compliance in the Everglades Protection Area (EPA); Chapter 5 addresses hydrology in all areas; and Chapters 10, 11, and 12 address specific issues in three new areas. Thus, some chapters are moving toward a completely integrated presentation of their assigned topic, while other chapters remain focused on specific areas and/or topics. A number of comments contained in this review, regarding individual chapters, address these discrepancies. The Panel recognizes that Chapter 2 may be designed to satisfy the Everglades Forever Act and that adding water quality criteria compliance for the Kissimmee River, Lake Okeechobee, and the coastal ecosystems, may detract from its ability to meet the a specific legal requirement. However, if Chapter 2 could be expanded to include all of South Florida, then the 2006 SFER would achieve a more integrated view of criteria compliance across South Florida, and would obviously serve both purposes.

Given the various audiences of the chapters, a more consistent framework for introducing the contents of each chapter would be helpful. An index at the beginning of each chapter, with a few comments about the content of each major sub-heading, would help readers understand the exact purpose and resulting content. For example, a Chapter 2 index might indicate that the chapter has three major bodies of knowledge: (1) an overview of the monitoring program designs and operations that created the data used to conduct criteria compliance assessment; (2) results of the criteria compliance for those water quality constituents for which there are criteria and standards currently existing; and (3) an assessment of constituents of concern for which current criteria may not be protective or for which there are no criteria. A chapter breakdown such as this recognizes that: (1) there are scientific reasons to carefully document how data are collected and analyzed; (2) criteria compliance for well recognized and accepted criteria can be rather straightforward; and (3) evaluating constituents of concern, for which current criteria do not exist, will require more of a research orientation than a straightforward criteria compliance assessment.

Monitoring and Design Coordination

It has been noted at several recent monitoring conferences in both the U.S. and Europe (e.g. National Monitoring Conference and Monitoring Tailor-made Workshops, respectively), that consistency, in water quality information presentation and content, breeds confidence in findings and conclusions. Thus, when considering an overall SFER structure, i.e. chapter organization and content, there is a need to plan for a report that is reader friendly, logical, legally acceptable, scientifically correct, and consistent. It must be recognized that few people will actually read the entire report; fewer yet will become conversant with the details of each chapter, or comprehend all of the implications of an integrated management structure. This places considerable burden on those currently preparing each of the SFER chapters, as well as coordinating its overall preparation, to think beyond next year's report – to think about a series of future annual reports that provide both consistency and flexibility to address new issues – all in a carefully designed reporting format that helps readers know where to find routine information, such as criteria compliance assessments, as well as interpretations of why certain trends exist (which may vary from year-to-year while the compliance assessment itself will not).

Monitoring, as used and presented in all chapters of the 2005 SFER, would be more transparent and appreciated, if defined in a coordinated and consistent, readily accessible, manner. The National Water Quality Monitoring Council (Ward and Peters, 2003) provides a framework that may help in defining and documenting South Florida's monitoring programs in a consistent and comparable manner. Such a common approach permits common elements of the monitoring programs to be repeatedly 'linked' to the report, without burdening the report with unnecessary monitoring program detail.

Monitoring coordination is also being fostered around the country by the National Water Quality Monitoring Council and a number of state monitoring councils. The SFWMD should support development and operation of a monitoring council to improve consistency and coordination of monitoring employed to support preparation of SFER in the future.

The *2005 South Florida Environment Report* expands the coverage of the past Everglades Consolidated Reports, which addressed the Everglades Protection Area, to include information on the restoration, management and protection of Lake Okeechobee, Kissimmee River and upper chain of lakes, and South Florida's coastal ecosystems. Such an expansion presents the reader with a much more integrated view of water management in South Florida. To obtain a scientifically sound, consistent and comparable view, requires that the water quality and hydrological monitoring across South Florida be integrated in design, operation and reporting. This, in turn, greatly increases the need to coordinate, integrate and consistently document monitoring efforts across projects, programs, and networks. A cross-referencing system in the final text of the report can aid that effort.

Coordination in water quality monitoring is a common problem among a number of water quality management agencies. Recent critiques of monitoring coordination have been prepared by the General Accounting Office (2004), National Research Council (2004), and Levin (2004). These critiques come on the heels of the General Accounting Office (2000 and 2002) and the National Research Council (2001 and 2002). These critiques have a common theme – more coordination and documentation of monitoring activities are needed to improve consistency and comparability in the data and information used to manage water quality.

In trying to understand the consistency and comparability of water quality and hydrological data and information from across South Florida, the Panel examined the website http://www.sfwmd.gov/org/ema/envmon/wqm. The magnitude of the monitoring coordination portrayed on the website is huge – 54 separate water quality monitoring 'projects' are listed for South Florida. The website indicates sampling sites for each monitoring 'project' and briefly reviews the scope and purpose of each.

A monitoring framework (or definition template), developed by the National Water Quality Monitoring Council (NWQMC) and presented in the September 2003 issue of *Water Resources IMPACT* (Ward and Peters, 2003), was used to organize the Panel's review of water quality monitoring programs employed for criteria compliance. In particular, the Panel examined monitoring system documentation to insure that data used in the water quality and hydrological assessments provided in Chapters 2, 5, 10, 11, and 12 are consistent and comparable over time and space.

1. **Develop monitoring objectives** – in general terms the scope and purpose of the 54 monitoring 'projects' are provided on the website;
2. **Design monitoring program** – it is not clear if there is a separate, complete, and documented 'design' for each of the 54 monitoring 'projects'; however there are bits and pieces of each design presented on websites and in the SFER. For example, the sampling sites are well identified at various places in the SFER and on the website; a list of water quality constituents being measured is provided at some places in the SFER; and, for some monitoring programs, sampling frequency is mentioned. There does not appear to be a place where an interested person can review the technical and scientific details of each of the 54 monitoring program designs (or of the methods applicable to each of the 54 monitoring programs, e.g. QA/QC procedures). The SFWMD monitoring programs are described in a 1998 report by Germain, but it is not available on the website. Do the Germain descriptions cover monitoring objectives, sample and lab methods, data storage and retrieval, data analysis, and reporting? Are there other reports that contain descriptions of the monitoring programs operating in South Florida and whose data is used in the SFER? Has the monitoring descriptions been updated since 1998?

3. **Collect field and lab data** – The methods used to collect samples and analyze them in the laboratory are not listed on the website or in the SFER. On Page 2A-3 of the SFER the reader is notified that the SFWMD follows strict quality assurance/quality control procedures approved by the Florida Department of Health under the National Environmental Laboratory Accreditation Conference certification process. The methods are documented in the SFWMD's Quality Assurance manual and in Standard Operating Procedures (SOP) that are reviewed and updated annually. However, the cited manuals and SOPs are not available for review on the website nor is there an indication that the same procedures are being used by all agencies collecting data in South Florida (and on which the various assessments in the SFER are made). For example, in Chapter 10 (Page 11), it is noted that data from the LOWOD, District's ambient monitoring network, USGS CERP monitoring network; and 'data from Lake Okeechobee inflow sites' are used to assess P. Then on Page 12 there is another description of 'water quality data collection'. It is not clear exactly what data are collected, for what purposes, and by what methods. Furthermore, are all the methods the same, or does the reference to SOP's above only refer to SFWMD monitoring?
4. **Compile and manage data** – Are the data from all 54 monitoring projects placed into DBHYDRO? What Meta data are included with the water quality data? Are the Meta data different for each agency collecting water data? Do the Meta data, employed in DBHYDRO, mesh with the data elements recommended by the Methods and Data Comparability Board (http://wi.water.usgs.gov/pmethods/elements/elements.html)? Where can one view the Meta data employed in DBHYDRO?
5. **Assess and interpret data** – For purposes of water quality standard compliance purposes in Chapter 2, the data analysis and interpretation methods are well documented in the 2005 SFER.
6. **Convey results and findings** – Chapter 2 conveys not only monitoring results of the criteria compliance assessment, but also describes parts of the monitoring design (but not all parts) and presents research information about constituents of growing concern (but for which there are no criteria). Other chapters of the SFER also report water quality conditions. It may be necessary to integrate other water quality reporting into Chapter 2. If pursued, this recommendation will, necessarily, require a careful redesign of Chapter 2. For example, compliance assessment and Long-Term Plan implementation may require separate sections in Chapter 2 to meet legal reporting requirements. Has there been an effort to develop an annual water quality 'report card' for use in the SFER, in a manner suggested by the National Research Council (2003), in discussing the Comprehensive Everglades Restoration Plan? This could be an introductory section of Chapter 2 serving to summarize water quality conditions for the entire SFWMD area.

There are two places in the 2005 SFER data consistency is a concern. On Page 2A-30 in footnote 6, it is noted that analytical methods between two sampling periods may not be completely comparable. On Page 12-6, it is noted that… "During 1991-2003, total phosphorus concentrations have decreased in the canal that discharges to Biscayne Bay, although some of this trend may be explained by improved analytical methods." Apparently, monitoring methods are changing regularly and these changes may have an impact on the information derived from the data. Are changes in monitoring methods noted in the data record? How are differences in the data, resulting from changes in methods, accounted for in trend and criteria compliance computations? If they are not accounted for, what impact do such changes have on the results?

The Water Quality Monitoring Project Areas webpage indicates that information is continually being added to the website, so hopefully many of the questions noted above will be addressed in the near future. It will be particularly helpful, as the SFER expands to cover all of South Florida, to have a 'directory' of monitoring strategies, designs, and practices, along with results, to provide more transparency in the monitoring programs employed in South Florida.

It should also be pointed out that many features of the monitoring designs are repeated in each annual report (e.g. the water quality criteria compliance methods and location of sampling sites). This adds to the length of the report. If there are no changes in the methods from year-to-year there is no need to repeat the design information if it is available on a website via a live link over the internet.

As the reporting on water quality and hydrological conditions is integrated across all of South Florida, the amount of data and information to be collected and synthesized will become enormous. Are there efforts to introduce modern information technology, not only into data management, but also into management of the entire water information system? An example would be the use of "supply chains" in business management. The supply chain, in a monitoring context, would follow the flow of information, in much the same way as outlined above in the monitoring framework. The monitoring operations are coordinated and tracked using a well defined and documented flow of water information. Future changes in the flow of monitoring data and information would be evaluated and documented as revisions to the Long-Term Plan are made.

The SFWMD may want to consider developing its own strategies for coordinating and managing its extensive monitoring programs, which might ultimately lead to incorporation within an information technology software package. Maintenance of locally developed software can be expensive, thus must be carefully considered. The National Water Quality Monitoring Council is currently examining the role of software in the management of water quality monitoring programs and these comments reflect the current state-of-the-art observed by the Council.

Conclusions

Expansion of *Everglades Consolidated Report* to cover the Kissimmee River and upper chain of lakes, Lake Okeechobee and the coastal ecosystems is both a major enhancement of information and a scientific challenge. The *2005 South Florida Environmental Report* is a good first effort to produce integrated environmental information; however, there are a number of rough edges. For example, Chapter 2 continues to address only the Everglades Protection Area while Chapter 5 addresses all of South Florida. The Panel's chapter-by-chapter review provides a number of recommendations to further refine the report for 2005 as well as enhance preparation of the 2006 report.

