Appendix 1A-5: Final Report of the Peer-Review Panel for the *2007 South Florida Environmental Report –Volume I*

These comments were provided to the public on the District's WebBoard. With the exception of reformatting some information for better readability, this appendix was not edited or spellchecked by the SFER production staff and appears as posted on the District's WebBoard.

FINAL REPORT

of the Peer Review Panel Concerning the

2007 South Florida Environmental Report

Review panel:
Jeffrey L. Jordan, Chair, University of Georgia
Neal E. Armstrong, The University of Texas at Austin
Joanna Burger, Rutgers University
JoAnn Burkholder, North Carolina State University
Yuch Ping Hsieh, Florida A&M University
Richard Meganck, United Nations University for Water Education
Ellen van Donk, NIOO-Center for Limnology
Robert Ward, Colorado State University (emeritus)

Submitted October 20, 2006

INTRODUCTION

The responsibility of this panel was to review and prepare questions on the draft of the *2007 South Florida Environmental Report* (SFER), dated September 2006. In addition, the panel's responsibilities included the consideration and inclusion of input from the public workshop conducted September 26-28, 2006, 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 is concerned when materials are presented in the SFER and at the public workshop that have yet to undergo any peer review, even including internal review. The panel's comments on un-reviewed material cannot be construed to constitute a peer review. 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.

At the suggestion of last year's review panel, the 2007 SFER was reviewed using a tri-level process. The panel found this new review process to be extremely helpful in guiding the comments below. Conclusions and recommendations from the panel were sought on the following three general areas:

Accountability: 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, consistent with earlier versions of the Report? Are findings linked to management goals and objectives? The chapters that were primarily reviewed for accountability were: **1A, 2, 3A, 3C, 4, 5, 7A, 7B, 8, 11, and 12**.

Technical: 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? 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? If so, the panel shall identify specific studies that should be addressed or available data to support alternative findings. The chapters that were primarily subject to a technical review were: **3B, 6, 10, 12; App. 2-2, App. 3B-3, App. 3C-1, App. 12-1.**

Integrative: Are large programs presented so that the overall goals are clear and linked systematically to descriptions in the Report? Are chapters cross referenced in a thorough and consistent manner? Are there integrative data summaries and analyses bridging programs and projects that should be included in future, annual peer reviewed reports to the Governor and

Legislature? The panel shall also provide constructive criticism of the District's programs and projects, as appropriate. The chapters that were primarily the subject of this integrative review were: **1B and 9**.

In addition, the District sought guidance from the panel on how to continue to optimize the reporting and review process. What chapters or sections of chapters can be reduced, consolidated or eliminated? What analysis can be eliminated or done more effectively? What integrative themes should be emphasized in future SFER's? Finally, the panel also provided comments on the 2006 Executive Summary.

General Panel Response to the Draft Report

After reviewing the 2007 South Florida Environmental Report, the panel continues to be impressed by the thorough and informative report describing a comprehensive water management program for the complex South Florida environment. The authors are to be complimented for their efforts and success. We take note that the 2005 South Florida Environment Report recently received recognition from the National Association of Government Communicators 2005 Blue Pencil/Gold Screen Awards Program - one award for Technical Report Excellence and one for Annual Report Excellence. Such recognition is well deserved and the panel notes that the authors continue to work to improve what is already an excellent report. The panel welcomes the opportunity to offer suggestions for further enhancements.

As is noted in Chapter 1, reporting on South Florida's environment has evolved from an almost totally research-findings orientation to a blend of research findings and management reporting (on subjects where the science behind the reporting is well understood and supportive). Thus, along with the report's authors, the panel's review of the 2007 report continues to search for areas of the report where the science is reaching maturity, for management purposes, and where information can be organized and presented in a more efficient and effective manner, with references to the scientific details for interested readers. Moving the hydrology discussion to the second chapter was an improvement in the SFER.

Exploration of the history of hurricane impacts on South Florida, in the 2006 report, combined with assessing knowledge about long-term climatic variability in the 2007 report (Appendix 2-2) is to be commended. Examining science in this manner helps insure that the District is making use of the latest in scientific knowledge to keep its management plans and operations in tune with what history has to teach us as well as what science has to offer as we peer into the future.

The use of an integrative chapter (1B) is a substantial refinement of the SFER. The discussion of phosphorus issues in 1B can, and should, be duplicated to include issues of nitrogen, sulfates and mercury.

As suggested in the 2006 review, the panel still believes that the SFER can be improved by adding a Table of Contents type listing of subtitles for each chapter. Besides helping readers of the report locate material, a listing of subtitles will help authors view how the material, often written by separate authors, is sequenced and grouped.

Integrating Water Quality

Unlike hydrology, water quality reporting is not integrated across South Florida, but rather remains divided into regional assessments (and related chapters of the report). The panel notes, particularly, that Chapter 2 provides an integrated overview of the hydrology of South Florida introducing readers to the complex water system and the role of the District in managing the flows for multiple and often competing objectives. Chapter 3, addressing water quality (18 constituents in 3A and nutrients in 3C), on the other hand, does not provide an integrated overview of water quality. Why is hydrology reporting integrated across South Florida in Chapter 2 and mercury reporting is integrated across South Florida in Chapter 3B, but water quality continues to be discussed in separate Chapters (Chapters 3A, 3C, 10, 11, and 12)? This point was made in the 2006 panel review comments.

Different water quality constituents are being addressed in Chapter 3A, 3B and 3C. Each section employs a different template in presenting findings. Given the history of working with phosphorus and testing a variety of approaches for its assessment and presentation in Chapter 3C, is there a possibility that the current effort to delve further into sulfate and mercury (in Chapter 3B) could be informed by the previous experiences with phosphorus? In communicating complex water quality findings to the public and policy makers, consistency breeds confidence. Thus, maintaining a consistent assessment and presentation format, where feasible, across key water quality constituents will greatly facilitate communication. For example, can the methods employed to develop Figure 1B-1 be used to develop a similar figure for sulfate and mercury?

The panel suggests converting Chapter 3 into a broad, integrated, overview of water quality conditions in South Florida with a section that then summarizes where standards were not met (not unlike the overview nature of Chapter 2 and 3C). The standard violation section could make use of graphics to convey legal reporting compliance with standards in a manner similar to that in Chapter 2 where success in meeting regulation schedules is graphically portrayed (e.g., Figures 2-37 and 2-39).

DBHYDRO Database

Throughout the report scans of the DBHYDRO database are made to obtain the data needed for the various analyses required. In several places the panel noted that the data used for WY2005 in the 2006 report and that used for WY2005 in the 2007 report are not the same. This practice may result in non-comparable results and should be carefully examined.

The 2006 and 2007 reports contain a number of inconsistencies in data used to describe conditions for WY2005. If this is an indication of a pattern of inconsistency (which it appears it could be) the panel is concerned that the current strategy of scanning DBHYDRO to obtain data for analyzing various conditions in South Florida will not achieve the consistency needed for scientifically rigorous comparisons of water flows and water quality over time and space.

Public Workshop

The panel remains impressed with the commitment of the District Board and management to the public workshop process. This is a unique endeavor and continues to provide an open, transparent review process. The panel wishes to commend the authors of the chapters for their attention to our comments. The panel also welcomes the memo from the District Executive Director to the Board outlining our review and the responses to our comments.

The format of the author's responses to the comments posted on the Web Board prior to the workshop should be continued. We ask, however, that the comments be available to the panel prior to the workshop, at least when the panel arrives the day before.

At the workshop itself, author presentations can focus on what is new since the last report and where the work is going. After this review, each panelist can each ask about any responses to comments that were unclear.

General Recommendations

1. Measurement of a number of water quality constituents has reached the point where reporting can be integrated across South Florida. Furthermore, it is possible to provide a broad overview of water quality rather than focus only on standard violations (such as is the case in Chapters 1B and 3A). The panel realizes that water quality comes with many more dimensions than hydrology (i.e., there are many constituents to report). This fact presents a large challenge to staff, but once the conversion is made, reporting water quality conditions in South Florida should be more efficient and effective.

2. The SFWMD and its partners who manage the water resources of South Florida should examine the feasibility of developing an integrated South Florida Water Monitoring Strategy – a strategy that addresses the scientific limitations of the current annual scans of DBHYDRO and proposes ways to establish consistent data records for annual evaluations of water quantity and water quality conditions in South Florida.

3. Throughout the report authorship should be identified in such a way that it is possible to determine the major authors who contributed to the writing and agree with the conclusions of the entire chapter, versus those who merely contributed data to the chapter or wrote only a small section. Titles of the various authors should be added to clarify their responsibilities and roles.

4. A clearer chapter on sulfur should be devised including the relationship between mercury and sulfur that defines the problem, states hypotheses, presents data relative to the specific hypotheses, discusses the data, and arrives at conclusions based on the data. These conclusions should then be related to management goals. This process should lead to a clear statement of data gaps.

5. Each chapter should include a section that clearly describes the importance of the research and findings to management and restoration with the Everglades. The cross-cutting chapter (1B) should include a section that relates these major management goals with policy and future work. This should include providing summary tables on how the research relates to SFWMD operations, regulations, permitting, environmental monitoring, Everglades Forever mandates, and CERP.

Thoughts on 2008 Cross-Cutting Themes

After the successful introduction of Chapter 1B in the 2006 SFER, the panel suggests the following topics for consideration in the 2008 SFER:

1. External pressures that may have an impact on the accomplishment of South Florida environmental goals, including urbanization in undeveloped regions, rapid expansion of exotic species, demand for recreation on restoration lands, and climate change.

2. Since the interface of management and research/science occurs often in the SFER, a description of the Research Management Strategy and the Core Monitoring Strategy employed across South Florida may be helpful.

3. A discussion of the transitioning from a 'project'- oriented approach to management to an integrated water resources management strategy in South Florida: Mosaic of funding streams and cross cutting management tasks.

4. Sustainability of the constructed systems is becoming an issue and needs to be addressed. For example, what are the management options for failure of facilities (e.g., STAs) the bases for engineering design of the STAs, WCAs, BMPs, and other structures and processes put into place to manage water flow and water quality, and management structures within the Everglades?

Comments on 2006 Executive Summary

By stepping back somewhat from the organization of past reports, it is possible to reduce the information to be conveyed into three basic categories:

1. Management goals - historical goals of flood control and water supply;
2. Lightening the human footprint on water quality and natural systems (ecosystem health);
3. Project-oriented approach (required by funding mechanisms).

Thus, the Executive Summary would begin with the introductory section and 'hydrology' discussion, followed by a water quality and ecology discussion. Then, a section would highlight the projects (by category?) being designed, implemented, and completed to accomplish management goals, including research on emerging issues (perhaps in a tabular format).

Otherwise, this is a well-written, very nicely presented document which could be further strengthened as follows:

1. Definitions of scientific terms/units should be added to the Glossary. Considering this document is being used as an environmental education outreach tool that appropriately showcases the District's activities within a given water year, the use of many scientific units, without explanation, seems potentially confusing to non-scientist readers. The panel also suggests that in some cases, brief explanatory legends should be added for figures (for example, second and fourth figures on p.2).

2. A section should be added identifying the most important challenges facing the District for the next water year including, as appropriate, what citizens of Florida can do to assist. Such a section could be very useful to the District, for example, on the exotic species issue.

3. A section should be added regarding major education outreach activities that the District accomplished during the water year including tangible positive outcomes with broad effects beyond completion of the specific activities.

Thoughts on the Review Process

As the SFER has evolved, and in fact has changed substantially over the past few years, so too has the review process undertaken by the panel. A significant change this year was the tri-level review process. Shifting from strictly technical peer review to this new regime requires some adjustment on the part of the panel as well as the report authors. Just as the chapter authors wonder how the panel is incorporating the presentations and responses from the public workshop, the panel wonders how its comments are incorporated in the final report. There are issues that have been raised in previous panel reports that have not been responded to or have been addressed only partially. Thus, it should not be surprising that some comments will appear again because of the importance placed on them by the panel.

Any discussion of the issue of closure on panel recommendations has to consider that the panel conducts a scientific review on an annually produced management report. The panel understands that the SFER cannot respond to all of our comments in the next year's report. We have come to expect an evolution of the SFER - an evolution that eventually appears to address the vast majority of the panel's recommendations, in one way or another. Often the panel and the SFER authors are working on different levels from scientific to management. It is understandable that we have some difficulties in communicating. The fact that can revisit topics over several years gives all of us the opportunity to reach a common level of communication between science and management, if not a common perspective. It is also not surprising that some of our scientific recommendations will not be practical within a management setting. Just as it may take a review cycle or two for some recommendations to be incorporated by staff, it may take a cycle or two for changes to be assimilated by the panel.

The panel review of the Draft 2007 SFER included, as did reviews of previous SFERs, an overall evaluation of the quality of the work reflected in the chapter or appendix reviewed, factual and grammatical corrections, requests for clarification, guidance about needs for inclusion of further information, and recommendations about what should be included in future SFERs. Authors'

responses at the public workshop spanned from directly addressing the panel's web-posted comments, to cursorily addressing the comments, to skipping over various comments, or in some cases, stating that the comments "might be considered ". The panel's report reflects this span of author responses to posted comments by including points that the panel feel were/are important. In some cases the panel included points that the authors adequately addressed at the workshop if it was felt that inclusion would help readers of the draft 2007 SFER understand and appreciate the efforts planned for WY2006. The panel recommends the following steps:

1. It would be helpful for the authors to provide, prior to the start of the workshop, a list of their responses to each comment and supporting rationale as appropriate.
2. The panel can then include in our report a summary of authors' responses, and additional comments or concerns based upon those responses.
3. It would be helpful for the authors to provide, at the workshop, a discussion of major new thoughts that they have about the chapter or appendix as a result of the panel's posted comments. This can provide a point of departure for an exchange of views rather then just presentations and questions.