General SFER Recommendations

1. The Panel recommends a cross-referencing system, perhaps hyper linked with the existing glossary of terms, to facilitate a more comprehensive understanding of major issues being addressed. Links to major topics, such as monitoring, assessment, wading birds, invasive species, contaminants, phosphorus, etc. should be included.
2. The Panel recommends that a table of contents (organization of the chapter) be included in a box at the beginning of each chapter. Included should be an outline of its contents, a statement of objectives, rationale, clear protocol, time line, significant findings, and a summary of the interrelationships between management objectives and programs, noting how the chapter information is related to restoration projects and what new information is needed. Further, each chapter should be focused around four questions:
   a. What do we know about the system?
   b. What have we learned over the last year (progress report)?
   c. What do we not know?
   d. What is the next area of investigation?
3. The Panel recommends that future reports include a new chapter on cross-cutting issues that are system-wide. The subject of this chapter could change from year to year to focus on important problems that affect more than one geographic area or administrative unit of South Florida. Examples might include the importance of atmospheric inputs (P, Hg, and other constituents), or data management of monitoring data from all monitoring programs in the Greater Everglades. Such cross-cutting exercises would encourage coordination among work groups, and allow the focus on important issues that are not clearly the responsibility of any single work group. These reports would also serve as stand-alone baseline documents from which to evaluate progress on a specialized topic.
4. The separate data collection and analysis programs need an overall environmental information strategy in order to insure that the data and information used to prepare the SFER are consistent and comparable over all of South Florida. At present, monitoring appears to be designed and operated in a project-by-project manner. While there are efforts to employ consistent monitoring methods in monitoring programs, there is a need to further coordinate methods, both within SFWMD and with other organizations collecting data in South Florida. A monitoring council, along the lines of those operating in other states, may provide the forum for developing monitoring coordination that better supports the goals of the SFER.
5. The Panel recommends the inclusion of a table listing the overall regulatory standards, exceedances, and locations of major exceedances.
6. The Panel suggests that line numbers be included in future reports to facilitate preparation of written comments and cross-referencing during the public Panel Review sessions.

Some Additional Thoughts on Report Organization

The Panel understands the current format of the chapters in the SFER. We also appreciate the desire to have chapters in the current report align with previous reports. However the Panel would like to suggest that a rethinking of future reports may be appropriate.

The 2005 SFER is organized as in the previous years with three new chapters on the Kissimmee system, Lake Okeechobee, and the coastal systems. If reorganization is possible, then the following chapters are recommended: (1) Introduction – purpose and content of the report including guides for the readers to the parts of the report addressing their particular interests; (2) Water quality management framework, history, and framework overview of the legislative/regulatory initiatives, water quality standards, and WQ report card; (3) Overview of the watershed and its subsystems, their natural and modified features, flows and general water quality, and overview of the operational rules for managing water flow and water quality; (4) Kissimmee System; (5) Lake Okeechobee; (6) Everglades Agricultural Area; (7) Everglades Protection Area including the Water Conservation Areas, Storm Treatment Areas, and the Everglades; (8) Coastal systems; and (9) Special Studies. It is assumed that the report would be preceded by an Executive Summary.

With this organization, Chapters 1 through 3 would change only to the extent that the water quality management framework has changed, that laws and/or regulations have changed, that water quality standards have changed, that knowledge gained in the past year has advanced knowledge of the system, or that operational rules have changed. From year to year, such changes would be small. Chapters 4 through 9 would contain the largest changes, and those changes would be the progress reports of the various initiatives that have an impact on a given sub-basin. Because these initiatives are not necessarily coordinated or conducted by the same groups, integration of work on those initiatives would be needed and encouraged. That integration also would have benefits throughout the organization and the work being done in the watershed.

An additional benefit would be that the audiences for the report would know where to find particular information from year to year. The lay public would be encouraged to read the Executive Summary, scientists would focus on Chapters 4 through 9, regulators would find Chapters 2 through 9 of interest, and legislators Chapter 2, along with those parts of the report dealing with the legislative/regulatory initiatives. It would be helpful to have a matrix in which the sub-systems of the drainage basin are listed as columns and the various legislative/regulatory initiatives listed as rows with the intersections indicating material relative to each initiative and the chapter (or even page numbers) in which it is found.

The current report organization could be mapped into the new organization in the following way:

Current	Reorganized
Chapter 1	Chapter 1
Chapter 2	Chapter 3
Chapter 2A	Chapter 3
Chapter 2B	Chapter 9
Chapter 2C	Chapter 3
Chapter 3	Chapter 6
Chapter 4	Chapter 7
Chapter 5	Chapter 3
Chapter 6	Chapter 3
Chapter 7	Chapter 7

Chapter 8	Chapters 2 and 7
Chapter 9	Chapter 3
Chapter 10	Chapter 5
Chapter 11	Chapter 4
Chapter 12	Chapter 8

These chapter assignments are not exact because of the fragmentation that is found throughout the report, but the new organization integrates topics in single chapters that are now spread through up to four chapters.

The balance of this final report is a chapter-by-chapter review of the 2005 SFER.

CHAPTER 1: INTRODUCTION TO THE 2005 SOUTH FLORIDA ENVIRONMENTAL REPORT-VOLUME 1

Overall, the Panel found this chapter to be concise and very well written. It provides an excellent summary of all major ecosystems and ecosystem components as well as the major management problems affecting each area and the general status of management actions taken to date. The chapter is well organized and a close reading provides the logic of an information-to-action-continuum.

The Panel continues to support the need for this chapter and agrees that the information presents "a basic understanding of the governmental, scientific, and legal context behind the 2005 SFER." In the opinion of the Panel this chapter is also of utmost importance, given the increasing level of public interest and scrutiny regarding the Comprehensive Everglades Restoration Plan (CERP). The new consolidated format of the report including chapters on Lake Okeechobee and its watershed and the Kissimmee River Ecosystem, based on what formerly were separate annual reports and appendices, plus volume 2 summarizing progress made on mandates from the State Legislature, is a logical step in providing a comprehensive overview of the work of the District as well as the CERP.

Chapter 1 continues to serve as a "stand alone" document for many readers interested in gaining an overview of the area and its principal management issues and *results of research for water year 2004* without having to have an in-depth understanding of scientific principles or the application of the research results in a complex management context. Since first included in the 1999 report, the section describing the District and other governmental agencies have been vastly improved. It is it critical to understanding the balance of the Report.

CHAPTER 2A: STATUS OF WATER QUALTIY IN THE EVERGLADES PROTECTION AREA

Chapter 2 describes the status of water quality conditions in the Everglades Protection Area (EPA). The chapter highlights those water quality constituents that did not comply with applicable water quality criteria and standards during the 2004 Water Year. In addition, the chapter discusses trends in water quality constituents, for which there are no applicable criteria and standards, to identify potential concerns.

In performing the assessment of water quality status in the EPA, data from a number of water quality monitoring programs were used. These data were collected for a number of different purposes and, when combined, form the database for evaluating criteria and standard compliance. The data were not collected specifically for criteria and standard compliance. This fact creates a number of problems for the authors of Chapter 2, but they do an excellent job in carefully documenting all aspects of the assessment procedures employed to determine compliance with applicable criteria and standards.

Chapter 2 presents the status of water quality for the Everglades Protection Area alone, even though Chapter 1 says the 2005 report is an expansion of previous *Everglades Consolidated Reports* (*ECR*). There are no comparable water quality status assessments for Lake Okeechobee, Kissimmee River, or South Florida's coastal ecosystems. Rather there are separate chapters on these areas focused on phosphorus, water levels and flows, and freshwater discharges, respectively.

This continued focus of Chapter 2 on the EPA is in contrast to Chapter 5 which covers the entire South Florida hydrology. As reporting for the entire South Florida area matures, there is an expectation that more balance in the coverage, and reporting strategy, for both water quality and hydrology will emerge.

More specifically, the new site specific alternative criterion for dissolved oxygen, reported in a past *ECR*, is a great improvement, and takes into account natural variation. Chapter 2's organization would benefit if its presentation of specific constituents was organized into those with criteria and standards (which can be treated in a more straightforward manner) and those without criteria and standards, or whose criteria and standards are being questioned (which must be treated more in a research context).

General Monitoring Design and Assessment Questions:

1. Is the water quality assessment reported in Chapter 2 based only on data collected by the SFWMD, or were data from other monitoring programs included?
2. A number of times during the report (e.g. Page 2A-4 and 2C-4) the reader is referred to Germain (1998) for a description of the current SFWMD monitoring programs. The 2005 SFER suggests that a large number of new monitoring programs have come on line since 1998. Is there a more current description of the monitoring programs?
3. With the 2005 report including four major areas of South Florida, why doesn't Chapter 2A examine the status of water quality in all the four areas?

4. Were the data collected in a rather uniform manner across the water year? Or were there times when data were not collected, i.e. values missing for a portion of the water year? If there is not consistency in sampling frequencies over the water year, does this fact affect the accuracy of the compliance assessments? For example, if more samples were collected during the period of the year most vulnerable to compliance problems occur, the overall percent of excursions may by more an artifact of the monitoring design rather than the actual quality of the water.
5. Is the data screening process the same from year-to-year, or is it modified each year during preparation of the SFER? If it is changed, is the total data record re-screened each year in assessing changes over time?
6. When there is insufficient data to apply the binomial hypothesis in a year, the excursions analysis is based on a five-year period of record. Is the comparison of excursions across areas (e.g. Refuge and WCA-2) and class (inflow and interior), when different time periods are used to support the calculations, sufficiently comparable for ranking severity of excursions?
7. On Page 2A-14, 'insufficient data' was noted as occurring when there are greater than or equal to 28 samples. This should be less than 28 samples.

Questions regarding constituents for which there are criteria and standards:

8. Page 2A-15. The middle sentence in the first paragraph is unclear. Do you mean that all factors (conductivity, iron, pH, turbidity) had excursions every year, or only one of them did?
9. Historically, the northern EPA was a soft water system but today alkalinity is a concern in the interior of Refuge, WCA-2 and WCA-3. What is the source of this alkalinity? Ground water? Sea water? Or both? Through what route does it enter into the system? Is it possible to use natural chemical signature, e.g. Ca++/SO-- Na+/Cl- ratios and conductivity, to trace the source(s) of the alkalinity? The information is quite important for estimating the relative contribution of rain in surface water and ultimately, the partition of P from rain and non-rain sources. The alkalinity then may be useful as a tracer to understand the hydrodynamics and spatial P distribution patterns in EPA units and structures.
10. The statement on P. 2A-23 said that "alkalinity and pH have close relationship." Fig. 2A-6, however, indicates that alkalinity and pH do not necessarily have a close relationship. In fact, alkalinity and pH could be quite independent of each other because dissolved CO2 has a great effect on pH but has completely no effect on alkalinity.
11. Page 2A-23. What are the implications of pH and alkalinity for some of the fish communities (and therefore colonial birds because of their prey base)?
12. Page 2A-24. What affects absorption of CO2 from the atmosphere?
13. Page 2A-41. Are there currently any measures to limit the use of atrazine in the EAA?
14. Given the atrazine criterion, are there any measures to limit its use in the EAA?

Questions regarding constituents for which there are no criteria and standards or for which existing criteria and standards may not be protective:

15. On Page 2A-30, it is noted that diatom community shifts may indicate that the current specific conductance standard may not be fully protective of the area. Does the community shift vary year-by-year or is there a long-term trend in the shift? Figure 2A-9 does not seem to indicate a trend in specific conductance nor do the observations at most other sites? Also it is noted that differences in measurement methods may interfere with comparability of results over years. How can the above conclusion about the specific conductance standard be reached? If the conclusion is correct, what standard would be protective?
16. On Page 2A-31, the difficulty in separating current human and natural impacts on specific conductance is implied. Does the historical water data record provide sufficient detail to determine if the current conditions have been observed at some point in the past?
17. Although currently the state has no surface water criterion for sulfate, sulfate is a concern to water quality in South Florida due to its close relationship to Hg methylation (Chapter 2B). Two important sulfate questions need to be addressed in EPA: What are the sources of sulfate (ground water or sea water or both)? Why is the variation of sulfate concentration so large (Table 2A-7, in many cases one standard deviation is > 200%)?
18. Page 2A-37. Other than the effect of sulfates on methylation, what is the greatest concern regarding high levels about sulfates?

Conclusions

1. The criteria compliance analysis for the Everglades Protection Area, presented in Chapter 2, is well written and all elements of the analysis are addressed.
2. Monitoring programs employed to produce data for criteria compliance assessments are not transparent in their designs. Elements of the monitoring program's designs are well documented, or referenced, in the SFER (e.g., data analysis methods) while other elements discussed are not readily available for review (e.g., sampling and laboratory methods). Changes in monitoring methods over time can influence conclusions drawn from standard compliance analysis. There are several indications in the SFER that there is some concern about the impact of changing methods on information produced.
3. Chapter 2 continues to examine criteria compliance in only the Everglades Protection Area (EPA). Water quality criteria compliance, in the three areas added to the SFER, are not presented in this Chapter.