Since the final SFER is not complete until the following spring, the panel does not know at this time how its review will be incorporated. Consequently, the panel proposes two changes to the review process. First, the Statement of Work for the panel should be expanded to include a review of the previous year's report. Also, each panel member should examine the final SFER and note whether the changes suggested during the previous year were incorporated. Second, as part of each author's presentation at the workshop, the presentation should include a summary of how the authors dealt with the previous year's review. The panel recognizes that there will be some issues then that can be resolved and some that may not reach closure. Adoption of these two recommended changes will afford the panel a better accounting of both resolved and unresolved issues. Also, beginning with its review of the draft 2008 SFER, the panel will subdivide its recommendations section into long-term goals and needs for the particular subject area, and focused recommendations that can be used immediately by the authors in finalizing the SFER.

CHAPTER 1A: INTRODUCTION TO THE 2007 SOUTH FLORIDA ENVIRONMENTAL REPORT-VOLUME 1

This summary chapter is concise and well written. 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 2006 SFER." In the opinion of the panel this chapter is of utmost importance, given the increasing level of public interest and scrutiny regarding the Comprehensive Everglades Restoration Plan (CERP). The panel also notes the line numbering in the left margin of the entire document as an improvement as recommended in the 2005 review process.

Chapter 1A 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 WY2006 without having to have an in-depth understanding scientific principles or the application of the research results in a complex management context. Separating-out the appended documentation and data is valid as the majority of the readers will not need to delve into this level of detail.

The panel continues to stress the importance of chapter 1A, and highlight the positive aspects of the revised format of the SFER - reporting major results and findings from the previous year. Once again, the panel found this chapter to be clear and well organized, concise and a very strong contribution to generating understanding and support for the overall restoration process and its component activities and programs on the part of the general public. The panel noted the increased tendency to report findings in both metric and English measurements. The revised tables 1A-1 and 1A-2 are very readable and add to understanding the region for the casual reader and expert alike. The panel likes that both tables are organized on a geographic basis and particularly the "strategic plan connections" column in table 1A-2. This feature facilitates understanding the integrative nature of the various plans being implemented. The tables also replace quite a bit of text which, while important, is more difficult for the first-time reader or a member of the general public to grasp. The overall goals and related strategies of the SFER could logically be reported in this chapter. The panel supports the idea of adding a table of priority actions but cautions that the level of detail has to be such that it does not result in an unduly lengthy table.

Recommendations

1. As an introductory issue, the panel suggests that some mention should be made of the potential impact on the South Florida Environment of increasing urbanization onto to EAA lands that have been removed from production.

2. The panel recommends a one or two page general description of the South Florida environment that will orient the reader to the various parts of the system that are being discussed as well as describe their interconnectedness.

3. The panel recommends that the District include a section in Chapter 1A, or perhaps more appropriately, a new chapter, which provides information about the District's many outreach

education activities. Although the Executive Summary is, in itself, a high-quality education outreach document, the panel views the general lack of such information within the SFERs as a seriously missed opportunity, considering that the District appears (through brief mention in other chapters) to be engaged in many excellent endeavors to help educate the general citizenry about the environmental and socio-economic issues affecting South Florida. Such a chapter could cross-cut District education outreach activities from the headwaters of the Kissimmee to the coastal estuaries. Discussion of tangible progress should be included with examples of positive outcomes extending from the District's education outreach efforts. In addition, a section could be added to provide information of the positive effects of District activities extending well beyond Florida to help other states and nations.

CHAPTER 1B: AN INTEGRATIVE PERSPECTIVE ON REGIONAL WATER QUALITY AND PHOSPHORUS

This is an excellent chapter that crystallizes phosphorus issues in the South Florida environment. This chapter summarizes a great deal of information and is a benefit to the reader. The panel notes the concern by some scientists about upscaling data to policy level decisions and overall water quality and CERP goals. The summary map (1B-1) is useful, although by necessity providing only a general concept of the TP issue. It is particularly useful in highlighting the concerns of the panel regarding phosphorus flows into Lake Okeechobee and the effectiveness of BMPs north of the Lake. The panel notes the idea that even if no more phosphorus entered the lake, it would still have high levels coming out for decades.

Chapter 1b provides an excellent synopsis of the cross-cutting issue of phosphorus in the South Florida ecosystems managed by the District, including Figure 4 (note typo in key - presented).

P.1, 1800+stations – Is there a summary inventory of these to which readers can be referred (maps by area/ program, frequency of sampling, parameters)?

The statement at bottom of p.6 seems misleading. The fact that marine environments tend to be nitrogen-limited means that phosphorus should be co-managed with nitrogen in upper, mid and lower watersheds as well as coastal areas. As shown for various estuaries, management of P without co-management of N in upstream segments reduces freshwater algal growth and, therefore, more inorganic nitrogen reaches estuaries. Thus, the problems for estuaries ironically can be worse because of P reductions, if not accompanied by N reductions, in upstream segments (see, for example, Fisher et al. 1992, *Marine Ecology Progress Series* 82:51-63; Harding and Perry 1997, *Marine Ecology Progress Series* 157:39-52).

When will the hydrologic simulation model for the Kissimmee basin be completed (p.8)?

Clarification would be helpful (p.9) as to how long it is expected to take for the extreme sediment resuspension problem in Lake Okeechobee to subside (decades). This information would help readers to have realistic expectations about the recovery period. It is also of interest to estimate how much of the sediment in the Lake arose from transport from the Kissimmee basin following restoration.

Recommendations

1. The panel recommends adding the C-139 basin and data (inputs, outputs) to Figure 4.

2. The panel recommends that the District should take the necessary steps to obtain reliable estimates of atmospheric deposition (p.3). It would greatly benefit the District to have a baseline, especially confronting what Chapter 1b describes as dramatic increases in adjacent urbanization.

3. Chapter 1B as recommended in the 2005 review process is also a positive development as it provides a context for the report in terms of cross-cutting issues affecting large parts of the South Florida region.

4. The panel recommends that the District redouble its efforts to control TP loads entering Lake Okeechobee by working with appropriate agencies on development policies (BMPs, chemical

treatment, sedimentation ponds, etc.) that will contribute to reduced TP loads. More attention in the 2008 SFER should be paid to describing the BMP effectiveness above the Lake. A BMP report similar to the one presented in the past for work in the EAA should be added to any future phosphorus discussion. This is particularly needed since there has not been any substantial reduction in loading of phosphorus into the Lake in the last decade.

5. The panel recommends that chapter 1B in the next SFER duplicates this effort by focusing on sulfur and mercury.

6. Given the importance of phosphorus loading from the Kissimmee River and areas north of the Lake, the panel recommends that current phosphorus management strategies that are only in the early planning stages be accelerated. Concerted efforts should be made to advance a BMP implementation that presently is not expected to commence until 2009 (and be completed by 2015) should be drastically advanced.

7. While the focus of the SFERs has been heavily on phosphorus, nitrogen is an important nutrient within the system as well, particularly in the coastal environments where nitrogen is normally limiting. Releases of nitrogen to the various estuaries on the Gulf and Atlantic coasts necessitate paying attention to the sources and processes affecting nitrogen concentrations in those releases.

CHAPTER 2: HYDOLOGY OF THE SOUTH FLORIDA ENVIRONMENT

Chapter 2 provides a readable, thorough, and informative overview of the physical water features and flows of the South Florida environment. Given the fact that the South Florida Water Management District is charged with "managing and protecting water resources of the region by balancing and improving water quality, flood control, natural systems and water supply" (from the District's webpage), it is appropriate to begin the 2007 South Florida Environment Report by providing the reader with a solid understanding of the District's hydrology and related management goals, operations, and accomplishments (e.g., meeting target water levels and flows).

Chapter 2, while describing the hydrology of the region, also updates the reader on data collection and analysis for WY2006 as well as providing additional detail on the South Florida Hydrologic Monitoring Network and an overview of the potential role of long-term climatic variation on District planning and operations. The basic template for the hydrology chapter is settling on three categories of contents: (1) a hydrologic/management overview of South Florida and the District; (2) an annual water year update; and (3) an elaboration on emerging issues facing the District in its efforts to balance the hydrology of the system with multiple, often competing, objectives. Chapter 2 is not presented in this order, but contains this information. The hydrologic overview, from year-to-year does not change substantially as it describes the physical setting (e.g., page 2-9 in the 2007 report is almost exactly the same as page 5-9 in the 2006 report and Figures 2-4, 2-5, and 2-6 are the same as Figures 5-3, 5-4, and 5-5). Depending upon the communication purposes of the report (e.g., an update of information or an explanation for new readers), it may be possible to place information that does not change year-to-year in an appendix as background information on the District's water supply and flood control goals within a complex and highly variable hydrology.

A key improvement in the 2007 report is the change in graphic presentation of water levels for each of the lakes. The 2007 report plots average daily water levels against the regulation schedule for each lake. The 2006 report plotted historical average instead of regulation schedule. This change permits the reader to quickly compare District operations to regulation goals (as established by the U.S. Army Corps of Engineers). The narrative provides explanations where there are differences between operations and goals.

Such improvements, as noted above, provide information readily useful to a spectrum of users. The challenge remaining for the authors is how to present the data in a form that benefits a wide spectrum of users. The inclusion of stage-storage and stage-area relationship of reservoirs is a good example. The information benefits many users who require calculating mass-balanced properties and water mean residence times of the system. The hurricane season of WY2006 added challenges as well as valuable data on pulsed hydrological events on the system.

While surface flow data have been relatively adequate for WCAs, that of the ENP is generally lacking. Except for inflow, there are no data provided for ENP that one can use to calculate the mean water depth, volume and water mean residence time of the system. This information is essential for completing the understanding of the South Florida ecosystems. Rain must be a very significant contributor to the surface water flow in the entire EPA. Is the contribution of rain to

surface water in various parts of EPA available? Better yet, can the effects of rain, ET and ground water, respectively, to the surface water flow and storage of the systems be included in the report? In the opinion of the panel, the water mass-balance relationship of surface water in various parts of the WCAs and ENP is essential information to the CERP.

The arrangement of material presented in Chapter 2 begs several questions. To discuss the flow of information across Chapter 2, the subtitles for Chapter 2 are listed below, using the size of type to indicate the subtitle breakdown. Structural and content questions for the Chapter emerge when considering the flow of topics (i.e., a Table of Contents) in the chapter, which was structured as follows:

a. Summary
b. Introduction
    i. The South Florida Regional Water Management System: A Regional overview
    ii. Hydrologic Variation in South Florida
        1. Hydrologic Variation Indicators
        2. Water Management and Hydrologic Variation
    iii. Long-Term Climatic Variability
        1. Stage-Storage Relationships of Lakes and Impoundments and Nominal Hydraulic Residence Time
    iv. The South Florida Hydrologic Monitoring System (2/3 of a page)
    v. Water Management
        1. Purpose of Water Management
        2. Use of Regulation Schedules for Water Management
        3. Elements of Water Management
        4. Operation of Water Control Structures
        5. Tools Used for Operations and Water Management
        6. Use of Data and Decision Making for Operations
        7. Management and Operations of Lake Okeechobee Water Levels
c. The 2005 Hurricane Season in South Florida
    i. Hurricane Dennis
    ii. Hurricane Katrina
    iii. Hurricane Rita
    iv. Hurricane Wilma
d. Water Year 2006 Hydrology
    i. Rainfall and Evapotranspiration
    ii. Evapotranspiration
    iii. Water Levels and Water Management
        1. (list of 11 lakes follows)
        2. The Caloosahatchee Canal and Estuary
        3. The Everglades Agricultural Area
        4. The Everglades Protection Area
    iv. The Lower East Coast
    v. Surface Water Inflows and Outflows
        1. (list of 6 lakes and estuary flows)

There are four main subtitles (a-d), prefaced by the 'Summary' and an 'Introduction' which describes the hydrology and management provided by the District. Also included in the 'Introduction' section are two special focus topics: climate variation and monitoring. Would it not be more helpful to describe the water management system (in part b-v) before introducing stage-storage relationships (in part b-iii) and the hydrologic monitoring system (in part b-iv)? Is 'Introduction' the most appropriate term to subtitle emerging topics?

Why are the water levels and water management presented (in part d-iii) separately from surface water inflows and outflows (in part d-v)? They are related since water moves throughout the control flow system. Why does 'Evapotranspiration' appear in both the d-i and d-ii subtitles? Can the subtitles be combined, since both address ET and the second subtitle is only a half page long (could move this description to front of d-i where ET is introduced). Why is there no conclusion section as there was in the 2006 report?

The less than two-page section on climatic variability appears to be based on one reference - a draft paper presented in Appendix 2-2. Is this to be submitted to a peer reviewed journal for publication? Why there is one subtitle in this short section-is it necessary?

The panel greatly appreciates the efforts of the District to document its hydrological monitoring system (summarized on page 2-19 and presented in detail in Appendix 2.4). It is critical that all environmental data used in SFER be transparent and consistent over both time and space, especially if long-term trends or spatial comparisons are to be scientifically sound. Without such documentation, it is impossible to check if the data supports the analyses and interpretations made in the report.

Appendix 2.4 contains documentation of the current water quantity measurement system. The Appendix does not indicate what equipment was used in the past, only what is being used now. Thus it is not possible to check whether changes in sampling equipment resulted in changes in the data. The Appendix does document *current* monitoring networks, equipment, and operations well. Can information be added about the equipment used in past measurements? Is it possible to note equipment changes in the DBHYDRO database? On page 59 there is an indication that the longest consistent measurement record is from 1995 to 2005. If a longer analysis is needed, is it possible to correlate past data with current data to account for differences in measurement technology, so that the data are comparable over 20 or 30 years? This is a critical question to the soundness of long-term trend, or even year-to-year, assessments of lake levels and flow.

Given that several of the networks are under going evaluation, how will future sampling locations be 'optimized' (word used in the report)? What criteria will be used to determine sampling locations? In the current monitoring design studies, is the need for long-term consistent and comparable data and information being considered? For example, will a subset of sampling sites being denoted long-term sampling sites where the emphasis of sampling is on consistency over long periods of time? There are indications that the networks are constantly changing. How does such constant change impact the ability of the District to examine long-term hydrological trends in a scientifically sound manner, such as those associated with climate change? On page 40, there is a discussion about the loss of data due to equipment malfunction. Is it possible to estimate the percentage of data lost to equipment malfunction?

What is the connection, if any, between the hydrologic monitoring, reported on page 2-19 and the water quality monitoring used in Chapter 3? Is there an overall water information strategy for the District that could explain such connections, and how consistency and comparability are insured over time and space (and agencies)? Could the District achieve economies of scale if the hydrological and water quality monitoring efforts were coordinated to the point where staff could work on both networks in an integrated manner?

Conclusions

1. Chapter 2 provides an integrated overview of South Florida's hydrology and the nature of the South Florida Water Management District's management goals, operations, and accomplishments. This Chapter, in describing the South Florida hydrology and its management by the District, provides an excellent baseline understanding needed to properly context the remainder of the report.

2. The 2007 version of Chapter 2 is much more connected to the District's management goals with respect to water supply and flood control (as was recommended in the 2006 panel's review).

3. The design of the hydrometeorologic network is described in the 2007 report again, as was requested by the panel's 2006 review. The documentation is for current equipment and network, however, and does not describe how changes in equipment and the network may impact the consistency of the data employed in data analysis, and thus the information, presented throughout the chapter.

Recommendations

1. While the content of Chapter 2 is excellent, organization of the material needs attention. The subtitles, and content under each subtitle, do not always capture what the reader expects to be presented, and the chapter does not provide the information in a logical sequence. The structure (template) for Chapter 2 should be carefully reviewed in the production of the 2008 report.

2. There is a need to assure the reader, in the documentation of the hydrometeorologic network, that periodic changes in the network are not causing inconsistencies in data quality and/or resulting information? One way to help insure that changes in the measured hydrology are the result of changes in the hydrology, and not changes in the network, is to document such changes so that analysts are not comparing data that actually are comparable. Perhaps tags could be placed in DBHYDRO to note equipment changes so analysts can correlate past data with current data to account for changes in the network design and operations.

APPENDIX 2: CONSIDERATION OF LONG-TERM CLIMATIC VARIABILITY IN REGIONAL MODELING FOR SFWMD PLANNING AND OPERATIONS

This is an impressive piece of work. The problem has been defined as have the variables of interest, and the possible shortcomings identified. For example, they looked primarily at ENSO, AMO, and PDO as their variables. The authors have approached the problem with care, and as the predictability of their variables improve, their predictions for South Florida will improve. The fact that positive and potentially useful results are being obtained is gratifying.

It would help the reader if a graph of the 1965 to 2000 period of record rainfall could be displayed along with the changes that might be imposed by considering these long-term trends in dry and wet periods to get a sense of how this hydrologic record would be impacted.

It is suggested that this work be related, if possible, to the seagrass die-off problem in Florida Bay. Seagrass die-offs that had occurred in the mid-Atlantic estuaries several decades ago was never fully explained, and similarly the die-off of seagrasses in Florida Bay, while studied extensively, could not be entirely explained by eutrophication phenomena and hypersaline conditions that formed in the northeast corner of the Bay during the summer period. Long-term warming and cooling trends also be affecting the seagrasses in Florida Bay, and this work could prove very useful in helping to explain seagrass “health” trends in Florida Bay.

One specific error is noted:
Page 44, line 1180: The phrase "...climatic shifts..." is probably intended rather than what is written.

CHAPTER 3A: STATUS OF WATER QUALTIY IN THE EVERGLADES PROTECTION AREA

Chapter 3A, within the constraints of the monitoring system, provides a thorough assessment of water quality criteria compliance in the Everglades Protection Area. The assessment focuses only on violations of criteria and attempts to explain why violations occur and what is being done to reduce future violations. The assessment is based on data currently available in DBHYDRO and data that are able to pass a QA/QC screening. Thus, the data used in the water quality compliance assessment are not collected for the purpose of water quality criteria assessment but, rather, are data collected for a variety of management purposes and then examined to determine which data, from a data quality perspective, can be used for criteria compliance assessment purposes. This situation, while common in water quality management efforts, is not ideal from a sound science perspective. The situation is the classic 'found' data, or 'secondary information product', problem – a problem that was addressed by the U.S. Environmental Protection Agency (2003). Chapter 3A follows most of the recommendation in this report. A key feature of the recommendations is to carefully document procedures and Chapter 3A, with its explanations, appendices and citations, provides considerable insight into the methods used to analyze 'found' data to produce the criteria compliance information.

The 2007 edition of the chapter, as has been the case for a number of years, is an evaluation of water quality standard compliance in the Everglades Protection Area (EPA) only. The status of mercury is reported in Chapter 3B for South Florida while phosphorus and nitrogen are reported, for the EPA, in Chapter 3C. Water quality conditions for other areas of South Florida are reported in Chapters 10, 11, and 12.

With the limited scope and purpose of chapter 3A, the wording and content are quite routine. In fact, there are many pages of the 2007 chapter that are worded almost exactly the same as the wording in 2006 chapter, even to the same explanations for standard violations. Because of this, the first two pages of the Chapter 3A 2006 review are valid for the 2007 chapter and will not be repeated it here.

As was discussed in the 2006 review, the routine nature of the reporting contained in this chapter begs the question of streamlining the reporting. Instead of simply calling up the electronic text of the previous year's chapter and converting data from WY2005 to WY2006, it appears that this chapter could use a complete redesign to condense its findings. This type of streamlining, as was described in Chapter 1A, was to be included in this report, but there has been no change in Chapter 3A. Why not?

Lines 43-46, on page 3A-2, notes increases in WY2006 conductivity. The WY2006 excursion frequency was noted as being significantly greater than the WY 1978-WY2004 historical period of 10.3. In checking the 2006 SFER for the historical period, the WY 1978-WY2003 excursion frequency is 15.8. It seems unlikely that adding one year to the historical period would decrease the excursion frequency by 35%. How meaningful is the historical period, since it changes each year and is not a constant baseline for comparison purposes?

In comparing the number of sampling sites in the Everglades National Park (Figure 3A-1 of the draft 2007 report) with the corresponding number of sampling sites in the Everglades National Park (Figure 2A-1 in the draft 2006 report), there are 11 stations included in the analysis for 2007 and 13 (perhaps 14 as the plot appears to have two sites very close together) included in the analysis for 2006. How can the results for 2006 be comparable to the results for 2007 if the number of sampling sites included in the analysis is not the same? This observation, again, points out a consistency problem in the 'found' data strategy used to support the water quality assessments in Chapter 3A and 3C. While there are standard protocols to analyze the data, the database contains data that were not collected (or even organized) for the purpose of evaluating standard compliance. Thus, the database, when searched for data meeting a given set of criteria, will select different stations to include in different years (due to a large number of factors over which the data analysts have no control). This situation is the result of using 'found' data to conduct water quality standard compliance assessments – the database can change from year-to-year through no fault of those doing the assessment. The panel has pointed out this issue before and it needs attention. The 2007 report contains many examples of inconsistencies between the 2006 and 2007 reports due to using 'found' data to conduct water quality assessments.

In line 392 there is reference to observed change in alkalinity excursions most likely being the result of added sample sites. This is another example of an information problem resulting from the use of 'found' data to perform standard compliance assessments over time and then trying to explain detected changes. Is the change due to a change in water quality or a change in the monitoring system (i.e., added sites in this case). The monitoring network, for standard compliance purposes, needs to be clearly specified and held constant from year-to-year to avoid this type of uncertainty creeping into the assessment.

In Table 3A-3 for inflow to the Refuge, the 1978-2004 timeline uses 134 samples to assess DO standard compliance. For 2005 and 2006 the sample numbers are 5 and 4, respectively. Is it meaningful to compare the percent excursions from the 1978-2004 period with that of 2005 and 2006, since different methods were used to compute the findings AND the number of samples is so different? Is Table 3A-3 referred to in the text of the 2007 report?

In Table 3A-4 of the 2007 report, in the Refuge inflow row for 1978-2004, 59 samples are shown to be included in the sulfate concentration computations. In the corresponding table in the 2006 report, Table 2A-4, 836 samples are shown to be included in the sulfate concentration computations for 1978-2003. This is a huge difference in the number of samples - why? The mean in the 2006 report is 58 mg/L while it is 42 mg/L in the 2007 report. Given that 'found' data are being used for the assessment, again, either the data selection criteria changed and/or the database changed. In either case, the numbers do not indicate consistency in the analysis from year to year. Similar sample size differences exist elsewhere in the table.

The reporting on pesticide detections does not provide information on how detections have changed over the years. When attempting to make such a comparison between the 2006 report and the 2007 report, it was noted that the time period for the analysis is not constant. Why did the time period for reporting pesticide detection in Table 3A-5 change in the 2007 report, from December 2004 to February 2006, when the time period for pesticide detection reporting in the 2006 report, in Table 2A-5, was October 2003 to December 2004? Was December 2004

included in both assessments? With unequal time periods it is difficult to compare the 2006 findings with the 2007 findings, particularly in search of a trend in pesticide detections.

Chapter 3A has been expanded for 2007 to include an overview of water quality monitoring for the non-ECP structures. Table 3A-7 reports TP concentrations and loads associated with non-ECP basins. Why does the table use both English and metric units? Given the mixed units, concern develops as to how the loads were computed.

Table 3A-6 contains a list of the non-ECP permit reporting requirements. The list does not appear to specify how the data are to be analyzed. Is there a standard protocol for data analysis for the non-EDP basins or is this a judgment call on the part of the analyst each year?

Page 3A-18, lines 370-389: Alkalinity levels may vary diurnally in areas of high productivity caused by the uptake of carbon dioxide during photosynthesis. This phenomenon could account for the excursions of alkalinity below 20 mg/L. Water sources with different alkalinities can of course also account for the low alkalinity levels, but the excursions noticed in the interior of the Refuge (Table 3A-2) are more likely from diurnal variations. It is suggested that diurnal measurements of alkalinity be made at several located in the Refuge to document this phenomenon if it is occurring.

Page 3A-20, lines 405-437: There needs to be a distinction between conductivity changes caused by ionized substance concentrations and changes in ionized substances mixture. Conductivity instrument calibration standards are made up of particular mixtures of ionized substances, and when these mixtures do not compare favorably with those of the waters being tested, some error will occur. Are the conductivity measurements being made accurately, and are they being influenced by ionized substance mixtures in the waters being tested?

Page 3C-22, lines 609-619: The language used to describe the values used for the annual network geometric mean and the five-year network geometric mean in Appendix 3C does not match well with the statements on this page. The appendix clearly calls for an arithmetic mean of the station annual geometric means over one year or over five years. Please verify that the values presented on this page have been calculated using the methodology described in the appendix.

In the above discussion, several references have been made to differences in the data included in the 2006 and 2007 reports. The panel emphasizes that there is a major concern about the consistency of the data employed in producing the two reports?

Conclusions

1. Chapter 3A continues to employ a scientific *data analysis* process to evaluate water quality standard compliance in the Environmental Protection Area.

2. The Chapter does not provide an integrated view of water quality in South Florida.
3. The annual scan of DBHYDRO to obtain data to support standard compliance assessments results in different data records being used from year-to-year. This fact raises concern about the

consistency of the standard compliance conclusions included in the South Florida Environmental Report.

4. The Chapter's format, and in many cases, wording, is almost exactly the same at the 2006 report. This Chapter is ready for a redesign (and expansion to include all of South Florida in a manner similar to Figure 1B-1).

Recommendations

1. Given the maturation of the procedures employed to conduct water quality standard compliance assessments, it appears that now is a good time to expand the role of Chapter 3 to include water quality descriptions for all of South Florida along with a condensed section of the standard compliance assessment findings. This would permit the Chapter to place extreme water quality events in a larger context, in much the same way Chapters 2 provides an overview of South Florida's hydrology and Chapters 1B and 3C provide overviews of phosphorus. In addition, a section(s) of the revised chapter could be devoted to presenting standard violation results (i.e., water quality extreme events).

2. In seeking more consistency in the data employed for standard compliance from year-to-year, the panel recommends use of a subset of sampling sites that can consistently serve as the basis for standard compliance assessments. For these sites extra effort should be devoted to obtaining the number of samples needed to conduct the assessment. A 'network' of these sampling sites should be identified, documented, and consistently employed to perform the water quality criteria assessments – sites that have 'information' reasons for being included and for which the sample size will be consistent each year.

References

U.S. Environmental Protection Agency. 2003. *A Guide to Developing Secondary Information Products: Methods Review and Documentation.* Report Number EPA 260-B-01-006, Office of Information Analysis and Access. Washington DC., 28 pages.