Recommendations

1. There is a need to update and make readily available the designs of the water quality monitoring programs used to determine criteria compliance in South Florida. Much of the design documentation is available in a variety of locations, thus the main effort will be to pull the documentation together, organize it into a framework that can be readily understood, make it readily available to readers of the SFER, and update the designs where necessary.

2. If acceptable for legal reporting purposes, it is recommended that Chapter 2 include a criteria and standard compliance analysis for all of South Florida, in an integrated manner outlined in Chapter 1 of the SFER.

CHAPTER 2B: MERCURY MONITORING, RESEARCH, AND ENVIRONMENTAL ASSESSMENT IN SOUTH FLORIDA

This year's Mercury Monitoring, Research and Environmental Assessment chapter (2B) is a good overview of the mercury problem in the Everglades, how mercury interacts with other nutrients, how the concerns about environmental problems in the Everglades are addressed, on-going research with biota and mercury, and the new initiatives to understand mercury cycling. The data, models and conclusions in chapter 2B reflect the complex problem faced by many agencies dealing with mercury in freshwater ecosystems. The data generated are proving useful for other aquatic ecosystems throughout the United States. The summary is excellent, and hits the high points. However, two issues need to be addressed: 1) the upturn in mercury in biota (bass and egret feathers) and its possible relationship to increases in medical waste, and; 2) the exceedance in parts of the EPA of 0.3 ppm mercury in fish tissue. Research should focus on addressing these two issues.

Unlike many models used to understand the fate and effects of mercury, the Everglades Mercury Cycling Model is dynamic and makes use of additional data as it becomes available. This is a key point that will increase the general understanding of mercury cycling. However, there appears to have been little work on the models during this year.

The summary section on new findings is helpful to a wide range of stakeholders, from the scientist to the general public, and highlights key issues of concern for the rest of the report. One issue identified is the importance of tracking potential mercury hotspots (even while the mercury in 3A-15 has declined). This clearly illustrates the importance of continued mercury biomonitoring throughout critical areas of the Everglades system. The continued high levels of mercury in bass suggest the importance of toxicokinetic modeling of mercury bioaccumulation in the fish, including uptake and bioavailability, and in their prey. Moreover, the increase in mercury in bass and egret feathers in this last year is very disturbing, and needs to be watched. Further, the possible relationship between increased medical waste and these mercury levels should be examined in the next year.

Key issues for the mercury research program continue to be the understanding the spatial pattern of mercury deposition and methylation, along with the failure of mercury levels to continue to drop in Largemouth Bass. This problem is a more general one to some aquatic systems, and every attempt should be made to further understand this pattern. Additionally, the increase in mercury in bass and egret feathers is disturbing, and requires continued monitoring to make sure this is not a new trend.

New data from the air deposition network, presented only at the public workshop, indicates there are unanswered questions about the source of Florida's mercury. Identifying point sources remains a critical issue. However, the data indicate that there are high atmospheric inputs, the source of which remains uncertain. Although in the past reductions in local emissions corresponded to a reduction in mercury levels in fish and birds, on-going research reported in the chapter indicates that mercury levels in biota have stabilized, and remain higher than the EPAs ambient water quality guideline of 0.3 ppm in fish.

This year's report is more integrated than previous years, and highlights the key issues with mercury fate and effects in the Everglades. Recent research findings are summarized briefly (with appropriate appendices), and the key issues with mercury in the Everglades are discussed in detail with excellent figures.

Research Progress

This section summarizes the key research needs identified in the 2004 review of the *ECR*. The authors are to be commended on beginning a study to quantify the no-effects mercury level for fish-eating birds. It is no longer necessary to rely on the Mallard----an unlikely model for piscivorous species. The uncertainly associated with species differences has made it difficult to generally understand the effects on fish-eating birds.

Further work on the mercury cycle, on "old" versus "new" mercury, and global versus local sources remain a critical need. This research will be on-going and iterative because of increases in knowledge. The ability of the program to continue to modify the Everglades Mercury Cycling Model is vital to this process. Understanding methylation is needed to continue modeling of the mercury cycle in the Everglades, and several on-going research projects address this issue.

Discussion of atmospheric mercury cycling is necessary to understanding the mercury problem in the Everglades, as mentioned in the chapter. The graphics are clear, yet show the complexity. In this regard, the continued monitoring and modeling of local versus long-distance atmospheric deposition is critical to improved understanding of both the mercury cycle and management of mercury levels in the Everglades. This will always be a necessary component of the data collected in the Everglades, making sure that there is no new local source (or some change in global atmospheric mercury over this region). Continued refinement of the models to understand the time lag between decreases in mercury emissions and abatement of the mercury problem in the Everglades continues to be an important issue worth examining.

The role of DOC in methylation is a key finding, and one that requires further examination because of its implications for management of mercury in biota.

Mercury Trends and Mercury in Biota

One of the important issues in understanding mercury in the Everglades remains the concentrations in biota, especially those of concern, such as high levels of mercury in predators (herons and egrets, fish). Mercury concentrations in bass in most of the Everglades declined from 1990 to recently, but have now stabilized. However, there is not a clear decline in Everglades National Park. There are also declines in mercury in the feathers of Great Egret chicks. Since chicks are fed entirely on food obtained from the local area, levels in the feathers of chicks are a good indication of local exposure. This section of the report clearly lays out the logical steps needed to demonstrate that there is a link between mercury emissions and mercury concentrations in biota. This is a general problem faced by scientists in many aquatic and terrestrial systems, and the work in the Everglades is at the cutting edge of understanding this problem. It has general relevance beyond the Everglades for documenting the impact of strengthened (or relaxed) emission regulations on downwind receptors.

Figure 2b-1 clearly shows the changes in mercury as a function of different sources for 1980 to 2000 and is invaluable for understanding the mercury problem. Consideration of local inputs, and of atmospheric deposition, is critical to demonstrating that the declines are indeed due to local sources in South Florida. A third part of the picture, however, is an examination of atmospheric mercury deposition in the eastern US. Since this section deals largely with mercury emissions, it should be so labeled.

The Everglades is fortunate in having two data sets to examine trends in mercury concentrations that can be used as bioindicators of potential ecosystem effects. Both species, egrets and bass, are high level predators, and are of concern to the public; egrets for aesthetic reasons, and bass for human consumption. Agreement between the two data sets, and within each data set, is a powerful demonstration of their conclusion. Thus, it would be more impressive if the bass data were similarly presented, allowing a comparison to the egret data. While the briefness of this section is an advantage, it is also a disadvantage since a more complete presentation of the bass data would allow comparison across both species and regions of the Everglades.

Links between Mercury Emissions and Concentrations in Biota

This section deals largely with links between mercury emissions and bass, and should be so titled. Further, a similar analysis with egrets might prove useful in examining whether the percent not explained relates to the timing of the declines. An alternative explanation for the decline in mercury is that the fish are larger than that predicted by the models. Nonetheless, this kind of analysis is very important to linking mercury emissions with mercury concentrations, and is to be commended. It is a compelling story, but the recent data on regional deposition suggests that it is only part of the mercury picture.

The increase in mercury in bass and egret feathers that occurred in the last year bears detailed examination. The possible relationship between increased medical waste facilities and increases in mercury levels in biota needs to be examined.

Concentrations of Mercury in Fish

This section is new in the SFER and is valuable because of its public interest and regulatory relevance. However, the section might better be called "mercury in bass." It would be more useful with a general introductory paragraph that details the issues to be discussed. The importance of bass to the fishing public, and the presence of fish consumption advisories should be mentioned. From the graphs presented, it is clear that the mean mercury concentrations of bass at many of the sampling stations exceed the EPAs criterion ambient water criterion (0.3 ppm). Understanding this remains a key issue for future research.

The lack of reduction of mercury in bass in the Everglades National Park, compared to the rest of the Everglades, suggests several research needs: 1) establishment of specific stations to assess mercury deposition into ENP; 2) detailed monitoring of mercury concentrations in bass at more places within ENP; 3) modeling of atmospheric movement over ENP, and; 4) monitoring of sulfates in different parts of the ENP. Sediment analysis should also be considered, as well as the impact of flooding and drying cycles. The increase in mercury concentrations in fish in the ENP should be a high priority research area, particularly since it has occurred since 1999. A more detailed discussion of the reasons for increases in mercury concentration in bass in the ENP is essential to this report, and should include a full discussion of why atmospheric deposition is higher (or sulfates should be higher). It is the increase that is critical, or the lack of a decline in mercury concentrations?

This section would also benefit from a paragraph that places mercury concentrations in bass within a larger context of other similar estuaries or regions. It may be that bioavailability and internal toxicokinetics influence mercury concentrations differently at low ambient mercury levels than at high, creating a threshold that is difficult to break. More detailed toxicokinetic studies within bass themselves may be required to understand a lack of further reductions in mercury concentrations.

Further, data on mercury levels in other fish in the Everglades should be examined or reported. Some of the data might have temporal information which could aid in understanding the anomalies with mercury in bass. What other data on the prey of bass might help understand the overall anomalies? A study of organisms at several trophic levels should be considered for the ENP, where mercury seems to remain high despite changes in other areas of the Everglades.

Recommendations

1. Design the avian studies so that a threshold “no effects” mercury level can be obtained for White Ibis, and consider also Great Egrets to address the issue of species differences. Evaluating the biological effects of mercury on wading birds is impossible without determining the NOAEL or LOAEL. Evaluating the effects of mercury on wading birds is important.
2. The body of the report would be better if the division of topics was clear, there was a clear statement of topics to be discussed, and they were discussed in that order.
3. Attempt to make all mercury graphs coincide when a given issue is discussed. For example, Figures 2b-1 and 2b-2 would be most useful if they covered the same time period. Additionally, a graph of global atmospheric mercury deposition should be included.
4. Add a graph for bass that is similar to Fig. 2b-3 in the same section with Fig. 2b-3. Also include a detailed discussion of the similarities and differences in the findings between the two species.
5. The research linking mercury emissions to declines in mercury concentrations in bass should be published in the peer-reviewed literature.
6. Design a research program to specifically address the high mercury concentrations in bass in the ENP: establish more stations to assess mercury deposition into the ENP; b) monitor mercury concentrations in bass at more places within the ENP; c) model atmospheric movement over the ENP, and; d) monitor sulfates in different parts of the ENP.
7. Consider a study of bioavailability and toxicokinetics of mercury in bass.
8. Include a small section on mercury in other fish in the Everglades. This would help to understand the anomalies in mercury concentrations in bass.

9. Consider doing a broader study of a range of organisms at different trophic levels in the ENP to determine the compartments where mercury is bioaccumulating and to understand movement through the system.
10. Include atmospheric deposition maps in the report and appendices.
11. Determine and graph the increased emissions of mercury from medical facilities.
12. The issue of the EPA freshwater criterion of 0.3 ppm in fish needs to be incorporated into the mercury chapter, and discussed in the compliance chapters. How is the criterion going to be integrated? Mercury needs to be discussed as a regulatory issue in this chapter (not just as a research issue).
13. Continue the mercury monitoring in bass and egret feathers. Consistency in methods is critical to understanding trends.

CHAPTER 2C: STATUS OF PHOSPHORUS AND NITROGEN IN THE EVERGLADES PROTECTION AREA

Overall, this chapter is clear and describes adequately the total phosphorus (TP) criterion, history of its development, and current status. The process for developing a TP criterion has been addressed in a number of past *ECR*.

While addressed in previous reports, is there value in repeating, in the 2005 SFER, the basis of the statement that the system was phosphorus-limited in the past? What years have data available on phosphorus levels? What were the levels? Such documentation will serve to highlight why a separate subchapter is devoted to nutrients.