CHAPTER 3B: MERCURY MONITORING, RESEARCH, AND ENVIRONMENTAL ASSESSMENT IN SOUTH FLORIDA

This year's Mercury Monitoring, Research and Environmental Assessment chapter (3B) is an excellent overview of the mercury problem in the Everglades, how mercury interacts with other nutrients, ongoing research with biota and mercury, the role of sulfur, and the new initiatives to understand mercury cycling. It clearly delineates the major problems, and identifies new research that will be needed to understand how to reduce mercury levels further, particularly in fish. The data, models and conclusions in Chapter 3B 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. In many areas, the mercury research program is a leader that is providing testable paradigms for other aquatic systems. The summary is excellent, and hits the high points. It is particularly useful to have a bulleted summary of all the major findings from the overall mercury program.

The authors are to be commended for writing a chapter that is very readable and accessible to a broad range of readers. It is written in a style that can be easily followed, and that makes the main points clear. Further, this year's report more clearly describes the research findings, with appropriate references to the primary literature. This year's summary will be particularly useful to a wide range of stakeholders, including those new to studies of the Everglades. The report also makes the data readily accessible to scientists not previously familiar with the Everglades. The authors have effectively used bass and Great Egrets as bioindicators of mercury exposure, and have one of the longest running such data sets in the country from one region. The chapter accurately reflects the state of the knowledge about mercury fate and effects in wildlife.

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 they become available. This is a key point that will increase the general understanding of mercury cycling. The suggestion that further modeling is required to understand how to reduce mercury further is a move in the right direction. Integration of sulfur into the models is an important step in understanding chemical dynamics within the Everglades, and should be given high priority. The models would profit, though, from an in-depth and transparent peer-review.

The "previous findings" section of the summary is particularly useful in providing an overview of the past mercury cycling and affects research conducted as part of the SFWMD work and reports. It highlights the critical issues and findings, especially noting the role of new atmospheric depositional mercury, the role of drying events, and the long-term trends of mercury in large mouth bass and wading birds. This section could be improved by noting the primary previous documents for each bullet item.

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. The experiments with wading birds, particularly the white ibis, are extremely important in identifying possible effects of mercury. Similarly, further understandings of the effect of drydowns will contribute markedly to management goals. The high mercury levels in Everglades National Park continue to be a problem requiring additional, targeted research and clearly illustrating the

importance of continued mercury biomonitoring throughout critical areas of the Everglades system. The continued high levels of mercury in large mouth bass suggest the importance of toxicokinetic modeling of mercury bioaccumulation in the fish themselves, including uptake and bioavailability.

Key issues for the mercury research program continue to be an understanding the spatial pattern of mercury deposition and methylation, along with the failure of mercury levels to drop in Largemouth Bass, and the role of sulfur within the system. The problem is more general to aquatic systems, and every attempt should be made to further understand this pattern.

The inclusion this year of an initial section responding to research needs identified in previous Everglades Consolidated Reports is an excellent addition. It also serves as a reminder of unanswered questions, and provides an update of progress and future work. The major outstanding issues include effects of environmentally-relevant mercury on wading birds, the relative relationship of global versus local mercury, revision of the Everglades Mercury Cycling Model, geochemical controls on mercury methylation, and sulfur sources. The comparison, using the SAMS approach, between mercury dynamics in the Everglades and in other regions (Hawaii and Ohio) will be extremely useful. Further, the continued finding of the effect of new versus old mercury is significant.

Trends in Atmospheric Deposition of Mercury

Understanding of the atmospheric deposition of mercury is particularly important given the role of "new" versus "old" mercury in the mercury cycle. Further, understanding mercury dynamics within the system (as opposed to from external sources) continues to be a critical component of understanding mercury in biota. The finding that declines in mercury within the Everglades could not be accounted for by input sources is extremely important, and points to a need to further understand mercury dynamics within the Everglades itself. The recent increases appear to be reversing the previous declines, a significant and important finding that requires further examination, continued monitoring, and effects studies of biota within the Everglades. Further, the sources of the mercury need to be identified more carefully so that the contribution of atmospheric and local mercury can be better quantified.

Concentrations of Mercury in the Everglades

Understanding mercury trends in Everglades fish is one of the key bioindicators for the Everglades, and continues to be particularly important for understanding risk to the food chain. Such information is necessary not only for understanding (and managing) the risk to fish consumers (both people and other wildlife), but to the fish themselves, as well as ecosystem dynamics. The trends data from 1988 to the present are valuable, and this indicator clearly needs to be continued.

The trend of declining mercury levels in large mouth bass (refer to fig.3B-9) seems to have ceased in 2001, with higher levels since then. Further, there has been a clear increase in individuals with mercury levels higher than reported in 2000 and 2001. This is disturbing and suggests cause for concern. Comparing this year’s data with those for the maximum year, as in

Table 3B-1, masks the more recent increases. In any case, the age-standardized mercury concentrations have at best stabilized (Figs.3B-11 and 12), and in other cases have increased (Figs.3B-14 and 15). The increases in age-standardized mercury concentrations, while disturbing, should be examined in terms of size to eliminate the possibility that it growth is affected.

The exceedingly high levels of mercury in large mouth bass in some locations require further understanding, particularly the levels in Everglades National Park. The rapid declines, followed by increases, do not seem to track the increases in water to the region; and this relationship should be further explored.

Sources of Sulfur and Effects

The examination of the importance of sulfur pollution in the Everglades is an important addition. Sulfur pollution is influencing mercury levels within the ecosystem, and it should be highlighted with a series of studies to understand fully the dynamics. Since sulfate contamination affects nearly 30% of the Everglades, it requires additional study, including the development of criteria and management goals to reach safe levels. The problem of sulfate-induced eutrophication of the Everglades has risen to the fore because many of the more pressing problems have been addressed. Yet sulfur pollution appears to be affecting internal mercury cycling and contributing to overall eutrophication of the Everglades as a critical biogeochemical cycling issue. The role of sulfur in phosphorus releases should be integrated into the modeling efforts for the Everglades. The report states that, without sulfate, the mercury problem would not exist, a statement that requires further explanation and justification, and is not fully justified in Appendix 3B-3. While the sulfate problem has been identified, there is still controversy about the sources, which must be resolved as a key management goal. Whether the sulfate comes from agricultural use, from soil subsidence, and/or from Lake Okeechobee is critical to both understanding biogeochemical cycles and to management and restoration. Several different hypotheses for the source of the sulfur should be examined, not just agricultural amendments. Further, the possible effect of sulfur on sawgrass, by favoring the replacement by cattails, is an important finding that requires extensive study.

Future Research and Activities

An important component of any research program aimed at improving management and restoration is the ability to examine the past, current, and future research needs and goals. The Everglades mercury group is embarking on an ambitious program with several projects and agencies, including US EPA, Broward County, Everglades National Park, and the University of Michigan to better understand mercury methylation and sulfur chemistry, a laudatory goal. These extremely important programs need to be more clearly defined and described with respect to objective, goals, first-year goals and brief methods (each project described similarly). Examining mercury in coastal waters is particularly important because of the overall coastal ecosystem and human use of these waters.

Conclusions

Overall, the authors of this chapter should be congratulated for writing a clear, concise description of the past, current and future research on understanding mercury dynamics and effects in the Everglades. The three major problems remain the levels of methylmercury in biota (particularly fish and the potential effects on fish-eating birds and people), the very high levels of mercury in the ENP, and the role of sulfur in the Everglades overall and in mercury methylation. The program is addressing these problems.

Recommendations

1. The panel recommends adding a reference to the bullet items in the overall summary so that readers can find a more complete analysis of each item.

2. The District should examine the possible effects of changing from 2 to 18 medical waste incinerators.

3. The District should strengthen understanding as to why mercury levels are high, and continue to increase, in the ENP.

4. The District should obtain a mass balance for sulfur in the Everglades.

5. Extensive study should be undertaken to examine the possible effect of sulfur on sawgrass, allowing replacement by cattails, including continuation of the experiments on the relative effects of sulfate on plant growth.

6. The new SAMS site should be within the ENP since it is critical to begin to understanding mercury dynamics within the ENP.

7. The wet deposition of mercury studies are extremely important and should be continued, especially since they seem to be indicating a disturbing increase in wet mercury deposition.

8. The sulfur studies should be continued in terms of both sources and effects. This effort should include a detailed analysis of the sources of sulfate from the EAA, and clarification of whether the sulfate comes from the EAA amendments (delineating current from legacy uses), or from Lake Okeechobee.

APPENDIX 3B: PRELIMINARY ASSESSMENT OF SULFUR SOURCES, TRENDS AND EFFECTS IN THE EVERGLADES

This appendix describes the current effort to understand the sources, trends and effects of sulfate in the Everglades. The appendix documented sufficient information pointing the most likely sources of sulfate in the Everglades, as sulfur fertilizer of the EAA and the deep groundwater. The surface water sulfate concentration follows a north-south gradient from more than 100 ppm in the northern part to less than 1 ppm in the southern part. The effects of sulfate on mercury methylation and plant growth are also discussed.

Conclusions

1**.** The strength of the conclusions is not supported by the data, and the overall picture is not clear

2 .Sulfate and the mercury problems in South Florida are closely related. The sulfate/mercury methylation relationship needs to be understood in order to manage the mercury problem in South Florida. Increase in sulfate concentration may or may not be the reason for increased mercury levels in fish. For example, mercury in fish is high in ENP but sulfate concentrations are low.

3. Sulfate concentration, along, is not a good indicator for the mercury methylation problem. Sulfate may be the source of the problem, but sulfate is not the problem *per se*. It is sulfate reduction that affects mercury methylation, phosphorus and nitrogen mineralization, and plant growth. Porewater sulfide is only a small part of the sulfide storage in the system. The acid-volatile and chromium-reducible sulfides in the system are active in affecting mercury methylation.

4. The sulfur isotopic ratio is not a good tracer for sulfur source in South Florida because of the large fractionation involved during sulfate reduction (Fig. 16), and limitations in interpretations about more than two sources with distance.

Recommendations

1. The sulfur problem in the Everglades should be studied considering the sulfate reduction and sulfide storage in the sediment, rather than considering only sulfate concentrations.

2. The acid-volatile and chromium-reducible sulfides in the system, which are active in affecting mercury methylation, need to be investigated.

3. The sulfate-to-chloride ratio and mass balance calculations for sulfur among consecutive reservoirs of Everglades should be examined because they may provide useful information about sulfur ‘behavior’.

4. Indicators of the mercury methylation problem other than sulfate concentrations should be developed for management purpose.

CHAPTER 3C: STATUS OF PHOSPHORUS AND NITROGEN IN THE EVERGLADES PROTECTION AREA

The organization of Chapter 3C provides an overview of nutrients in the Everglades Protection Area before focusing on criterion compliance. This permits the regulatory aspects of compliance to be better understood within a broader context (which was suggested for Chapter 2A). In fact, this aspect of the chapter format could serve as a chapter template for examining water quality in all of South Florida.

When comparing Table 2C-1 of the 2006 report with Table 3C-1 in the 2007 report (as well as Tables 2C-2 with 3C-2), and examining WY2005 results, which appears in all tables, questions as to consistency of data analysis and reporting arise. Why are the WY2005 data different in the two tables (i.e., the number of samples employed in the analyses are different in all cases, which in turn results, in some cases, in the geometric means being different and the max/min being different). While the geometric mean differences are not great, the differences are quite disturbing from a scientific consistency point of view. Are the data for analysis selected each year using new QA/QC criteria? If the data included in the analysis can vary from year-to-year, how can consistent and comparable results be obtained over time and space? The situation noted in comparing the two tables is an artifact of the need to always select the data for analysis from a large data based where the purpose is to store all data - not to support a consistent production of criterion compliance information. The TP criterion compliance effort must make use of available data and that availability, obviously changes over time. This, in turn, makes it extremely difficult to produce information over the years that is consistent and comparable, in spite of a huge effort on the part of data analysts to carefully document their methods and use the methods in a consistent manner over the years. The database is, apparently, not consistent.

Statistics of the 1978-2004 timeline, against which annual comparisons are made, also change from year to year as the record lengthens. What, then, is the purpose of the 'historical' period comparisons? Would it not be more meaningful to put the WY1979 - WY1988 baseline period concentrations in Table 3C-1? Are the WY1979 - WY1988 sample size and statistics are constant over time, or are they recomputed each year after another search of DBHYDRO? The absence of a firm, constant, baseline, in Table 3C-1 (and similar Tables) make it difficult to discern trends in TP concentration over the years. In other words, the WY979 - WY1988 period statistics are trending either up or down as the annual geometric means are trending up or down. Figure 3C-1 is designed to help the reader understand how the TP concentrations are changing over time, thus it is not clear why the base line period is changed every year. The panel realizes that there is a section comparing TP loads across structures, but there is no table or figure comparing TP loads across years. Why not?

In attempting to explain high TP readings in the data set, there is reference to potential problems with the sampling methodology. For examples, on page 3C-14, lines 385-386, the following statement is made:"As noted, this unusually high measurement was made during a low water period and may not be representative of ambient conditions." The same type of statement is made in lines 638-640. The implication of the above statements is that staff collecting the samples are not guided in how to measure low water conditions in a manner such that the samples are representative of prevailing conditions. Given the guidance in the Field Sampling

Quality Manual, how can this occur? If a representative sample cannot be obtained, how is this fact reflected in DBHYDRO? Is there a qualifier that could highlight, with certainty, the problem with the sample, rather than speculating about a possible problem with the monitoring system?

Are the TP loads at individual water control structures within the EPA not updated each year? The sentence in lines 394-395 imply that they were not updated as the reader is referred to last year's report to view the calculated TP loads at the structures within the EPA. Table 3C-3 provides a summary of flow and TP load by basin

There are a number of comparisons of TP concentration between years and there is concern that the inconsistency in the data may introduce differences that are also part of the monitoring program itself. For example, the paragraph, in lines 396-401, provides percentages of samples below given levels of TP. Is there sufficient control over the samples and sample sites to give meaning to comparisons of percentages between years? This might occur when sufficient samples are not taken at a particular sampling site and its data are excluded from the analysis that year, while during another year the number of samples might result in it being included. Without more consistent control of sample size and sampling locations (i.e., the data used to support this analysis), there is concern that such statements as presented in this paragraph, and others in the Chapter, may not be accurate. In other words, would it be possible that the percentages reported may be more an artifact of annual differences in available data than differences in TP concentrations? Has the potential impact of changing available data on resulting information been studied?

On page C-14, last paragraph, there is a discussion of the 'abnormal' conditions of WY2005 increasing TP concentrations and how the data for WY2006 indicates that TP concentrations have returned to normal. As another line of evidence, the TP loadings from the basins should reflect a similar 'return' to normal. By examining the TP loadings in the 2006 report and comparing them to those in the 2007 report (in Table 3C-3), the trends indicates that 'From WCA1' the loadings were considerably less than 2005, but the 'From WCA2' indicates more loading in 2006. It is not clear that the loadings confirm the conclusions stated on page C-14. However, it should be pointed out that a sufficient time series of the loadings is not available in the report to enable evaluation of 'normal' TP loading relative to the discussion on page C-14. Is a time series of TP loadings (plot or bar chart) at key structures relevant to the purposes of Chapter 3C?

It is assumed that the atmospheric deposition was computed from rainfall volumes and TP concentration in the rainfall. How accurate is this number (193 mt)? In particular, what is the spatial distribution and frequency of sampling of rainfall TP concentration across the Everglades Protection Area? Is it possible to place a confidence interval around this estimate?

With respect to next year's report, would it be possible to develop a map showing TP loads moving over South Florida using arrows at key transition points? The width of the arrow could indicate the size of the load and its color could indicate change from either a baseline or established historical average, which does not change every year. An update could be made every five years. This figure could be designed similarly as Figure 2-1 for the hydrology.

During the review of the draft 2006 SFER, statements were made about a special monitoring network being designed to assess compliance with the TP criteria. There is no mention of a special monitoring network for phosphorus criterion compliance in the 2007 report. An update on the status of the design effort would be helpful.

From reading Chapter 3C, the data available to perform the assessment are, again, that which is available from DBHYDRO (line 178). There are also statements, on lines 596-598, which indicate that the network employed to monitor TP is not firmly established such that consistent data is used across the years to track TP criteria compliance. Lines 651-652 express a desire for more robust datasets in the future, rather than a more robust monitoring program. As has been noted earlier in this Review, the focus on 'found' data may create inconsistencies in criteria compliance assessments over time and space.

In light of the above concerns about the monitoring program not being adequate to insure consistency in the phosphorus criterion compliance assessment, a very important qualification of the assessment is provided in lines 598-600. The panel whole heartedly agrees with this qualification, especially given the fluid nature of the data employed in each year's evaluation.

In reviewing the results of the phosphorus criterion compliance assessment, were the sampling sites employed in the assessment the same ones identified in Figure 3C-3? While the phosphorus compliance assessment results presented in Appendix 3C-3 are welcomed for exploring the detail, Chapter 3C needs a summary table or figure of the findings (as is the practice in many parts of the SFER). The discussion of the findings are appropriate, but it is difficult to take the raw data and discussion and relate it to the Everglades Protection Area.

With the insight presented above, the panel hopes that refinement of the 'template' (mentioned in lines 588-589) for assessing and reporting phosphorus criterion compliance will carefully consider the data issues that must be addressed to obtain the consistency sought.

Regarding the nitrogen concentration status update, why is arithmetic mean used for TN while geometric mean is used for TP? It appears that the data screening required for the TN evaluation requires rejecting many more samples. In comparing the number of samples employed in Refuge inflow calculations in Table 3C-1 with those employed in Table 3C-4 for TN, there is a 44% loss in sample numbers (133 for TN and 74 for TN). The situation is similar for the other regions. Is this a concern to the analysts?

Conclusions

1. Chapter 3C provides an informative and concise overview of the status of phosphorus and nitrogen levels in the surface waters of the Everglades Protection Area during WY2006 as well as an assessment of compliance with the new phosphorus criterion rule.

2. The 2006 Chapter on phosphorus mentioned development of a monitoring program to measure compliance with the new phosphorus criterion rule. No mention of the status of this

monitoring program was made in the 2007 Chapter. Rather the assessment seemed to follow the same data acquisition procedures as in Chapter 3A (not the same data analysis procedures).

3. As with other Chapters, concerned was raised over the inconsistency of data abstracted from DBHYDRO to produce the chapter.

Recommendations

1. Presentation of the phosphorus criterion rule compliance could benefit from a graphic summary of the data/findings from Appendix 3C-3 placed in the body of the text in Chapter 3C. Currently, there is only a brief discussion.

2. Recommendation 2 for Chapter 3C applies here also. Perhaps the phosphorous criterion rule monitoring program's design (particularly efforts to ensure consistency in data used in the analysis from year-to-year) will be available for next year's report.

APPENDIX 3C: CALCULATION OF ANNUAL AND FIVE-YEAR GEOMETRIC MEAN TOTAL PHOSPHORUS CONCENTRATIONS TO ASSESS COMPLIANCE IN THE PHOSPHORUS CRITERIA FOR THE EVERGLADES PROTECTION AREA

Appendix 3C-1 is, in many ways, a data analysis protocol that describes precisely how data will be analyzed to determine compliance with phosphorus standards (or 'criterion rule' in the wording of Chapter 62-303 of the Florida Administrative Code) applicable to the Everglades Protection Area. As with other standard compliance determinations in South Florida, it appears that the data used in the calculations will be that available as a result of monitoring for a variety of purposes. In other words, the data used in the computations are not collected by a statistically designed monitoring program dedicated to the purpose of standard compliance (acknowledgement of this fact is noted in the reference to uncertainty as to how many samples will be available each year – a fact that can lead to inconsistency and incomparability in statistical findings). In light of this situation, the method presented fits well with the U.S. Environmental Protection Agency's (2003) recommendations regarding secondary information products (e.g., the data are checked for quality assurance, the rules for use of data are spelled out, the calculations are described, and the range of interpretations of the results discussed). A study currently underway by the Water Environment Federation Research Foundation provides similar insight into the methodologies employed to assess standard compliance (the final report for this study will be published at the end of 2006).

The calculation procedures are sound. Also on the positive side the Data Precision and Criterion Compliance Assessment are straightforward and conservative (e.g., if the calculated values for any waterbody segment exceeds any one of the limits established in the four-part assessment methodology, the P criterion will not be achieved in that segment for that assessment period). On the other hand, it seems unfortunate that the rule (which has been approved by both the ERC and U.S. EPA), based upon the brief description in the Appendix, accepts a minimum annual data requirement of six valid temporally independent TP measurements per year (p.2, para. 1 - thus allowing a weakening of a monthly data set to a bimonthly data set, and substantial loss of information). It is also unfortunate that the rule accepts as adequate collection of just 1 sample during the wet or dry season. Thus, hypothetically, 5 samples could be collected during a dry season, giving a potentially and artificially skewed (favorably low) picture of TP concentrations in the general absence of most non-point inputs, along with only 1 sample in the wet season. Also, the rule does not allow sites designated as unimpacted to be converted to impacted sites – only conversions of impacted to unimpacted are considered. The District and partners are working to restore ecological integrity in South Florida, within constraints imposed by increasing, rapid urbanization in or adjacent to many parts of the area and associated impacts on water quality. While the major trend will be from impacted to unimpacted, the reality is that the opposite will occur/is occurring, as well, in some waters.

It is not clear how many samples are desired to compute the annual individual geometric mean. Are there 12 monthly TP values (one per month) or are all the data collected each month averaged (how?) to create one observation per month. Is there any control over the number of samples employed in the calculations or is the number dependent upon available samples that clear the QA/QC filter? The statement in lines 69-71 indicates that there is no control, which has the potential to lead to inconsistent calculations, making year-to-year comparisons difficult, if

not impossible from a sound science perspective. Furthermore, the computed annual individual site geometric means, when there is adequate samples for computations, may be based on quite different sample sizes. Will this sample size difference cause further comparison problems?

Is the calculation of the five-year network geometric mean based on the arithmetic mean of the entire annual individual site geometric means computed over a five-year period? Why is the six-sample exclusion added when the five-year network geometric mean computed, but not when the annual individual site geometric mean is computed?

The reason for designating monitoring sites either 'impacted' or 'unimpacted' is not clear. One can infer that the desire to so designate monitoring sites stems from a desire to determine, in some fashion, how much of the Everglades can be declared 'recovered'. In Chapter 3-C (page 3C-11, lines 368-370) there is a statement that counters the ability to identify the percentage of the Everglades exceeding the TP criterion: "…as the monitoring sites are unevenly distributed across the EPA, it is impractical to estimate accurately the percentage of the marsh exceeding a TP concentration of 10 µg/L based on these results." Thus, the question arises, what is the purpose of designating sites 'impacted' or 'unimpacted' if the design of the monitoring system does not permit this designation to have scientifically sound spatial meaning? Is this designation of sampling sites required in the law?

Does the methodology described in Appendix 3C-1 apply to phosphorus standard computations in all areas of South Florida (in the spirit of an integrated report on South Florida's environment)? If not, what methods are used elsewhere and why are different methods being employed in different regions of South Florida?

Conclusions

1. Appendix 3C-1 provides a data analysis strategy to check compliance with the phosphorus criterion rule – a strategy that is logical and, yet, struggles with the uncertainty of the data available for the assessment.

2. There was no mention of the status of the monitoring program being prepared to check compliance with the phosphorus criterion rule.

3. The panel, as with other uses of DBHYDRO, is concerned about the consistency and comparability of the phosphorus criterion rule calculation results over time and space, due to apparent inconsistencies in the DBHYDRO data available and/or that passes the QA/QC filter from year to year.

Recommendations

1. Some fundamental information should be added to this succinct appendix: Geometric mean should be defined, including explanation of how it differs from an arithmetic mean, and explanation as to why geometric means were selected for use, including appropriate references. A description of the four-part test (methodology) specified by the phosphorus criterion rule (62-

302.540, FL Admin. Code) should be included. Clarification should also be added as to how unimpacted-to-impacted situations are addressed.

2, The descriptions of the calculation procedures for the various geometric means need more clarification including, if possible, addition of an equation for each geometric mean being computed?

3. The data available for the phosphorus criterion rule need to be more consistent and comparable over time and space. Perhaps the monitoring program, currently under development, will resolve these issues.

References

U.S. Environmental Protection Agency. 2003. A Guide to Developing Secondary Information Products: Methods Review and Documentation. Report Number EPA 260-B-01-006, Office of Information Analysis and Access, Washington, D.C., 28 pages.

Griffith, L.M., R.C. Ward, G.B. McBride and J.C. Loftis. 2001. Data Analysis Considerations in Producing 'Comparable' Information for Water Quality Management Purposes. Technical Report 01-01, National Water Quality Monitoring Council (available online: http://acwi.gov/monitoring/pubs/tr/nwqmc0101.pdf).

Ward, R.C. and C.A. Peters (Editors). 2003. Seeking a Common Framework for Water Quality Monitoring. Water Resources Impact, Volume 5(5), September. (available online: http://acwi.gov/monitoring/pubs/0309impact.pdf)

CHAPTER 4: PHOSPHORUS SOURCE CONTROLS FOR THE BASINS TRIBUTARY TO THE EVERGLADES PROTECTION AREA

This chapter provides a summary of the progress being made to control phosphorus in the basins tributary to the Everglades Protection Area (EPA). These controls are to meet permits issued by the Florida Department of Environmental Protection (FEDP) for these discharges. These permits are part of the Everglades Construction Project (ECP) and the non-Everglades Construction Project (non-ECP) permits. Each permit incorporates a comprehensive approach for controlling phosphorus at the source utilizing regulatory, voluntary, and educational programs.

The ECP permit requires that a Best Management Program for total phosphorus (TP) control be implemented in the Everglades Agricultural Area (EAA) and the C-139 basin, the two largest tributary sources to the EPA. The eight non-ECP basins, the remaining basins discharging to the EPA, have voluntary or cooperative source control programs and discharge directly to the EPA. These eight basins include: C-11 West, North New River Canal (NNRC), North Springs Improvement District (NSID), Feeder Canal, L-28, C-111, Village of Wellington's (VOW) ACME Improvement District, and Boynton Farms.

For the EAA, the required source control strategy is a 25% reduction in total phosphorus in any given water year when compared to a pre-BMP baseline period (WY1980-WY1988) estimated phosphorus load of 270 mt/yr. As noted in the chapter, a 44% reduction was achieved in WY2006 when the discharge was 153 mt, the eleventh straight year – an excellent record of compliance, while the three-year average load reduction is 56%. Significant progress (greater than 50% reduction in total phosphorus annual percentage load) has been made over the 11 years since the program's initiation in reducing phosphorus loads leaving the EAA with the implementation of BMPs, and based on this report and previous SFER reports, the District is continuing an aggressive program to reduce phosphorus loads as needed to meet regulatory provisions.