A proposed TP criterion of 10 micrograms per liter for the EPA is currently working its way through the approval process. The rule has not received the necessary final approvals for formal implementation. Consequently, Chapter 2C is an update of the current situation as well as an evaluation of TP and TN using data from existing monitoring programs. The new monitoring programs to measure compliance with the new criterion, have not been implemented yet. Once the TP criterion is formally established and monitoring data available to determine compliance, will the separate subchapter devoted to TP be eliminated? Will TP become another constituent dealt with in Chapter 2A?

The surface water of the EPA is mainly a direct rain fed system. This is a unique hydrologic condition in the EPA due to the topographic nature (i.e., very flat landscape that allows sheet flow rather than the usual river channel flow system in most other watersheds.) This unique situation should have a direct impact on the spatial P distribution in the surface water of the EPA along the flow direction. For example, under the most simplified scenario, the hydrologic data (e.g. Chapter 5, Fig 5-50), suggests that a roughly 3x to 4x dilution would occur in the surface water flow just from the inflow of WCA-1 to the outflow of WCA-3. The situation would be complicated by the processes of plant uptake, sediment adsorption/desorption, P atmospheric deposition and very small soluble P from groundwater. Could this hydrologic mediated spatial P distribution question be addressed in the future, perhaps through some modeling studies?

The Panel suggests a paragraph at the end of the chapter summarizing the major findings and implications for the overall Everglades system.

Questions

1. Will the new phosphorus criterion compliance monitoring efforts be totally separate from other water quality monitoring or integrated with other monitoring programs in not only the EPA but the entire South Florida region?
2. How will the new monitoring program(s) connect with the historical data used to establish the criterion?
3. How would the lack of load reduction to Lake Okeechobee, where BMPs are being implemented, be compared with the reduced concentrations in all inflows to the EPA, where BMPs are also being implemented (realizing that loads are discussed in Chapter 10

and concentrations are discussed in Chapter 2C)? It appears the BMPs are working in one area, but not in the other.

4. The reduction in TP geometric means, indicated in Table 2C-1, are rather dramatic for a one-year time period, both in uniformity of reduction across the EPA and in magnitude at some regions and classes (e.g. Refuge rim – medians 68.0 to 39.0). Is there reason to expect similar reductions next year? Or are the reductions in 2004 within the normal variability in the system, which means the climatologically normal 2004, when followed by a climatologically active 2005, indicates a high probability of an increase in 2005? What will be the effects of this reduction on different components of the ecosystem (and how long will it take for them to show up)?
5. Will the new monitoring program be designed to measure TP compliance status only or will it be designed to both measure compliance and why compliance is possibly changing from year-to-year? These are two competing information objectives, requiring different spatial and temporal scales of sampling.
6. The two major components of the TP compliance monitoring program, presented on Page 2C-8, suggest an even set of sampling sites for TP criterion compliance purposes, but does not clarify how the second component will be designed to 'protect against localized or shorter-term imbalances …" Is it possible to further elaborate on the TP monitoring design? Perhaps on Page 2C-2, the addition of a paragraph on the monitoring plan, believed best to monitor the phosphorus criterion, would meet this request.
7. Page 2C-8-9. The Panel is still a little unclear if the standard is for each station, summed over 5 years? Not over a water management unit? Is this going to be a problem since phosphorus is higher at the northern end (inflow to the Refuge and SCA-2)?
8. Page 2C-11. Will there be a problem when there is another severe drought?
9. Page 2C-16. What are the biological effects of progressively lower phosphorus levels?
10. Page 2C-17. Is there any reason to expect the nitrogen inputs from the agricultural area will increase or decrease in the next few years?

Conclusions

1. Overall, this chapter is clear and describes adequately the total phosphorus criterion, history of its development, and current status of the criterion (not formally approved yet). The process for developing a TP criterion has been addressed in a number of past *ECR*. The current Chapter 2C in the 2005 SFER is an update on the status of TP in the Everglades, using existing data and without comparison to the proposed criterion.
2. A monitoring plan is being developed for TP as part of implementing the new TP criterion in the EPA.
3. Chapter 2C does not discuss the phosphorus concerns in the Lake Okeechobee area or compliance in that region of South Florida.

Recommendations

1. The new TP monitoring plan should be carefully integrated into existing water quality monitoring programs, not only in the Everglades Protection Area, but also in the other three regions now being included in the SFER.
2. Chapter 2C, if deemed needed, should address phosphorus criteria compliance in all of South Florida and not just the EPA. Once the EPA TP criterion is approved, is it possible

to move the phosphorus criteria compliance assessment, for both the EPA and Lake Okeechobee, to the routine analysis contained in Chapter 2A, thus eliminating the need for Chapter 2C?

CHAPTER 3: SOURCE CONTROLS IN BASINS TRIBUTARY TO THE EVERGLADES PROTECTION AREA

This chapter provides a summary of the progress being made in controlling phosphorus in discharges tributary to the Everglades Protection Area through the use of BMPs and other means in the Everglades Agricultural Area and the C-139 basins. Significant progress has been made in reducing phosphorus loading leaving the EAA with the implementation of BMPs, and the District appears to be continuing an aggressive program to reduce phosphorus loads as needed to meet regulatory provisions. The BMP "equivalents" program appears to be an innovative way to provide incentives for BMP implementation to achieve necessary phosphorus load reductions.

Phosphorus load reductions have been most impressive within the EAA, but the C-139 basin is showing trends of flow-weighted TP concentrations that suggest that additional BMPs beyond those already in place will be needed.

As suggested in the review of last years report, the District has added information about other sources of phosphorus in the source basins and phosphorus control activities for them. This information is useful to understand the major and minor sources of TP and the priorities for dealing with them.

Specific recommendations are as follows:

1. The BMP "equivalents" system for BMPs is innovative, but it is not clear how the "equivalents" system was derived and what these numbers mean. It would help to understand the rationale, for example, for Nutrient Application Control being assigned 2.5 points while Slow Release P Fertilizer is assigned 5 points.
2. The distribution of TP in the EAA is given in Figures 1 and 2 (Appendix 3), and it is recommended that some explanation be provided for the distribution found.
3. TP sample preservation in the field is an issue, particularly if left in the field in the automatic samplers for up to seven days or longer. Sample deterioration may render the analytical results questionable unless proper sample preservation procedures are followed since the normal sample preservation procedure for total phosphorus (TP) is acidification with H_2SO_4 to a pH level <2 and a temperature ≤ 4 °C followed by analysis within 28 days, and for ortho-phosphorus, samples should be stored at ≤ 4 °C followed by analysis within 48 hrs (see the USEPA Region IV procedures cited by FDEP). Though the FDEP laboratory standard operating procedures for field sampling with automatic samplers permit preservation with acidification only, this can be done if TP is the only constituent analyzed in the sample and the results are not being used for NPDES purposes, given that TP standards are now in place, the District and FDEP should determine whether NPDES conditions now apply and whether more rigorous sample preservation procedures be followed.
4. Where mass balance information is given throughout this chapter, the sources and sinks need to be itemized. The time period over which the mass balance applies also needs to be clear.

5. BMP effectiveness for controlling TP needs to be continued, and comments regarding monitoring programs for such determinations noted elsewhere in this report should be heeded.

Recommendations

1. The Panel recommends that the District conduct an analysis of the research program that concentrates on evaluating BMPs. It appears that more rigorous research or BMP effectiveness if required.
2. The Panel recommends that a new area of concern in BMP research could examine the atmospheric deposition of phosphorus.

CHAPTER 4: STA PERFORMANCE, COMPLIANCE AND OPTIMIZATION

The performance, compliance and optimization of the Stormwater Treatment Areas (STAs) are critical to the success of CERP. STAs are designed and implemented to lower P level in the surface water entering EPA. This year marks the completion of the STA3/4 unit. Since 1994, STAs have successfully removed 427 mt of P from surface water that entered EPA. During WY2004, the STAs removed 87 mt P, representing a 69% reduction of TP in surface water (from an average of 136 ppb P inflow to an average of 42 ppb P outflow). This year's report summaries the results of WY2004 and the progress and experience gained on the operation of STAs since 1994. The STAs enhancements, including additional flow control structures, refined operation, and revision to vegetation communities, are also included in the chapter along with the status of long-term plan projects.

So far, the performance of STAs have achieved or exceeded the original design goals. The coming challenge is how to maintain the performance of the STAs on a long-term basis and ultimately, to determine how long can this level of performance be expected? The continuing operation of the STAs, therefore, relies on the understanding of physical, chemical and biological principles involved and the application of the knowledge to the operation and optimization. The sediment and vegetation monitoring program and the long-term performance evaluation of the STAs are important steps towards an in-depth understanding of the temporal and spatial function of wetlands as a sink of P and other nutrients. Followings are specific comments and questions:

1. Vegetation management seems to be increasingly important in the STAs. The presentation on vegetation management seems too general. Practices were given (e.g. use of herbicides, fire, etc.) but not results. For example, did control of FAV achieve expected results?
2. Vegetation distribution in the STAs is important and valuable information. It may be used to evaluate the effectiveness of vegetation management practices and help to interpret STA performance. Was vegetation distribution obtained by remote sensing technology? How frequently have vegetation surveys been conducted? The vegetation distribution maps presented in Chapter 4 are all WY2000. While there is more current information in Appendix 4-12, these should be updated here. Comparison of current and archived maps can provide valuable vegetation distribution information pertaining to the operation and performance of the STAs.
3. P. 4-62 "In addition to linear regression analysis, a logarithmic relationship was analyzed to examine whether the removal rate dropped off at a higher loading rates?" Statistical inference of the logarithmic transformed data has theoretical problems. It is better to use original data in statistical analysis.
4. It appears that the STAs require occasional herbicide treatment. Are the herbicide treatments followed by water-quality problems (drops in DO or spikes in nutrients)? Why is Hydrilla being controlled in the STAs (P. 4-23)?
5. Table 4-6 and Fig. 4-8 refer to a mesocosm treatment that appears not to be described in the text.
6. Several of the STAs are scheduled for modifications. Diagrams should be added showing the planned improvements.
7. Why is there low outflow from Rotenberger WMA (P. 4-53)?

8. It would be useful to use a distinctive symbol for WY04 data in Fig. 4-33, so the consequences (if any) of high water loads can be highlighted.
9. Page 4-12, line 5: should read “in the inflow than in the outflow.”
10. Table 4-14 is an exact duplicate of Table 4-13 and should be eliminated.
11. P. 4-2. Is that load reduction multi-year?
12. P. 4-4. What are the issues with the permits?
13. Are the activities instituted to manage the overload event the same for other STAs?
14. What is nuisance vegetation (if it is not floating vegetation?). Are contaminants (like mercury) regularly monitored in the STAs? It might help to have one table that lists the vegetation to be controlled in each STA, and how much diquat and Glyphosate was used.
15. P. 4-22. How frequent are drydowns?
16. P. 4-35. Does this imply that no surface aquatic vegetation exists, or that it was not controlled? How large are the woody invasives - remaining from a long time ago? How are they being controlled?
17. P. 4-43. What is the source of ametryn and atrazine?
18. P. 4-46. Are shrubs a problem one?
19. P. 4-48. Referring to field observation of obstructions; is there routine monitoring of all such outflows, with appropriate corrections?
20. The discussion of water quality at sites downstream of STA discharges is limited in scope and discusses only dissolved oxygen.
21. P. 4-68. The citation of Tukey-Kramer HSD is not listed in the Literature Cited.
22. App. 4-13. Tracer studies are of great value and should be continued.

Recommendations

1. The sediment and vegetation monitoring program and the long-term performance evaluation of the STAs is crucial for the next phase of STA operation and management. Presentation of the results in this area should be emphasized in the future report.
2. The objectives and results of vegetation management in STA need to be more specific.
3. Cross-comparisons of the vegetation, soil, hydrodynamics and performance among STAs are recommended.

CHAPTER 5: HYDROLOGY OF THE SOUTH FLORIDA ENVIRONMENT

Chapter 5 addresses the hydrology in all four areas now covered by the SFER. The hydrology of the Everglades Protection Area has been well documented in previous Everglades Consolidated Reports. Are there similar descriptions of the hydrology associated with Lake Okeechobee, Kissimmee River system, and the coastal areas? These should be placed on the web with links noted in the SFER.