In C-139, the goal has been to maintain total phosphorus loads at or below pre-BMP baseline levels (34.5 mt/yr), and in the four years since the programs initiation the basin has been out of compliance. As noted in the 2006 SFER, the WY2005 TP concentration was below 200 ppb for the first time since BMP implementation, yet the WY2006 TP concentration average was 260 ppb, (producing a discharge of 106.9 mt/yr), more in line with previous years. Because the C-139 basin has not met the TP load requirement, the District is required to initiate rulemaking pursuant to Chapter 120, Florida Statutes.

For the eight non-ECP basins, the discharge permits require schedules and strategies for maintaining water quality standards taking an adaptive management approach. TP loads were highest from the Feeder Canal, L-28, and ACME Improvement District basins while no loads were measured from the North New River Canal, North Springs Improvement District, and the Boynton Farms basins for lack of flow. Continued progress in reducing phosphorus was demonstrated through voluntary and cooperative efforts.

Overall, significant progress is being made in controlling total phosphorus in the EAA, but further work will be needed to do the same in the C-139 basin. In terms of total phosphorus loads

leaving the ECP and non-ECP basins during WY2006, the ECP basins contributed 259.5 mt (or 82.7% of the total) while the non-ECP basins contributed 54.2 mt (or 17.3%).

Several specific issues are of interest, namely, BMP effectiveness and design criteria for BMPs, the ineffectiveness of BMPs in the C-139 basin, and, carried over from the 2006 SFER, monitoring consistency.

Conclusions

1. TP control via BMPs in the ECP and non-ECP basins is proving to be effective in areas like the EAA. Continued efforts to determine BMP effectiveness, development of design criteria for the appropriate application and operation of BMPs and education of those implementing the BMPs are keys to overall TP removal success.

2. TP control in the C-139 basin using BMPs over the past four years has not yet been effective, and continued attention to BMP effectiveness in this basin will be needed. Again, continued efforts to determine BMP design criteria for appropriate application and operation and education of those implementing the BMPs are keys to overall TP removal success in C-139.

3. TP control in the non-ECP basins, though dealing with small loads compared to the EAA and C-139, are showing good progress in some basins and not in others. Understanding the contribution of each TP control method within each basin to overall TP removal will be important to lowering TP loads leaving these basins to desired amounts.

4. Monitoring consistency continues to be of interest because of the changes in sites monitored within the EAA over the past year. Due attention is being paid to the stations being used for compliance monitoring, and retaining consistency from year to year so that estimated TP loadings reflect actual changes in the system rather than changes in the monitoring is the issue. Continued vigilance is needed.

5. The streamlining of this chapter to focus on TP removal progress in the ECP and non-ECP basins in a consistent and comparable manner as well as the activities in the current water year and those planned for the next water year is a significant improvement.

Recommendations

1. Continued research should be conducted on BMP effectiveness, appropriateness of application, and the development of design criteria is needed for BMP application in the ECP and non-ECP basins. In particular, innovative management of the drainage channels on the farms and innovative designs of BMPs in the channels themselves should be considered. In addition, while the BMP “equivalents” provide an innovative basis for BMP implementation, the “equivalents” assigned to each BMP should be reviewed periodically in light of additional experience gained with and effectiveness found for each BMP.

2. The panel recommends that information be developed and provided that speaks to monitoring consistency from year to year so that estimated TP loadings reflect actual changes in the system rather than changes in the monitoring.

3. Continued “tightening” of the chapter is recommended using summary tables where possible (the summary of activities for the non-ECP basins, and the ECP basins for that matter, could also be applied to the ECP basins) and references to background information in other documents that are readily available on the District’s website or some other location.

CHAPTER 5: STA PERFORMANCE, COMPLIANCE AND OPTIMIZATION

This chapter documents the performance, operation, enhancement and compliance of the Stormwater Treatment Areas (STAs) in the Water Year 2006 with historical accounts. From early 1990s, the construction of STAs has been continuing and currently about 40,000 acres of wetland have been built to remove excess phosphorous from entering into the Everglades Protection Area (EPA). Clearly, the District has focused on how best to operate the STAs to accomplish the levels of nutrient removal needed to meet regulatory requirements, and it has been remarkably successful utilizing a natural system relying primarily on submerged aquatic vegetation and periphyton communities on a very large scale. A significant amount of effort has gone into learning how to operate the natural treatment systems starting with the very basic design criteria utilized in the mid-1990s to first design these systems, to learn appropriate operating depths, and measuring hydraulic loading rates, nutrient loading rates, hydraulic retention times, etc. anticipating that these would be important design parameters.

For the past few reviews of the STAs, recommendations have been made to the District that engineering design approaches and criteria be applied to these natural treatment systems so that these STAs may be operated within certain hydraulic and nutrient loadings so they will remove TP at high levels with confidence. The original engineering basis for STA design described in Burns and McDonnell (1994), which was based on work by Walker (1993 and 1995), has been followed by more sophisticated modeling of these systems by Walker and Kadlec (2005) as embodied in their DMSTA2 model. It is clear that the engineering criteria to be applied to the design of the STA's, however, are still in development. It is gratifying to see efforts along these lines noted as part of the adaptive management approach the District is taking, an example being the 2006 "Stormwater Treatment Area 1-West Lessons Learned" document, but there is more that can be done.

For example, there are simple relationships that can be developed from the STA operational data given in Table 5-59. Expected increases in effluent TP concentration with increasing TP loading and expected decreases in TP removal with increasing TP loading are evident although with more variability than would be expected in systems that had been in operation for awhile and had stabilized. Expected increases in TP removal and decreases in TP effluent concentrations with increasing hydraulic residence times are also evident but again with significant variability. Envelopes of nutrient loading coupled with similar envelopes of hydraulic loading and water depths used in the past provide a growing list of design criteria that can be used to guide STA operation and design of future STA's. The District is breaking new ground with these STAs, particularly with respect to nutrient removal, and it can be at the forefront of guiding future applications of STA-like systems if it performs the right kind of analyses and gathers the right kind of data. It is the latter work that should be the focus of future editions of this chapter while a good deal of this information like the permit status and operations could be placed in an appendix.

Since 1995 the STAs have exceeded their designed goals in removing TP from surface water entering into the EPA. More than 800 metric tons of phosphorus that would have been discharged into the EPA have been removed. In WY2006, the STAs reduced the average total P concentration of the inflows to outflows by 68% (from 144 ppb to 44 pbb).

The chapter also reports on STA expansion and enhancements projects, the adjustments of operation in response to the presence of migratory birds, the design of recreational facilities for three of the STAs and the increased use of recreational activities, such as duck hunting, bird watching and hiking.

In the WY2006, the six STAs in operation were in full compliance with state operation permits.

Numerous events this year had an impact on the performance of the STAs including the devastated effects of hurricanes. Some of the STAs experienced vegetation lost and rehabilitation that reduce the effective treatment area. The turbidity problem caused by hurricanes on the SAV communities was observed in STA-1W and STA-2.

Several facts reported this year warrant a closer look into the potential problems associated with the long-term operation of the STAs. For example, the vegetation in STA-1W and STA-2 has shown stress in response to storm events, high nutrient loading and dry out. Are those observations reflecting temporary variation of the STA performance or more serious signs of aging and non-sustainability? STAs are highly managed constructed wetlands, their long-term performance and sustainability need to be re-evaluated. Most STAs are in the stabilizing stages, the data accumulated over the years should be able to provide a basis for a mid-term evaluation of the design, goals and performance of the STAs.

The side-by-side description and comparisons of the STAs with text and tables give excellent overview of the content. This is an efficient way to convey a multi-dimension factual data to the readers at a glance.

Conclusions

1**.** The engineering design of the STA systems using the modeling approach embodied in the DMSTA2 model is predicated on a developing set of criteria. It is important that these criteria continue to be refined based on STA operation as well as on experience gained at other engineered emergent and submerged vegetation systems.

2. A close examination of the factors causing operational problems in STA-1W need to be investigated further. The long-term sustainability of these systems is dependent on a good understanding of the biology of the systems as well as the engineering design that need to be applied.

Recommendations

1. Vegetation management seems to be emphasized in the STAs recently. Several questions may need to be addressed: What are the goals of vegetation management in the STAs? What are the pros and cons of maintaining emergent plants, SAV and PSTA? Is there a fixed vegetation management plan to be maintained in the STAs? Or does the goal of vegetation management vary from time to time depending on the situation?

2. Increased turbidity by storm events has been identified as a significant problem in the SAV cells. Sustainability of SAV in the STAs needs to be re-examined.

3. The Analysis and Interpretation section will become more important as STAs stabilize because future management decisions depend on the past experience. This section needs to be streamlined, focusing on the critical issues of STA operation and performance.

References

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Walker, W.W. and R. Kadlec. 2005. *Dynamic Model for Stormwater Treatment Areas, Model version 2.* Prepared for the US Department of the Interior and US Army Corps of Engineers. Available at http://www.wwwalker.net/dmsta/index.htm, Sept. 20, 2006.

CHAPTER 6: ECOLOGY OF THE EVERGLADES PROTECTION AREA

This is an extremely useful chapter in placing ecological research within the Everglades context, and the authors are to be commended. Further, it has been much improved over the years, and provides an excellent context for the management work in the Everglades. There remain a number of areas where citations to previous work would both aid readers and put the work in context.

The restoration of the Everglades has as a primary objective the establishment of an ecosystem with appropriate structure and functions. One goal of restoration was to restore, to the extent possible, the natural hydrology of the Everglades, which in turn would restore appropriate structure and function. The SFWMD operations, regulations, monitoring, and science are directed toward restoring the Everglades within the human-dominated South Florida ecosystem, including understanding and managing the hydrology, ecology, nutrient and contaminant patterns. The ecology research group conducts studies on wildlife ecology, plant ecology, ecosystem ecology, and landscape ecology within a framework of the hydrology of the Everglades. The organization of the last several reports around these four topics has achieved continuity and allowed building on previous studies to understand the Florida Everglades. It is perhaps time to integrate these four ecology areas and produce a discussion of how they, and the measures used to evaluate ecology of the Everglades, are inter-related. In addition, the relationship of the ecological studies to assessment measures could be clearer: for example, how do phosphorus and mercury findings and measurements affect the ecological components of the ecosystem that are studied and reported in this chapter?

Since it is not possible to examine all species, species assemblages, and processes, indicators must be selected for examination and monitoring. Several key indicators are examined in some detail in this chapter: hydrological patterns for 2005, wading birds, food limitation on wading bird reproduction, a food web pilot study, Lila tree seedling experiment, invasive exotic species research, sediment flux, tree islands, and cattail habitat improvement, the EFA long-term plan, accelerated recovery, the Rotenberger Wildlife Management Area.

The summary of the ecological research conducted in the Everglades is clearly and concisely described in the summary, and a solid background is provided in the introduction. The summary clearly describes the overall research areas. Some summary statements of how the research will be used in the short-term and long-term for both management of the Everglades, and future monitoring would be helpful (perhaps in a table format). The introduction, however, does not provide a clear statement of why the overall research areas or specific research topics were chosen. While this information could be gleaned from reading of several previous reports, it would be useful to have it in one place. While much of the research goes directly to understanding the overall ecology and functioning of the Everglades system, the information also contributes to management of the Everglades and to the development of bioindicators. The latter positive benefit should be described briefly.

Description of the overall hydrological patterns for the water year was extremely useful in placing the research results in context. The use of tolerances and good/bad evaluations is reasonable, but the presentation is unclear. Such snapshot evaluations are an important method of

communicating to both managers and the public, but need to be more clearly explained. Further, the attempt to relate hydrological conditions to biological measures (e.g., wading bird foraging) is important and useful.

The overall format for reporting the research (introduction, scientific details, results and discussion) is much improved over previous reports. The consistency across research studies makes the material more accessible. This format should be followed throughout this chapter, and might work well for other chapters as well. However, some of the studies reported clearly indicate the hypotheses being examined, while others do not. The formation of clear hypotheses (and their statement) will facilitate an adaptive management approach to Everglades's restoration.

Wildlife Ecology

The Everglades have historically had an abundant and diverse wildlife community which was threatened by changed in hydrology. Wading birds, as intermediate and top trophic-level predators, are a useful and important bioindicator of Everglades health and well-being. The District is correct in focusing on understanding wading bird numbers, distribution, and reproductive success, and in using wading birds as indicators of Everglades health. The District continues to use wading birds as indicators, while conducting studies to understand the factors that contribute to success of foraging and reproduction. These studies include an examination of the role of food availability (food limitation hypothesis) and hydrology on wading bird breeding success, prey availability, and food web studies. Three main studies are described: 1) evaluation of wading bird nests, showing that WY2006 was a "banner" year, 2) the initiation of a three-year study of supplementary feeding of White Ibis nestlings, and 3) a pilot stable isotope study to track carbon and nitrogen from periphyton through the food web.

Since Wading Bird Monitoring provides important data on a key measure of Everglades health, these studies are critical to both evaluating restoration and determining future management. This section would be improved by more tables and figures that show the numbers for this season (not just 3-year averages), especially for key species, such as Snowy Egret and Wood Stork. It is difficult for readers to understand the details of population changes, and thus the effect of restoration on wading bird numbers. Such graphics and numbers are essential, particularly since wading birds are a key indicator for the Everglades.

The report states that wading birds can be used as indicators of the health of the Everglades, yet there are more wading birds nesting in WCA-3 than in the Everglades National Park; suggesting that Everglades National Park is less healthy than WCA-3. This raises the question of what the indicators indicate, and to reconcile these kinds of differences, especially for the public. The indicators reflect not only specific places, but the Everglades overall.

The supplemental food study with white ibises is excellent, and long overdue. It will answer a number of questions. A multi-year study is required because any one year could be "good food" year for the birds, obscuring general differences. When data are presented, normal reproduction and growth parameters should be provided for other, non-optimal food years. Mercury should be measured in the birds as well, especially since blood will be collected.

The food web pilot study is also critical for understanding how periphyton ultimately affects the food web of the Everglades. Again, it is essential that this study be multi-year. However, the methods need to be described more fully to allow an evaluation, and the experimental design fully justified. Future studies might involve larger mesocosms, and those with more complex food webs. This approach is essential to understand the functioning of the ecosystem.

Plant Ecology

The introduction sets the stage for the plant ecology studies, both presented in this and previous reports. References to the Invasive Species Summit were intriguing, and deserve further mention, if only in a brief paragraph. How, for example, is the work of that committee going to impact the general ecological studies in the Everglades? Activities highlighted were 1) a seedling experiment on artificial tree islands, 2) impacts of Hurricane Wilma on the study tree islands, and 3) a program addressing invasive cattails.

The Lila Tree seedling experiment continues to be an important component of plant ecology studies for the Everglades. This type of experimental work can ultimately lead to understanding not only how to restore damaged tree islands, and how to construct new tree islands, but as a predictive tool for continued health of existing islands. Again, it is important for this to be a multi-year study because of the variability in hydrology and environmental conditions. The continued tree island work is important to evaluating not only the effect of Hurricane Wilma, but also other future hurricanes or disturbances.

Invasive species research is extremely important, both in describing the extent of distribution, but also in documenting effects on native species. The District is to be commended on making use of recent DNA technology to understand the complexities of invasive species and hybridizations.

Ecosystem Ecology

One of the unique aspects of the Everglades work is its emphasis on both ecosystem and landscape scale issues. Over the years this section will increase in importance as the interactions among components and ecotypes are more clearly identified and studied. This years studies focused on flume studies, the impact of bird guano on tree islands, fire as a tool for management, and management of cattail habitats.

Understanding the transportation of nutrients, including Phosphorus, through the Everglades system is critical to management, and the sediment flux studies are aimed at this objective. The sediment flux studies also require clearer descriptions of methods and hypotheses. Both pilot studies are important, and should form the basis for more in-depth work.

The biomarkers for tree islands, developed to understand the changes in P as a result of wading bird guano, are important for an overall understanding of P dynamics within the Everglades. It is not clear, however, how this biomarker will be used, particularly with respect to wading bird performance measures. Further, while so many other compounds are being measured, some

attention should be devoted to mercury. The wading bird biomarkers should be examined not only in marsh cores, but also in other tree islands that have never served as wading bird colony sites, although such islands may be difficult to identify.

The cattail habitat improvement project is extremely important to elucidating the factors that control cattail sands, and to an understanding of how to restore sawgrass and improve existing cattail stands. A detailed summary of the performance measures should be included with the project description.

Along with understanding of the factors that control distribution of cattails, the Accelerating Recovery Project will explore ways to decrease the recovery time for the eutrophic systems. This is an important goal since other species assemblages and communities cannot recover without overall improvement. Exploring methods of accelerating recovery is critical, and the potential use of fire is laudable. Does sufficient information exist on the spatial, temporal and seasonal effects of fire? This aspect should be further described in the report.

Results were described of a promising pilot study that tested the use of stable isotope techniques to improve understanding of relationships among trophic levels of the aquatic Everglades food web, from periphyton to fish. Methods information was lacking, however, and conclusions seemed to extend beyond the data.

Landscape Ecology

As studies of the Everglades continue, considerably more attention is understandably being devoted to ecosystem and landscape studies. This reflects an increase in knowledge at the individual and population levels, and is an indication of a maturing research program. Major topics of this section include tree island elevation studies and historical tree island changes. Tree islands are an important component of the mosaic of habitats in the Everglades. Therefore, the emphasis on tree islands in many of the ecological sections is not only warranted, but essential to providing the basic biological studies necessary for a full restoration of the Everglades. The full results are important for overall understanding of Everglades ecology, and a more in-depth description (with graphics) will prove valuable. The information on historical changes to tree island coverage is important toward understanding anthropogenic effects.

Recommendations

1. A short statement should be included in the summary of how the four research areas are inter-related – how they related and inform one another.

2. A clear statement should be provided of the agencies involved in all research areas, both in the summary and in each research section.

3. The introduction should include a clear explanation as to why each research area was chosen (this could be easily be accomplished with a table that lists the research project, the biological justification, and the management goals or uses).

4. The supplemental feeding study with white ibis should include analysis of contaminants, particularly mercury.

5. The same overall format should be used for reporting the research (introduction, scientific details, results and discussion) studies throughout the report. As is, it was mainly used in the wildlife section.

6. Future food web studies should be considered that involve larger mesocosms with more complex food webs.

7. All studies presented in this chapter should have clear hypotheses stated in their respective introductory sections.

8. The effects of fire, particularly with respect to temporal and spatial patterns, should be explored and described more fully.

9. Additional information should be included on the stable isotope techniques to examine trophic level inter-relationships.

CHAPTER 7A: COMPREHENSIVE EVERGLADES RESTORATION PLAN ANNUAL REPORT

The panel noted that the link between CERP and the Acceler8 programs is more clearly presented in the 2007 SFER than in previous reports. The background section of ecological programs and their relationship to CERP also helps the reader draw logical conclusions as to the pace and status of the overall restoration effort.

The addition of the background is a welcome development (starting with line 138) and in particular, the section describing the overall restoration effort (lines 159-167). The panel feels that the words choice ("Everglades –type," "such characteristics," and the frank admission that the Everglades will not recover many of its defining characteristics, etc.) in the 2007 SFER present a much more accurate picture of the outcome of the CERP process. The authors deserve to be commended for this treatment. As the panel has been insisting for several years, restoration is an ongoing process leading to measurable improvements in ecosystem functioning based on defined parameters and not a specific target, especially for the objectives of multiple stakeholders. It is fine to set specific targets (such as 10 ppb TP) but controlling that target implies any number of ancillary benefits and costs to the stakeholders involved. Organizing the background section by region was also an important change from last year's report.

The entire middle section of the chapter (lines 168-766) is commended by the panel as well organized, easy to read, and output oriented. The regional / problem / solution approach allows the reader to cross-reference the issues presented with proposed CERP, Acceler8 activities. The panel feels that this chapter will be an important asset to the final monitoring program design. This chapter represents a marked improvement to previous years' reports.

The section of the chapter starting with line 537 is of particular note to the panel as it is important that all involved in the restoration process understand that CERP is designed to impact the Everglades system. As is clearly stated, no single CERP activity will solve a system-wide problem. The panel feels strongly that this concept should be included in other chapters of the SFER.

The panel feels that CERP goals are clearly defined as preserving South Florida's ecosystem and providing for the water-related needs of the region – both related to improving the timing, quality, and distribution of water deliveries to the ecosystem. In order to accomplish the goals of CERP, the District must complete the land acquisition program while preparing Project Implementation Reports (PIRs), based on data collected from a host of restoration actions.

The section reporting the status of program-level activities is excellent as it clarifies the status and interactions of many CERP programs. The map provided to locate the pilot projects is useful and allow the reader to gain a certain degree of understanding as to the complexity and inter-related nature of the overall restoration program.

Recommendations

1. The panel recommends that the public relations efforts being mounted to inform the general public on progress realized in the Acceler8 program be made part of the 2008 SFER.

2. The difference between “yellow book projects” and “precursor projects” should be clarified in the report.

3. The final document should clearly state that the Adaptive Management Program should be used throughout the construction and monitoring phase of the restoration of the Everglades.

4. The staging or sequencing of project implementation (decompartmentalization, predecessors, successors, etc.) vis-à-vis the commitment of the State for 50% funding should somehow be clarified in the final report with a simple diagram.

CHAPTER 7B: UPDATE ON RECOVER IMPLEMENTATION AND MONITORING FOR THE CERP

This chapter is presented in a logical and convincing manner and is well written. The presentation has been revised and the volume reduced by nearly 66%, although still supported by additional web sites and appendices. The panel finds this new format to be desirable, contributing to readability while not requiring the serious reader to search for supporting materials for questions. The panel understands and agrees with the statement that there will always likely be a range of views as to the strategies that are employed to best reach the overall goal of the CERP as well as the outcomes of that process.

It is important that the public understands, as the report states, that the development and application of performance measures is a dynamic process, impacted by new science and technologies. The panel fully supports the need for refining and integrating the performance measures as noted in lines 45-48 as well as the fact that this process is science driven (lines 51-53). The two restoration projects presented (Decompartmentalization and Ten Mile Creek) are considered appropriate as challenging to, and requiring the use of, adaptive management concepts in order to attain positive outcomes. The challenge, of course, lies in the ability to adapt the outcomes of these studies to the larger context of other management strategies that will be implemented in the future.

Tables 7B-1 and 7B-2 provide excellent summary information.

Recommendations

1. The panel supports the need for greater detail in terms of reporting on progress realized in the RECOVER and CERP programs.

The panel supports the need for continued inclusion of more social science data as an important improvement in implementing CERP.

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

The chapter is well written and presents a logical context to the implementation of a number of ongoing projects related to the Long-Term Plan goal of achieving water quality goals in the EPA. Table 8-1 is particularly useful in locating information on specific projects in the 2007 SFER.

The panel notes the overall progress realized in reducing P levels into the EPA, and particularly the statement that the long-term Everglades water quality goal relates to all discharges to the EPA. While TP remains the most notable indicator of that objective it is clear that a number of other criteria will be influential, and will need to be taken into account in defining acceptable water quality. The panel also notes that previous SFERs have recognized that additional measures are necessary to achieve the overall Everglades water quality goal as required by 31 December 2006 by the Everglades Forever Act. There was no mention of this deadline, however in this year's Chapter 8.

The panel supports inclusion of the ACME Basin B project into the long-term plan as a means of securing funding for the important action to the overall water quality efforts of the CERP as well as the exclusion of proposed internal levees of STA-2 Cell 3, STA-6 Section 1 and STA-6 Section 2 from the long-term plan. However the panel notes with some concern the lack of a response to overall P levels as a result of the installation of the levees. The panel understands that many CERP projects are still in the early planning stages and therefore it is unclear as to how these projects will affect water quality. Yet there was only passing reference to the monitoring program that will have to be in place in order to be able to make specific recommendations for long-term water quality policies.

A review of the Long-Term Plan continues to raise 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 toward attaining water quality goals were noted. The 2005 SFER makes only limited references to this issue, and neither the 2006 nor 2007 SFERs provide further insights as to how such information will be treated legally or scientifically as implementation of new projects proceeds, in the opinion of the Review panel.

The issue of STAs is about sustainability and how engineering design criteria are being developed to operate these systems on a continuing basis. The environmental engineering (as opposed to the hydraulic and hydrologic engineering) of these systems has been in the background and is not apparent to the panel. For example, while a review of the 1995 Walker (1995) paper was conducted, the design tool that is now embodied in DMSTA is significantly different.

Recommendations

1. The panel continues to feel that the concept of STA optimization should be considered as an issue for the cross-cutting issues, since the success of the STAs has an impact on the entire South

Florida environment. It would be interesting to zero in on the role of STAs as a fundamental management strategy to the overall CERP.

2. The panel feels that some of the results of implementing BMPs should, at minimum, be cross-referenced in this chapter, as has been the case in other projects as a means of understanding the impact of individual and/or suites of BMPs on water quality.

3. A description of the environmental engineering of these systems should be included in this chapter – for example, a review of the DMSTA model.

CHAPTER 9: THE STATUS OF NONINDIGENOUS SPECIES IN THE SOUTH FLORIDA ENVIRONMENT

This Chapter presents the status of progress in understanding and controlling terrestrial, wetland and aquatic nonindigenous species throughout the eight ecological regions recognized by RECOVER, including the Florida Keys, Florida Bay and the Southern Estuaries, the Greater Everglades, Western Big Cypress (or Big Cypress?), Lake Okeechobee, the Northern Estuaries East, the Northern Estuaries West, and the Kissimmee River Basin. The Chapter provides a listing of species that are serious or potentially serious threats to Everglades restoration (Table 9-1 is excellent). The authors also consider each geographic module separately, attempting to use an across-taxa or "all taxa" (lines 20,290, etc.; perhaps more aptly termed "multiple taxa") format.

The authors responded well to the 2006 Review panel's suggestions: They built upon information included in the 2006 SFER about funding issues; the labyrinth of the many agencies, plans, control programs, interactions, and sometimes-conflicting management efforts to control nonindigenous species; and management tools used in attempts to control bioinvasive species. They also do a good job of indicating where the many management efforts/entities are integrated.

This Chapter makes a compelling case for six major overarching needs to strengthen nonindigenous species management in South Florida (p.9-75): (1) Centralized, improved coordination of nonindigenous plant management, including a coordinated database that spans taxa; (2) Funding and centralized coordination for a comprehensive nonindigenous animal management plan, including a coordinated database; (3) Establishment of priorities for nonindigenous animal management; (4) Creation of an "applied monitoring" program and a project tracking system for nonindigenous plant and animal species before, during and after control operations; (5) Use of an EDRR (early detection and rapid response) program - recognition and control of nonindigenous species during the early incipient phase of their invasions; and (6) Direct consideration of the impacts of nonindigenous species in models for the District's-and-partners' long-term restoration efforts, beyond the conceptual ecological models (p.9-8).