The graphical means of presenting data and information regarding rainfall, potential evapotranspiration, water levels, inflows and outflows summarizes considerable data in an effective, short hand, manner. It would be helpful, for some key sites, to graph past annual measures of each of the above hydrological categories of data, to provide insight into annual variation.

The SFWMD hydrometeorologic monitoring design details are provided in a reference that is not linked to the SFER. There appear to be a number of hydrologic monitoring systems operating in the area covered by the SFER (listed on Page 5-4). Are the monitoring systems documented? Such documentation would help answer questions such as: are all the monitoring programs using the same methods? Are the data from these other monitoring systems stored in DBHYDRO in a common format? Is the Meta data common?

On Page 5-42, it is noted that due to the extensive coverage of this year's report, the extent of data analysis is limited. What are the planned data analysis procedures? What hydrologic information should the reader expect to receive in next year's report? What information the year after? In general, what hydrological information is deemed critical to water management in South Florida and how will that information be summarized in future chapters on hydrology of South Florida?

Additional Questions

1. There is an implication that all rainfall data used in the SFER was obtained by the SFWMD's Operations and Maintenance Department (Page 5-7). Is there not data from other networks used in the SFER? If this other data is not used in preparation of Chapter 5, can it be used to provide quality assurance for the SFWMD's rainfall data?
2. What model is used to estimate ETp (Page 5-16)?
3. Chapter 11 reports that water levels in the Kissimmee River ranged between 2 and 10 feet prior to implementation of the C&SF project and 2 to 3 feet afterwards. There is no summary of historical flows in Chapter 5. With the river restoration project underway, will future hydrology chapters include data and information on Kissimmee River flow changes over time? If so, have 'expected conditions," for future hydrologic data interpretation purposes, been defined?
4. While Chapter 5 presents a summary of Lake Okeechobee water levels, Chapter 10 provides an interpretation of what the levels mean and what objectives, regarding future lake levels, will be sought. How will future SFERs combine the basic lake level data summaries with an interpretation?

5. As noted in Chapter 5, due to the extent of data collection, only limited analysis and synthesis are presented in this year's report. Could the inflow/outflow information be predicted based on the rainfall, potential ET and water levels of lakes? Is there any effort to analyze the data in that direction?
6. What are those "+" and "-" rainfall of WY2004 in Fig 5-5 to Fig. 5-19?
7. Why are the inflow and outflow of St. Lucie Canal and Caloosahatchee River not balanced? How are the significant differences explained?

Conclusions

1. Chapter 5 addresses the hydrology in all four areas now covered by the SFER.
2. The graphical means of presenting data and information regarding rainfall, potential evapotranspiration, water levels, inflows and outflows summarizes considerable data in an effective, short hand, manner. Water Year 2004 appears to have been close to a normal year.
3. Chapter 5 notes that, due to the extensive coverage of this year's report, the extent of data analysis is limited at this time. While this is recognized as a constraint on the 2005 SFER, it would be helpful if some indication were provided regarding the hydrologic analysis that can be expected to appear in the 2006 SFER.

Recommendations

1. There is a need to graph past annual measures of each of the hydrological categories of data, to provide insight into the annual variation. The current system masks such understanding by combining all data prior to 2003 in one number.
2. Add a brief explanation of the hydrologic data analysis procedures to be used when there is more time to prepare Chapter 5.

CHAPTER 6: ECOLOGY OF THE EVERGLADES PROTECTION AREA

The restoration of the Everglades has as a primary objective the establishment of an ecosystem with appropriate structure and functions. One goal is to restore, to the extent possible, the natural hydrology of the Everglades, in turn restoring appropriate structure and function. The SFWMD operations, regulations, monitoring, and science are directed toward examining wildlife ecology, plant ecology, ecosystem ecology, and landscape ecology within a framework of the hydrology of the Everglades. This chapter summarizes the on-going work in these disciplines. The overall research program is excellent, and the studies are important to improving the understanding of the function and structure of the Everglades. Basic ecological work is now essential to understanding the structure and function in its pristine form.

Ecology by its very nature involves complex relationships, making it difficult to demonstrate clear-cut cause and effect relationships. Thus the SFWMD approach of addressing particular indicators of the health of the system is appropriate, although a full description of this rationale is necessary. Since it is not possible to examine all species, species assemblages, and processes, indicators must be selected for assessment and monitoring. Five key indicators are examined in some detail in this chapter: wading birds, flood tolerance of tree seedlings, periphyton, tree islands, and GIS landscape analysis of vegetation. Restoration of the Rotenberger Wildlife Management Area continues to be a key project.

Wading birds were selected because they are top level predators, are visible and of interest to the public, and can be observed and studied in the field and in the laboratory. Seedling tolerance to flooding is a key factor for ecosystem management. Periphyton continues to be the base of the Everglades food web, and Tree islands are important features of the Everglades that must be preserved and re-established. Finally, using GIS to understand the total hydro-biogeochemical system in the Everglades is critical to restoration and management of the system.

The chapter examines four key areas that have appeared in previous reports; Wildlife, Plants, Ecosystem, and Landscape.

Wildlife

The Wildlife section should be called *Wading Birds as Indicators* because it does not truly discuss wildlife broadly. Alternatively, the section should contain an introductory paragraph that outlines previous research in this area, and states that for next year wading birds will be highlighted. In light of past data, the nesting asynchrony observed this year deserves further study. Is it conceivable that the decreased water available in the Everglades over the last decades increased the synchrony, and what is being observed is a return to more "normal” conditions.

With the institution of more extensive monitoring and assessment programs it is critical to ensure that any new methods allow for an interpretation of past data. In some cases, this will involve conducting both the new and old protocols for enough years to calibrate the new system. Ideally, the old methods should be incorporated within the new system.

Wading birds have always been a key indicator group for the Everglades, in the minds of scientists, regulators, and the general public. Nesting waders, and their reproductive success, are used as indicators of the progress of the Everglades restoration effort, and will continue to be so in the future. There was a general increase in the number of waders nesting in the Everglades, and an increase in asynchrony of nesting. Some of these changes may have been due to an exceptionally dry June. Asynchrony in nesting often occurs either because of heavy rains, because food supplies are sporadic or difficult to obtain, or because food remains available later (as it did this year in the Everglades). Since most of the waders breeding in the Everglades are not long-distance migrants, late fledging chicks may still be recruited into the breeding population. While the running year averages for number of nesting birds is useful because it dampens out large shifts from year to year, it might be useful to actually see the data.

Last year's promising studies using stable isotopes to study the Everglades food web and to examine different parts of the system were not reported this year. These studies could play a critical role in understanding wildlife within the Everglades.

Plant Ecology

The two main projects include restoration of the Rotenberger Wildlife Management Area, and the tree island seedling studies. Both are key to understanding the functioning and structure of the Everglades. The Rotenberger Wildlife Management Area has been the focus of study for some time, and is now experiencing an improved wet-dry season cycle that more closely resembles a natural hydrology. The plant composition has changed, but requires considerably more time to understand the nature of the changes. Wetland plants persist, indicative of a high nutrient condition, and information on the lag time for changes is critical to understanding plant ecology of the area. Continued monitoring of phosphorus into the system is important.

Restoration of tree islands in the Everglades is important for overall functioning of the Everglades, and for many different species groups of animals. While the susceptibility of seedlings of tree island species to flooding is a critical series of studies, the overall objectives should be more clearly stated, as well as the length of the study and plans for field experimentation. The rationale for selection of species for study should also be included.

Ecosystem Ecology

As studies of the Everglades mature, considerably more attention is understandably being devoted to ecosystem and landscape studies. This reflects an increase in the knowledge at the individual and population level, and is an indication of a maturing research program. Major topics of this section include influence of mineral content on periphyton (in the field and laboratory), and ecological processes in tree islands. The shift from softwater to a hardwater system influences the composition of the periphyton, and much attention has been devoted to understanding the influence of different aspects of water mineral content to periphyton diversity. The results indicate that relatively small changes in conductivity result in substantial changes in periphyton species abundance. This is an important conclusion, and one that bears further study and modeling because of the importance of periphyton to the Everglades food chain.

Understanding the complexity of both structure and functioning of tree islands is critical for Everglades restoration. A short paragraph outlining the major information gaps for tree islands might set the research in this chapter in perspective. The move toward understanding below ground biomass is important, and the work should continue. Attention should be devoted to understanding the relationship between above and below ground, and the implications for continued functioning. Does a particular ratio confer some advantage during droughts, hurricanes, or during other stresses?

Landscape Ecology

The SFWMD landscape scale work in the Everglades is landmark work that provides a paradigm for other very large aquatic ecosystems. The GIS system will help understand the ecology of the Everglades at all levels of biological organization. The objectives, rationale, and management use of this data should be more clearly stated. The overall objectives of the landscape projects need to be emphasized along with the intended management goals or options that this information will inform.

Each research project in this chapter should be described using the same format, including objectives, rationale, protocol, and future directions. The overall objectives of the ecological research program should also be introduced.

Recommendations

1. Discuss the importance of wading birds as bioindicators of wildlife health. This narrative could be added to next year's report.
2. Discuss the use of fish or mammals as bioindicators.
3. Ensure that any new monitoring and assessment protocols for the Everglades are coordinated with the present monitoring of wading birds so that long term status and trends can be evaluated.
4. Include information on the food web studies, using stable isotopes.
5. More detail on the rationale and protocol for the seedling studies should be included.
6. Consider modeling the water mineral content and periphyton species composition (and abundance) in different parts of the Everglades system to understand food web differences among parts of the system.
8. Include a paragraph identifying information gaps for tree islands, and how these would inform management.
9. For each research topic, have a clear statement of objectives, rationale, protocol, results, and future directions.
10. Include a table of contents for the chapter.
11. Include a rationale for each research topic - how is it going to improve our understanding of ecosystem processes (a scientific rationale), and how it will affect management.

CHAPTER 7: UPDATE ON RECOVER IMPLEMETATION AND MONITORING FOR THE COMPREHENSIVE EVERGLADES RESTORATION PLAN

The Panel supports the logic of the overall purpose and methodology utilized by the RECOVER team. The Assessment-Evaluation-Planning and Integration continuum is logical and can be applied to most management decisions. The adaptive management program is clearly stated and should be easily understood by all readers. Progress made in the work by the RECOVER team in refining its objectives and in applying and evaluating scientific and technical information in support of the CERP was noted by the Panel. Overall this is a highly readable and understandable chapter. The summary section is excellent and clearly identifies responsibilities and sequencing of the work to monitor progress made in implementing the CERP. The overall purpose of this chapter is clearly stated in the RECOVER mission statement.

The Panel also noted the effort to address the long-term and integrated nature of CERP by giving priority to projects that will allow tracking of CERP performance by establishing interim targets. This highlights the iterative and cyclical nature of the 30-year period for implementing the CERP which is presented in the RECOVER-wide section of the chapter.

The discussion of RECOVER-wide Conceptual Ecological Models was most interesting and noted by members of the Panel. Appling system-wide performance measures for evaluating alternative plans will also help in understanding the results of specific studies. Last year the Panel noted that while it did not undertake such an analysis, it was clear that parameters used in any system wide analysis could “give rise to different conclusions from a management point of view as to what could be expected.” The concern of the Review Panel is that applying the results of such models in a system-wide test may have an impact on one of the principle purposes of the RECOVER program in being able to track each project. On the other hand the planning and integration objective could be strengthened in the long-term if consensus can be reached regarding the scientific and technical priorities for the CERP. The fact remains that management of complex areas is an inexact science and one where long-term goals must be defined and strive in the general direction of such goals, even while meeting very specific scientific objectives (e.g., water quality measures; volume levels, etc.) the validity of which may change in a landscape level analysis over time.

The reports in this chapter on the various methodologies utilized to track the effectiveness of RECOVER activities comply with what the Panel suggested in past years. The CERP goals included in table 7-1 follow both the project and system-wide goals. The Panel also notes the comments that this chapter, and the models employed in tracking implementation of CERP, will receive specific peer-review from the National Academy of Sciences. While an expensive and comprehensive undertaking, it will help validate the overall CERP program.

The note that the 30-year implementation period of CERP will require an “integration function” and a process to incorporate changing conditions, new information, and other factors that may affect CERP performance, should continue to be emphasized. There is reason to build consensus and support for this fact over time. The CERP update is a step in this direction, but the report must be put into a context and written in such a way that the general public understands the implications of such an effort as well as the relationship between CERP and RECOVER.

The Panel continues to support the long-term goal of a total ecological model to evaluate the interactions among the regional models and the upstream and downstream effects of management actions. Further the Panel continues to support the concept that the RECOVER process, developing and implementing an adaptive management program for the CERP, is a critically important part of the overall CERP program, and must be based on a well-designed and well-supported program of monitoring, assessment and research. So far, most of the development efforts appear to have focused on identifying ecological indicators, although the Panel noted progress in data analysis during this reporting period.

The institutional implications of the third RECOVER objective - consensus building - continue to be critical to acceptance by the general public to future management of the region. This should be given priority from the outset so as to catalyze joint ownership of the program, between the agencies and the public.

The Panel voiced strong support for the Regional Evaluation and Report Process section of the chapter and in particular the adaptations made to team structure and in attempting to maintain consistency in data collection methods etc.

Recommendations

1. The Panel recommends that the RECOVER adaptive management program for CERP report both outcomes that support, and those that do not support, the basic hypothesis of the program.

CHAPTER 8: IMPLEMENTATION OF THE LONG-TERM PLAN FOR ACHIEVING WATER QUALITY GOALS IN THE EVERGLADES PROTECTION AREA

This chapter is a summary of the Long-Term Plan, and it's implementation. The chapter includes sections dealing with the Plan's overview, revisions, challenges to achieving long-term water quality goals, and conclusions. The importance of the Plan is clear as it guides the achievement and maintenance of water quality standards in the EPA, including the new phosphorus criterion.

The numerous and diverse regulatory requirements that have been implemented over the years present unique challenges to the regulators and well as those regulated. The 2005 SFER, like those before it, has addressed these requirements and how the District's response. In doing so, the District has brought together the various initiatives and projects underway, the results achieved so far, and the conclusions that can be reached and lessons. There is however a certain fragmentation in the report that is inherent due to the many regulatory requirements involved.

The Long-Term Plan can integrate the regulatory requirements with the water quality management activities undertaken and planned and identify the scientific studies needed to underpin management actions. This chapter provides some information about those regulatory and management plans, but it could be enhanced considerably with an elaboration of the management process, the overall results to date, and progress in achieving the water quality goals.

The fact that additional measures are necessary to achieve the overall Everglades water quality goal should come as no surprise to anyone following this complex process for the last several years. Nevertheless the Panel noted progress made in achieving reduced TP levels in water discharged into the EPA as required by the Everglades Forever Act. In referring to Chapters 3 and 4 of the 2005 report, the Panel also noted that the best management practices implemented in the Everglades Agricultural Area and the impact of the Stormwater Treatment Areas have had a positive and measurable affect in terms of reducing P loads into the Everglades system.

The organization of the Long-Term Plan into Pre 2006, Process Development and Engineering, and Post 2006 is a logical one given the December 31, 2006 deadline for complying with the terms of the EFA. It is likely that additional water quality improvement measures will be required after 2006.

The Panel agrees with the rationale utilized in preparing the Long-Term Plan objectives – adaptive management, continued investigations, and measurement of performance and economic benefits realized by implementing water quality measures – as logical given the iterative nature of this planning and restoration process as well as the reality of changing variables (input totals and sources) from the many contributing sources to water entering the EPA.

Several challenges to achieving long-term water quality as defined in the law were noted in the report including regulatory issues, uncertainty in terms of the long-term performance of new technologies, and unknowns related to the CERP. The Panel noted these concerns. The report also stresses that many CERP projects are still in the early planning stages and therefore it is unclear as to how they will impact water quality. However, now that the final decision has been made supporting the adopted phosphorus rule, the District can at least put that particular debate behind it as planning and implementation activities proceed.

A review of the Long-Term Plan continues to raise the issues related to monitoring as a way of gathering new data and improving the Plan itself. In Sections 5 "PDE" and 8 "Operation, Maintenance and Monitoring" of the 2004 SFER, the operational aspects of monitoring progress towards attaining water quality goals were noted, but neither that report nor the 2005 SFER provides insights into how such information will be treated either legally or scientifically as implementation of new projects proceeds.

Specific recommendations are as follows:

1. Clarify who - the District or FDEP - has the responsibility for updating the baseline data sets noted on Page 8-7.
2. Provide the bases for the assumptions presented in the "comparison of WY2004 P Loads to the 1979-1988 Baseline" section of the report over the long-term, given that no basis for long-term predictions exists.
3. Updated baseline data sets should distinguish between pre-TP controls and post-TP controls.
4. Studies of basins with limited current data, such as C-51W, should also be undertaken.
5. TP loads to the EPA are not given in a way that is easily comprehendible. Since a focus of this chapter is the phosphorus load to the EPA, Table 8-3 needs to be rearranged so it depicts the TP mass balance for the EPA. TP loads going from areas into STAs need to be separated so that only loads into and out of the EPA are included.
6. A figure should be added showing the EPA and surrounding areas with the TP loads from those areas shown. Such a visual presentation will clearly indicate the major sources of TP to the EPA as well as help explain the TP concentrations found in the water within the EPA.
7. Table 8-3 estimates that 65% of all TP inputs of the EPA come from atmospheric sources, yet theses inputs are poorly characterized and scarcely mentioned anywhere in the 2005 report. Atmospheric sources may be especially important because they reach directly into even the most remote parts of the EPA, bypassing many of the P-control efforts of the SFWMD. Are deposition rates really as estimated in Table 8-3? Is there large spatial and temporal variation in atmospheric inputs of TP? Is atmospherically deposited TP derived from local sources (which might be controllable by changing management practices within the SFWMD service area), or from more diffuse sources?

Recommendations

1. The Panel would like clarification on the comment (P. 8-12) that "comparatively little is known about the technical efficacy and economics of controlling total P loads…" The Panel's understanding is that a great deal is known about the overall impact of BMPs on TP loads. What is not clear is the impact and total cost of applying individual BMPs.

2. More attention should be given to atmospheric inputs of total phosphorus. The Panel recognizes that atmospheric inputs may be difficult to measure. Nevertheless, such sources may merit increased attention, given their apparent magnitude.

CHAPTER 9: COMPREHENSIVE REVIEW OF INVASIVE EXOTIC SPECIES IN THE SOUTH FLORIDA ENVIRONMENT

This chapter gives a comprehensive review on the problems, facts, science, task forces, policies, regulations, permits, methods, and management efforts pertaining to invasive exotic species in the South Florida environment. It also reports the results and progress of District's efforts on the control of priority exotic species. The task of reporting such broad-base information of invasive exotic species in South Florida is not an easy one.

Generally, the literature review is clearly written and informative. The parts pertaining to the task forces (and particularly, the organizational structure and relationships of the task forces) and the results generated by those task forces are not as clearly written. For example, is SFERTF commissioned solely by the District? Did the SFRTF lead "several other states, and federal agencies" in the compilation of the list of priority invasive exotic species? What is the "all taxa" interagency group that was convened in July 2004 to increase the dialog between and among plant and animal specialists? NEWTT and FIATT were established by SFRTF; how about the TAME Melaleuca project? Is this interagency demonstration project led by the District through NWETT of SFRTF? The authors stated that "to ensure future success, commitment to funding and support research needs" must be made. Is there any specific suggestion in this regard? Fund and support which projects? Is there any order of priority suggested?

The authors are commended for pointing out several important but often overlooked issues in the control of exotic species. Those are the contrasted emphasis in the research funding to agricultural exotic pest control vs. the exotic animal species control in natural habitat and the lack of consensus between private sectors and government agencies. Those important issues need to be addressed in order to have an effective invasive exotic species control

The review Panel believes that the chapters of SFER need to be presented in a more interconnected cross-referenced and integrated manner in the future. There is certainly room for improvement of this chapter in that regard. For example, the control efforts of Melaleuca and Brazilian pepper and other species in the STAs (Chapter 4) were not mentioned here. The chapter did mention other efforts put forth by federal and other state agencies (e.g. FGFWFC, ISWG etc.) As noted, invasive exotic species control has no artificial boundary. However, to serve a purpose in SFER, the efforts, progress, and results of the invasive exotic species control in the current water year need to be explicitly expressed in this chapter, among those of the other federal and state agencies to a possible extent. That is, more efforts should be given in this chapter to present an explicit and specific account on the results, progress, difficulties and suggestions within the scope of the District for decision making and management purposes.

Finally, quite a few specific comments made by the review Panel and the public were not addressed at the public workshop. They include:

1. The title of this chapter suggests that this is a comprehensive review of invasive exotic species in the South Florida environment. The chapter also reports the District's effort to control some priority species and management strategy. A more appropriate title may be: *Invasive Exotic Species in the South Florida Environment*. In fact, reporting the effort

and results of invasive exotic species control and management strategy probably should be emphasized in this chapter.

2. The summary should also include more results of the District's effort to control priority species in the EPA other than just melaleuca.
3. What do you mean in the statement in P. 9-3&4 "Overall, the major issue is the lack of meaningful information concerning the effect of invasive exotic species in South Florida?" How about the information described in 9-16-27?
4. P. 9-5. What are the specific problems in the NEWTT-developed comprehensive strategic plan?
5. P. 9-22. What do you mean by "To date, 8% of the Brazilian pepper forest has been restored"? Restored to the native species?
6. It might be useful to add a 3rd paragraph to the introduction that explains specifically why exotic species are a problem for protection and restoration of the Everglades, naming some of the species and the ecological problems they cause.
7. What is known of the biogeochemical consequences of exotic species control, especially for P, over the short-term (death of exotics) or long-term (replacement of exotics with natives)? Does exotic species control increase or decrease problems with P in the Everglades?
8. On Page 9-7, what is the reference for there being 40 species of marine exotics established in South Florida?
9. On Page 9-30, the authors rightly lament the ineffective patchwork of regulations for keeping new exotics from establishing themselves in North America. Does the SFWMD work with other regional authorities to push for national and international controls on the movement of exotics, or must SFWMD wait until an exotic is well established and moving into the District before investing its resources in control?
10. Today, the melaleuca infestation on SFWMD managed lands is no longer increasing in most areas, it has been significantly reduced. Can you give the numbers that sustain this assessment?
11. The ultimate control of melaleuca throughout the District will depend primarily on the future availability of funds. The magnitude of the treat of melaleuca and the cost of current control efforts are enormous. What are the numbers?
12. What is missing from this chapter is a discussion of what efforts were undertaken in FY 2003 for all species listed (and what the preliminary results/conclusions were for all) except melaleuca and torpedograss, where some treatment information was provided?
13. P. 9-14, Herbicide toxicity to Wildlife: the section is too short and not particularly well composed. Including a table listing the most commonly used herbicides in the EPA or CERP area for treatment for treatment of aquatic and upland species, their toxicity and safety, and citing studies or research indicating low toxicity or their effectiveness, could help.
14. P. 9-15 and 9-16, prescribed burning and water level manipulation: Section poorly written; more information is available and sections lack flow entirely.
15. P. 9-27. Lobate Lac Scale: Section is entirely too short. Additional detailed information is available on this subject (e.g., the UFL/USDA fact sheet is 3 pages long).
16. P. 9-28, near middle of page: it's "Dreissena", not "Dresseina"
17. P.9.1. Is the statement correct that "213 are listed primarily or exclusively due to losses caused by invasive exotic plants" or should it be invasive exotic plants and animals?

18. P.9.2. Shouldn't there be an "Adaptive Management" strategy for exotic plants that is iterative?
19. P.9.6. While the Panel agrees that for much of the Everglades, invasive plants are the dominant problem, is the problem equally severe for fish communities?
20. P.9.7. How well have efforts been coordinated between the Everglades groups and those in adjacent regions that serve as seed sources for the plants in the Everglades?
21. P.9.13. Could there be a table of herbicide use and amounts (within areas) of the Everglades?
22. P.9.13-14. Can you give some indication of how often each of these techniques is used in the Everglades?
23. P.9.16 and following discussion: Some indication of the potential effects on wildlife should be included. Are they used as foraging or nesting places by some birds? This is an especially important question for Casuarina.
24. P.9.28. What do you do with Cattle Egret that arrived on its own in the 1940s? Is the distinction between immigrant, exotic, and invasive clear? And who is to make the decision about which species to control, and are there clear criteria that are understandable to a range of stakeholders?
25. P.9.29. Again, with respect to management, the costs to other wildlife of removal of some vegetation needs to be discussed (particularly, some trees provide nesting sites for sensitive species). This is recognized in one sentence on the bottom of 9.29, but deserved more.

Recommendations

1. A more detailed statement should be added regarding the activities undertaken in WY2003 (and up to the cut-off point for new date in WY2004 for inclusion in the 2005 SFER) to control all the species noted in the chapter. This should be done either on a species basis or in general regarding the progress made in realizing the overall goals of exotic plant and animal control.
2. This chapter should include a discussion of the administrative relationships and organizational structure of the task forces involved in the invasive exotic species control.
3. The Panel recommends that future chapters clearly indicate the protocols utilized in controlling both plants and animals and the relative success of these undertakings.

CHAPTER 10: LAKE OKEECHOBEE PROTECTION PROGRAM—STATE OF THE LAKE AND WATERSHED

Chapter 10 provides a general overview of Lake Okeechobee and its surrounding watershed. It summarizes background material regarding the major issues surrounding the lake's flora and fauna, gives an overview of ongoing projects carried out under the Lake Okeechobee Protection Program (LOPP), and provides a comprehensive update of watershed and lake conditions, The lake currently faces three major environmental problems: 1) excessive phosphorus loads, 2) unnaturally high and low water levels, and; 3) the rapid spread of exotic and nuisance plants in the littoral zone.

This chapter is a clear summary of limnological conditions and plans for the recovery of Lake Okeechobee. The illustrations and tables used are clear and useful. It is also well referenced, with a good mix of peer-reviewed journal articles, and agency publications. The information helped in understanding how the Lake Okeechobee Protection Program (LOPP) will complement work being conducted by the Lake Okeechobee Watershed Project (LOWP) of CERP.

Phosphorus Loads

Lake Okeechobee has received considerable study over many years, and the understanding of this system, particularly the eutrophication processes, is growing. The major portion of the chapter deals with the phosphorus loading issue to Lake Okeechobee and the impacts of the excess P on the biogeochemistry and plant community structure in the lake. The authors say that it may take the lake 20-30 years to respond to reductions in P loads. Where does this number come from? Are the authors confident that the number is accurate, or are they making the point that internal recycling may cause a substantial delay in the response of the lake (in which case it might be better to substitute "decades" for "20-30 years")?

It was mentioned (Page 10-12) that the LOPA required that tributary sediment trapping be investigated as a phosphorus reduction technology. The results indicated that little particulate phosphorus can be removed by this method due to small particle size. Also on Page 10-8 (internal phosphorus management program) it was stated that sediment removal from the lake would not be effective in reducing internal phosphorus loading. Alternative measures for removal of sediment, like large pits dug in the lake bottom to trap P-rich sediment material, were found to be not feasible (see The Lake Okeechobee Sediment Removal Feasibility Study). The Panel would like to see that there is a clear reference to this feasibility study in Chapter 10.

Other questions that should be addressed include: How reliable are the reported estimates of atmospheric deposition? Are phosphorus inputs to the lake via atmospheric deposition considered "uncontrollable"?

In the SFER, water quality is synonymous with phosphorus. In Lake Okeechobee (not true of other parts of the Everglades, though), phosphorus does appear to be the major water quality issue. Except for nitrogen, other potential water quality issues are ignored in this chapter. For example, what about organic contaminants (herbicides and pesticides) and their impacts on lake aquatic organisms? How do high levels of sulfate in the lake water affect sediment redox chemistry, sulphide build-up, trace metal micronutrient cycling, methylmercury production in the lake? Also, what are the impacts on biota? Increased sulfur loads originating from polluted surface water and groundwater, and from enhanced atmospheric input, are a major threat to the biogeochemical functioning and biodiversity of freshwater wetlands. Sulfate reduction, normally playing a modest role in these freshwater wetlands, may become the most important biogeochemical process, inducing severe eutrophication and sulfide toxicity. In field enclosure experiments Lamers et al. 2002 observed striking differences between the responses of two freshwater marshes to sulfate. In one location sulfate addition resulted in strong phosphorus mobilization without sulfide accumulation, whereas high sediment sulfide concentrations, known to be toxic to wetland macrophytes, were reached in the other marsh without eutrophication occurring. The results could be explained by differences in groundwater iron discharge and nutrient contents of the sediments. Finally, what about the effects of increased conductivity (salinity) on biota? None of this is addressed in the report, and it is unclear if any of these potentially important water quality issues have been looked at in great detail.

Water Quality Modeling

Some water quality modeling efforts are being performed to provide a better understanding of how the Lake Okeechobee ecosystem functions. The models are also a basis for long-term projections of phosphorus concentrations. What are the District's plans to incorporate sophisticated models for this purpose? The estimated "lag time" for seeing water quality improvements in the lake as a result of reduced phosphorus loads is approximately 30 years. Has the LOPP developed any more refined estimates of lag time based on modeling that has been conducted?

Will the declining sedimentation coefficient of the lake mean that lower loadings than anticipated will be needed to restore the lake, or that recovery will be prolonged? Are there plans to investigate the reasons behind the decline in sedimentation coefficient? Does the model being used to project long-term responses of the lake include a dynamic sedimentation coefficient, including possible interactions with declining calcium? This seems like an important point with respect to the long-term prospects for restoring the lake.

SAV and Phytoplankton

The ongoing or proposed work on SAV responses to light and measuring the ecological value of SAV are both valuable. Are the experimental tanks used for SAV studies realistic enough to provide reasonable parameter values for an SAV model?

Within the lake, it appears that inadequate attention is being given to the role of SAV in cycling phosphorus from the sediments to the water column. Work by Barko at the Corps of Engineers Experiment Station in Vicksburg has shown conclusively that the primary source of nutrients for SAV is the sediment. Further, others have shown that SAV are nutrient "pumps" moving phosphorus from the sediment to the water column through metabolic processes as well as the normal shedding of leaves and stems from the lower, light limited portion of the plants. This shedding contributes organic material and nutrients to the sediment within the SAV bed producing a high organic content, nutrient-rich soil that can then exchange phosphorus with the water column – especially under low DO conditions which occur commonly at night in the midst of SAV beds. Given the coverage by SAV in Lake Okeechobee, what is the estimated internal phosphorus load created by the SAV and is it significant compared to other sources?

Hydrilla infestation in Lake Okeechobee seems to be positive for the fish population. *Hydrilla* provides valuable habitat for fish in shoreline areas. Its spatial extent appears to be kept in check by wind/wave action in this large lake. Can this aspect be included in this chapter and be compared with the impact of *Hydrilla* in the other systems

On the top of this Page 10-19 the mechanisms are cited by which submerged macrophytes in shallow lakes may negatively influence the biomass of phytoplankton and positively influence the transparency of water. What is missing include: 1) competition for nutrients especially for nitrogen, 2) allelopathy, and; 3) stimulation of denitrification by bacteria around their roots. Is it possible that the macrophytes are responsible for the N limitation of the phytoplankton in the littoral zone (Page 10-18) because they are taking up nitrogen for the water and because denitrifying bacteria are abundant in sediments in which macrophytes growth?

This chapter should explain that cyanobacteria are monitored for their toxicity. Further it is not clear whether there are filter feeding mussels (like unionids or Corbicula) in the lake that may be able to prevent algal blooms?

Fish Population and Condition of the Lake before 1900

Information on two key subjects is scarce or even absent: 1) the status of fish populations and; 2) the condition of the lake before 1900. Fish populations are important to the substantial fisheries on the lake, and may feed back strongly onto phytoplankton and other water quality issues. These receive attention in the chapter. Where were the 22 sites used for sampling largemouth bass (P. 10-22)? Randomly placed over the whole lake, just in the vegetated shallows, or just in certain regions of the lake? The conclusion that “a structurally diverse aquatic plant community is essential for successful bass recruitment in this lake” seems too strong, in view of the relatively short run of data presented in Fig. 10-24. This is certainly a logical conclusion that is consistent with the data, but not one that the Panel would support with great confidence. Until more data are available, the Panel suggests softening this conclusion.

Information on the function of the lake and the structure of its habitats before heavy human intervention would be helpful in interpreting present-day data, as well as in guiding restoration efforts. The chapter contains little information on the natural state of Lake Okeechobee. If the authors have more information on these topics, it would be welcome.

Conclusions

1. Chapter 10 is a very clear summary of limnological conditions and plans for the recovery of Lake Okeechobee. It is well written and technically sound.
2. It summarizes background material regarding the major issues that have an impact on the lake’s flora and fauna. The chapter gives an overview of ongoing projects carried out under the Lake Okeechobee Protection Program (LOPP) and provides a comprehensive update of watershed and lake conditions,

3. It is a major improvement that the 2005 report has been expanded to include coverage of Lake Okeechobee, the Kissimmee River and the Upper Chain of lakes, and coastal ecosystems in South Florida.

Recommendations

1. An outline at the beginning of the chapter is recommended by the Panel.
2. In this chapter it is stated that it was determined that sediment removal from the lake would not be effective in reducing internal phosphorus loading and that alternative measures, like large pits dug in the lake bottom to trap P-rich sediment material, are not feasible. The Panel should like to see that there is a clear reference in Chapter 10 to the Lake Okeechobee Sediment Removal Feasibility Study.
3. Research should include the possible role of sulfate on the mobilization of phosphate. It is known that an increase in sulfate may increase the mobilization of especially phosphate from the sediments. This may be an important part of the internal eutrophication (see reference above). A monitoring program for measuring other minerals than P and N is recommended.
4. More research should focus on the role of SAV in nutrient recycling and uptake. Is SAV responsible for the nitrogen limitation of algae in the littoral and is SAV acting as a nutrient "pump" moving phosphorus from the sediment to the water column?
5. The Panel suggests that in this chapter more connections can be made with the other chapters. For instance, the Kissimmee River is a major source of water and materials to the lake, which in turn supplies water and materials to the EPA, the St. Lucie estuary, and the Calusahatchie estuary. These connections could be addressed more explicitly.

CHAPTER 11: KISSIMMEE RIVER RESTORATION AND UPPER BASIN INITIATIVES

The Kissimmee watershed is the headwaters to the greater Kissimmee-Okeechobee-Everglades ecosystem. The watershed encompasses a diverse group of wetland and aquatic ecosystems, including more than a dozen lakes, their tributary streams and the Kissimmee River. Major projects in the watershed are the Kissimmee River Restoration Project (KRRP), Kissimmee River Headwaters Revitalization Project (KRHRP), and the Kissimmee of Chain Lakes (KCOL) Long-Term Management Plan (LTMP). The authors describe past, present, and future restoration projects in the Kissimmee basin, and present data showing how the ecosystem has begun to recover. As a major source of water and materials to Lake Okeechobee and downstream ecosystems, activities and conditions in the Kissimmee basin can have substantial effects throughout South Florida. Therefore, the Panel believes that including the Kissimmee River and the Upper Chain of Lakes in the SFER 2005 report is a major improvement of last year's report.

Several aspects of this chapter are especially well done. The summary and the conclusions are compact and clear. The Panel commends the authors on developing and explaining their procedures for producing defensible reference conditions for the Kissimmee system, a system for which good historical data are not always available. Further, the authors did a good job presenting solid data on the hydrology, geomorphology, vegetation, and macroinvertebrates of the Kissimmee River showing that the system has begun to make substantial progress, even at this early stage of the restoration.

However, other aspects of this chapter could be improved. The authors present a lot of information about the large body of restoration and assessment work in the Kissimmee River basin, but this information is not always easy to take in. The Panel has two major suggestions for improving the readability of this chapter. First, there really should be a good map (or multiple maps) of the area that shows all of the locations and structures in the basin that are mentioned in the text or figures. It is hard to make sense of data from Pool A, Pool B, etc. without an idea of where Pool A and Pool B are. A great many locations and structures mentioned in the text are not shown in Figs. 11-2 or 11-7. Second, the sections from "Kissimmee Chain of Lakes Long Term Management Plan" (P. 11-8) to "Tributary Restoration Projects" (Pp. 11-12 to 11-13) seem to be out of place and interrupt the natural flow of ideas. The opening sections (up to P. 11-8) set the stage for a discussion of restoration work on the Kissimmee. It would be more natural to proceed to "Kissimmee River Restoration Project", which is the meat of this chapter, and then close the chapter with the series of short sections describing projects that follow from or complement the KRRP/KRHPP. Also, it could be made clearer how each of these projects relate to the main KRPP/KRHPP. For instance, how are the data collected in the Ambient Water Quality Monitoring Project used?

Some parts of the chapter that deal with phosphorus need attention. On Pages 11-24 and 25, assumptions 1, 3, and 4 are not well explained (a reference is given for assumption 2), in contrast to the generally good explanation of how reference conditions were estimated for other ecological variables. These are key assumptions for estimating pre-channelization levels of total phosphorus, which is the basis for setting restoration targets for TP, a parameter of primary interest throughout the greater Everglades (including Lake Okeechobee, which receives water from the Kissimmee). It is not evident to the Panel that these assumptions are true (in fact, they seem likely not to be completely true), so it would be good to see references or reasoning defending the assumptions. Second, it would be good to have more explanation for why current levels of TP in the river are so high. Are they completely a result of mysterious source X of TP in southern Lake Kissimmee? At face value, the data suggest a large source of TP in the lake, adding 20-30 µg/L to the river water. Does SFWMD plan to track down and characterize the source of all this P?

The author's present data suggesting that a large amount of organic matter and marl was flushed from the newly opened channels (~10 cm in 9 months). It would be useful to estimate how much material in total was flushed out, describe the chemical and physical properties of this material, locate the places where this material ended up, and assess the ecological effects in the recipient system. It would be desirable to answer these questions before the next phase of channel restoration (which presumably also will flush sediments from old river channels).

The narrative of pre-channelization conditions in the Kissimmee is not well referenced. Is it solid or conjectural? Generally, it is important in this chapter for the authors to distinguish between what they *know* and what they *believe* to be true about the past state of the Kissimmee.

The interactions between water-level management and *Hydrilla* control in the lakes could be better described. What are the plans for control of *Hydrilla* in these lakes? How will future management of water levels in the lakes affect *Hydrilla*? Will it increase or decrease the problem?

Some parts of the chapter could be explained in a little more detail. What were the "alternative storage areas" mentioned on Page 11-8? Why were stage hydrograph and stage recession evaluated at just a single station (and different stations for each variable, at that)? On Page 11-20, the authors say that they have no estimates of baseline mean channel flow velocity. Wouldn't it be possible to calculate this number from discharge data and the cross-sectional area of the canal? Aren't these data available? Why should restoring flow increase dissolved oxygen?

The authors write (P.11-16) that dissolved oxygen, during and after construction, was "similar" in reference and treatment reaches. However, the data shown in Fig. 11-11 suggest that construction had a significant and possibly ecologically interesting effect on dissolved oxygen.

The figure legend for Fig. 11-2 ought to explain what the triangles are. Fig. 11-12 would be easier to read if the y-axis were stretched a little. There are so many data points on Fig. 11-14 that it's impossible to read (e.g., to check if the relationships are linear, to look for outliers, etc.). Better to plot each site on a separate Panel. Fig. 11-16 would be more interpretable if you added a reference line with a slope of -0.3ft/month, so that readers could make visual comparisons of observed and targeted recession rates. Have the authors looked at the outlier on Fig. 11-17 to see if it's in error? What are the error bars in Figs. 11-9, 11-10, 11-11, 11-22, and 11-23?

In the section on macroinvertebrates (P. 11-31), the authors note that several lotic species have already begun to appear. Some of these taxa (unionids, *Corbicula*) have long life-cycles. Is it really reasonable that these species have become more abundant already?

Conclusions

1. The Panel believes it is a major improvement of last year's report that the Kissimmee River and the Upper Chain of Lakes are included in the SFER 2005 report, in recognition of the substantial connections between the Kissimmee Basin and other ecosystems in South Florida.
2. The summary and especially the conclusions are compact and clear. The authors are commended on developing and explaining procedures to produce defensible reference conditions for the Kissimmee system, a system for which good historical data are not always available.
3. The Panel is encouraged to see positive results of ecological restoration in the Kissimmee basin, and looks forward to seeing data on the responses of other parts of the ecosystem as data become available in coming years.

Recommendations

1. The Panel recommends adding an outline of the chapter's contents at the beginning of the chapter.
2. The Panel has two major suggestions for improving the readability of this chapter. First, there should be a good map (or multiple maps) of the area that shows all of the locations and structures in the basin that are mentioned in the text or figures. Second, the chapter could be reorganized to proceed from the introductory material straight to "Kissimmee River Restoration Project" and then close the chapter with the series of short sections describing projects that follow from or complement the KRRP/KRHPP.
3. The Panel would like to see more complete explanations of how the restoration target for total phosphorus was derived and of plans for quantifying and characterizing the apparently large amount of phosphorus arising from the southern end of Lake Kissimmee.

CHAPTER 12: MANAGEMENT AND RESTORATION OF COASTAL ECOSYTEMS

This is a well-written summary of an impressive program of work on the estuaries and coastal waters that ring South Florida. The summary clearly lays out the major threats to South Florida's estuaries. The modular structure of the chapter, in which each estuary is treated in turn, makes the chapter easy to read, and the maps of each study system are useful.

Several aspects of the program are especially well developed, and will be essential in understanding and restoring these estuaries. The hydrology and salinity regimes of the estuaries are being monitored and modeled, which will allow the SFWMD to understand the ecological consequences of changes to hydrology, a vital driving variable in these ecosystems. Key biological resources (especially seagrasses and oysters, which provide valuable habitat and ecosystem functions) are being monitored and have been identified as the targets of restoration. At the same time that the SFWMD is developing the scientific understanding needed to best manage these ecosystems, they and their partners are moving ahead with a diverse array of on-the-ground projects to stabilize hydrology, reduce loadings of sediments, nutrients, and toxins, and restore habitat. SFWMD and its partners also are engaged in planning for future projects on South Florida's estuaries. These activities are most impressive and, if pursued to their logical conclusions, should lead to improved ecological conditions in South Florida's estuaries.

There are some areas that are not so well developed. The Panel suggests that the authors need to address three broad issues in more detail.

First, the Panel would like to see more attention given to the restoration endpoints or targets for coastal ecosystems. This is potentially a difficult point, because data on the historical conditions in these estuaries are not readily available. Further, several of the estuaries have been irreversibly altered from their natural conditions so that the historical conditions would be unattainable even if they were known in detail. It may be useful to set restoration goals at three different levels. First, what general goals will be set? For instance, the maximization of recreational opportunities, or minimization of hazards to human health, or develop systems with sustainable biological integrity or diversity. Second, what specific variables will serve as measurable benchmarks by which progress towards the broad goals will be assessed? The SFWMD has already chosen seagrasses and oyster beds as key variables. The Panel agrees that these are reasonable variables, but it would be helpful for the SFWMD to state explicitly why these variables were chosen, and why other variables were excluded. For instance, people care about fish, and fish may play important roles in the ecosystem, so they could be a logical target of ecological restoration. Are they not given a central role here because other agencies have jurisdiction, because seagrasses, oysters, and hydrology are thought to be adequate surrogates for fishes, because they're too difficult to measure, or because of some other reason? In many estuaries, destruction of nearshore and shallow water habitats has been a consequence of human activity, so restoration often tries to ameliorate this destruction. Are ecologically important habitats other than seagrasses and oyster beds under threat from human activities and therefore the target of restoration? Are there efforts to map or inventory remaining habitats in South Florida's estuaries? Finally, it would be useful for the SFWMD to state explicitly the range of numerical values that are acceptable for key variables. For instance, does the SWFMD want to see about 20-100 ha of oyster beds in estuary X? The Panel recognizes that it will be difficult to develop and defend such specific numerical goals for restoration. Nevertheless, such specific goals will be valuable for the management of South Florida's coastal ecosystems. Clear definitions of restoration targets at these three levels will allow the SFWMD to share their vision for South Florida's estuaries with stakeholders and cooperating organizations, while developing yardsticks to judge progress towards restoration goals.

Second, the Panel encourages the authors to address the severity and ecological consequences of nitrogen loading to coastal ecosystems. The SFWMD has identified hydrology and destruction of key habitats (oysters, seagrasses) as the leading problems facing most of South Florida's coastal ecosystems. This focus seems appropriate. Nevertheless, South Florida's coastal ecosystems also are facing increased nitrogen loads from a variety of sources. Even if problems with hydrology and habitat are corrected, will South Florida's coastal ecosystems still be impaired by excessive nitrogen loading? This issue is potentially problematic because many of the existing and planned programs for nutrient removal are much more effective for P than for N.

Third, the modular structure of the chapter obscures comparisons that might be made across the different estuaries. Is there any coordination or balancing of the programs on the different estuaries, or are they treated as independent programs? As research and management on the different estuaries proceeds, there may be increasing opportunities and needs to coordinate or compare the programs on the different estuaries.

The Panel also identified some more specific points about the chapter that could be improved. It would be useful for the authors to provide more information about the performance of the models they are developing. The detailed hydrology/salinity/water quality models look useful, but the chapter did not provide a sense of how well these models perform. How was the salinity envelopes for key species (P. 12-14) developed? The seagrass model (Figs. 12-32 and 33) could be better explained. Is it reasonable to think that the controls are independent and multiplicative? How well does the model actually perform compared to real data? A description or reference should be provided for the source of the functional relationships between seagrass growth and controlling factors. Does the model include any carrying capacity, competition among species, or feedback between seagrass biomass and available light, nutrients, or space?

How are live oyster beds mapped? Are the methods consistent over time? How old are "dead" oyster beds (recent or subfossil)?

The authors say that sediment is a problem in the Loxahatchee. Data for t his assertion should be provided. How is sediment monitored? What is the evidence that it is causing undesirable ecological changes?

Some of the figures and tables could be improved. Fig. 12-28 would be easier to interpret if a Panel were added showing hydrology or salinity. Figs. 12-38 and 12-39 might be easier to understand if combined into a single graph. Table 12-15 is not needed (the single datum in the table is given in the text).

Conclusions

1. The Panel applauds the efforts of the SFWMD to conduct research on South Florida's estuaries and work with a broad group of partners on management projects designed to improve ecological conditions in these ecosystems.
2. This chapter has clearly identified altered hydrology, habitat loss, and nutrient/sediment inputs as leading threats to South Florida's coastal ecosystems.
3. The work now underway by SFWMD and its partners should eventually lead to improved ecological conditions in South Florida's estuaries.
4. The chapter admirably describes this large, complex program.

Recommendations

1. The Panel recommends that the SFWMD explicitly state its restoration goals for its work on South Florida's estuaries, in specific, numerical terms where possible, and describe the rationale for choosing these goals.
2. Although the SFWMD appropriately focuses on altered hydrology and habitat loss as primary threats to South Florida's estuaries, the Panel recommends that the SFWMD assess the potential for excessive nitrogen loading to compromise the recovery of these ecosystems even if problems with hydrology and habitat are corrected.
3. The Panel recommends that the SFWMD develop plans to take advantage of opportunities to coordinate work on the different estuaries around South Florida.

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