Conclusions

This year's report is the best among what the review panel has seen over the years. Several key comments recommended by the review panel have been properly addressed. For example, the overview of programs, management and restoration efforts, planning, organization and funding have been much more clearly presented. The cross-reference to websites and cited literature has been extensive in this year's report. Cross-referencing is extremely important for those who are interested in following up the subject in detail. The report also provides the information and tables (for priority plant species) pertaining to the status and efforts on what control or managements have been initiated. The pictures of species (animals) are particularly useful because it is indeed "a picture is worth a thousand words." The tremendous effort invested in reporting this complicated and important issue will be worthwhile only if it is truly useful to the users, including government agencies, legislation, public and private organizations and general

public. The panel congratulates the authors for their tremendous effort in making this years report informative and user-friendly.

Recommendations

1. The involvement of the general public in the effort of nonindigenous species control is essential to the success of this task. Efforts should be made to educate the public in the problem and significance of exotic invasive species control in South Florida. Special outreach programs for students from K-12, advertisement in media, public workshops and websites are all effective means for public education. Volunteers from the general public would be a powerful force in the effort of exotic species control, in private-owned lands. Reporting public education efforts and programs in this regard probably should be included in this chapter.

2. Pictorial description of the priority nonindigenous species should be included in the chapter, especially plants. If the length of the chapter is of concern, cross reference to website can be made.

3. Concluding remarks at the end of the chapter should include comments on the gap of the current efforts, special notes of problems, and future needs in management, planning, research and funding.

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

The goals of this chapter were to provide the WY2006 status of Lake Okeechobee and its surrounding watershed, summarize the major issues impacting the Lake flora and fauna, and describe associated ongoing projects. The three long-term major impacts to the Lake were identified as: (1) excessive phosphorus loads; (2) unnatural hydrology; and (3) rapid spread of exotic and nuisance plants in the littoral zone. This chapter constitutes the seventh annual report to the Legislature summarizing the water quality and habitat conditions of Lake Okeechobee and its watershed, implementation activities including the status of the Construction Project, and challenges and unresolved issues. Chapter 10 provides a comprehensive update of lake and watershed conditions, focusing on phosphorus loading and water levels. Results of recently completed research projects are presented, as well as status updates for ongoing watershed and in-lake management projects.

The hydrologic and TP loads imposed on the lake by 2004 and 2005 hurricanes have provided a unique opportunity to study the impacts of short-term major loads to this large shallow freshwater ecosystem. Also notable are the downstream impacts associated with that loading as well as the major disruption to the biota and sediments from currents generated during the seiche that was created by the hurricane winds.

The authors succinctly convey the devastating impacts of these WY2004-2005 hurricanes, especially Frances, upon the water quality and aquatic life of Lake Okeechobee. The dramatic reductions in littoral zone vegetation (e.g., TSS concentrations up to 200 mg/L, and extreme hydrological conditions confronted by bulrush populations), the striking decrease in the sedimentation coefficients suggesting an increased role of internal P loading, the decline in habitat quality indicated for desirable fish and macroinvertebrate populations, and the struggle to control phosphorus loading are all clear. This Chapter also describes many ongoing efforts to improve water quality, and some successes at reducing P loads from various tributaries in the northern watershed, countered by increased watershed urbanization which would be expected to elevate the P loading. Accordingly, an additional “challenge and unresolved issue” has been identified this year – development and implementation of urban BMPs.

The authors were responsive to the 2006 SFER Review panel in both content and style; they also presented both English and metric units throughout. The numerous figures (maps, data graphics) and tables are of high quality, and very helpful. The writing is also excellent in content and quality.

Although little technical information (methods etc.) was presented in this year’s chapter, the descriptions of monitoring efforts and supporting studies appear to be backed by technologically sound approaches and data – for example, continuous flow monitoring and weekly TP measurements at key watershed stations (p.10-10). While co-management of P and inorganic N should be an ultimate goal, the present focus on P is understandable in light of the dramatic destructive circumstances created for the lake by the hurricanes.

Nutrients and Other Contaminants

The eutrophication of Lake Okeechobee, as in former years, has received considerable study by the District. The Lake did not sustain blooms of noxious blue-green algae (cyanobacteria) this year, likely because of extreme light reduction from suspended sediment loading/resuspension. Nevertheless, phosphorus loadings from WY2006 were extremely high and directly related to the hurricanes that impacted the lake and its watershed. Regarding the watershed, how serious/widespread is the problem mentioned of residual soil phosphorus (p.10-30)? Is the District (and partner agencies/entities) developing a concerted plan for controlling urban/suburban runoff?

In WY2006, the Lake water levels increased considerably. Large amounts of phosphorus-laden sediments were resuspended from the pelagic (central open-water) area and distributed throughout the Lake. Regarding phosphorus, however, several points were not clarified: Was there an effort to quantify the P contribution from the sediments that were resuspended from the central lake? How reliable are the reported estimates for atmospheric deposition of phosphorus, and is this source considered "uncontrollable"? Why was there a reduction of water-column calcium (p.10-35, line 780)? Given that calcium is effective in sequestering phosphorus and precipitating it out of the water column to the sediments, why is the option of adding calcium (lime) not considered? It was mentioned in the Sept. 2006 Workshop that alum (potassium aluminum sulfate) was planned for use in sequestering/precipitating phosphorus from the water column, rather than lime, because of lower cost. It is important to consider, however, that alum, unlike calcium, can be toxic to some beneficial aquatic organisms.

Other potential water quality problems were either not discussed or only briefly mentioned. Increased sulfur loads originating from polluted surface water and groundwater, and from enhanced atmospheric inputs, are a major threat to the biogeochemical functioning and biodiversity of shallow freshwater ecosystems. Thus, sulfate reduction may be an important biogeochemical process in the eutrophication of Lake Okeechobee. For example, in field enclosure experiments, Lamers et al. 2002 (*Limnology and* Oceanography, volume 47, pp. 585-593) observed striking responses of freshwater marshes to sulfate. Sulfate addition often promoted strong phosphorus mobilization. A similar phenomenon was also recently reported from an enclosure study in the Everglades (see draft *2007 SFER*, Appendix 3-B3). How high are sulfate concentrations in the Lake, and how does sulfate reduction quantitatively affect phosphorus availability to the phytoplankton? Sulfate reduction may also influence internal trace metal micronutrient cycling and methylmercury availability.

Widespread inundation of urban and agricultural lands during and after the storms likely resulted not only in increased phosphorus runoff, but also excessive inputs of other pollutants such as nitrogen and herbicides/pesticides. In Table 10-6 (p.10-29), why are only phosphorus data included, and not monitoring data for nitrogen, suspended solids, and herbicide/pesticides? Nitrogen is an important nutrient influencing algal growth. Once light limitation is relieved, the water-column TN: TP ratio (see Table 10-7) is important for the appearance of blue-green algae, including toxic species. What were the concentrations of organic contaminants (herbicides, pesticides) in the runoff?

Sediment Management

Suspended sediment loading/resuspension was described as a major, potentially long-term impact of the hurricanes on Lake Okeechobee. How long is it projected that this problem will continue, and what models were used to make this projection? Despite the knowledge that the lake response to load reductions will be slow, little information was included about the feasibility of sediment management as an option for accelerating changes in water quality in the lake. In the Sept. 2006 Workshop, it was explained that the feasibility of sediment removal was examined and the cost was found to be prohibitive, but this information was not clarified in the chapter.

Flora and Fauna

The panel appreciates the expansion of the program with analyses for the presence of microcystin in the blue-green algal blooms. Regarding desirable flora and fauna, two questions remain from last year. First, what is the overall extent of the exotic species problem in the Lake, and how does it compare with pre-hurricane years? Second, what is the potential influence of herbicide/pesticide applications on desirable flora and fauna? The authors provided encouraging information to the effect that native plants (e.g., *Nymphaea*, spikerush) have become established in some treatment sites once exotic plant species (e.g., torpedograss) are pushed back by herbicides (p.10-55). As the authors also acknowledge, it appears to be a "question of balance" – floating-leaved plants such as *Nymphaea* can become problematic if they proliferate to the point that they cover the surface of the water and cut light and oxygen for the aquatic life below.

The high water levels and high suspended sediments after the hurricanes in 2004 and 2005 caused extreme hydrologic shifts and reduced light availability in near-shore and littoral zones that led, in turn, to a significant decline of submersed aquatic vegetation (SAV). However, the desirable water clarity target for SAV recovery was not clarified.

Fish populations are not only important aquatic resources, but may also directly and indirectly control phytoplankton growth. Fish received little attention in this chapter, such as impacts of planktivorous fish on the lake food web following the hurricanes. Once the lake begins to clear, high biomass of planktivorous fish could reduce water clarity by decreasing zooplankton biomass, resulting in an increase in phytoplankton.

Water Quality Modeling

Very little summary background information was provided about modeling approaches used for Lake Okeechobee. The modeling results were described to indicate that the hurricanes will have long-term impacts on the sediment transport, sediment resuspension, and nutrient exchange between the lake "bed" (bottom sediments) and the water column. Do the models being used to project long-term responses of the lake include provision for a dynamic sedimentation coefficient, and possible interactions with declining calcium and increasing sulfate? This seems a potentially important point with respect to long-term prospects for restoring the Lake.

Conclusions

1. This chapter presents a helpful synopsis of activities by the District in WY2006 for the Lake Okeechobee Protection Program. It provides a comprehensive update of Lake and watershed conditions during WY2006, focusing primarily on phosphorus loading and water levels.

2. This is the third year that the SFER has been expanded to include coverage of Lake Okeechobee, as a major improvement to the Report.

3. The hydrologic and TP loads imposed on the lake in 2004-2005 from hurricanes have provided a unique opportunity to study the impacts of short-term major loads to this large shallow freshwater ecosystem, and the downstream impacts associated with that loading as well as the major disruption to the biota (especially SAV) and sediments from currents generated during the seiche that was created by the hurricane winds.

Recommendations

1. This chapter should include additional data from the monitoring program for inputs of suspended solids, nitrogen (inorganic and organic forms), sulfate, and herbicides/pesticides to Lake Okeechobee.

2. The models being used to forecast eutrophication and recovery of Lake Okeechobee from hurricanes should be briefly described, including information about incorporation of changing sedimentation coefficients and internal phosphorus loading.

3. Research is needed on sulfate reduction in the Lake and its role in mobilizing phosphate, as a potentially important biogeochemical process influencing phosphorus availability and eutrophication.

4. A description should be added about the extent of residual soil phosphorus accumulation in the watershed, the projected influence of this problem on the Lake's water quality, and the model(s) used to make this projection.

5. Information should be added about the severe suspended sediment problem in the Lake, the model(s) used to make this projection, and the analysis of feasibility for sediment management to accelerate improvements in water quality.

6. Influences of fish on the lake food web should be examined.

7. Additional information should be included about exotic species in the Lake (for example, maps of major exotic species distributions, and descriptions of potential impacts on beneficial native species).

8. The panel recommends, as in its review of the *2006 SFER*, that this chapter provide more integration with other chapters. The Kissimmee River is a major source of water and chemical constituents to the Lake, which in turn supplies water and materials to the EPA, the St. Lucie

Estuary, and the Caloosahatchee Estuary. The impacts of the upper watershed on the Lake, and of the Lake on the St. Lucie and Caloosahatchee Estuaries and the EPA, should be described. The chapter should also include a description of plans to account for potential impacts on the Lake from urban/suburban development affecting the upper watershed.

CHAPTER 11: KISSIMMEE RIVER RESTORATION AND UPPER BASIN INITIATIVES

This chapter focuses on three major topics: First, it summarizes major initiatives of the District's Kissimmee Division in the Kissimmee watershed. The major goal of the District under the Kissimmee River Restoration Project (KRRP) is identified as restoring ecological integrity to the Kissimmee River and floodplain ecosystem through a long-term management plan for the Kissimmee Chain of Lakes (KCOL), while retaining the existing level of flood control in the watershed as a whole. The major initiatives under KRRP (KRREP, KBMOS, KRHRP, KCOL, and LTMP) and initiative goals are clearly described.

Second, the Chapter nicely summarizes the historic and present hydrology of the Kissimmee watershed, including consideration during WY2006 of operational modifications of the Zone B regulation schedules (pertinent especially to Lake Tohopekaliga and East Lake Tohopekaliga) to supplement releases from S-65 and replace some of the water being released from Lakes Cypress, Hatchineha and Kissimmee, and to improve nesting success of the federally endangered Everglades snail kite in the Upper Basin. The operational modifications were imposed on a one-year experimental basis. Efforts are proceeding to consistently achieve a desired (slow) rate of stage recession; three recession events occurred in WY2006, but this was a year of extreme wet vs. extreme dry conditions, and only one event approached the criteria for a recession event that would create desirable hydroperiods for floodplain wetland vegetation. The authors point out that these findings demonstrate the importance of implementing a planned headwaters revitalization effort, which will include a new schedule to raise the high pool stage 1.5 ft and create considerable additional water storage, thereby reducing the need for release of extremely high discharges during/after flood events and enabling maintained releases during dry seasons.

Third, the Chapter summarizes a subset of evaluation projects that was monitored in WY2006, and ongoing development of an excellent Conceptual Ecological Model (CEM) of a "generalized KCOL lake" with performance measures and indicators that are being developed to, in turn, guide development of the KCOL LTMP. An accompanying comprehensive data collection and monitoring plan is also being developed. Some highlights of WY2006 included initiation of the second phase of canal backfilling, and responses assessed in the Phase I area that was consistent with restoration expectations. A quality conceptual ecological model was completed, and additional modeling tools and performance and indicator measures are under development.

In general this chapter is well written. The authors responded to various concerns from previous review, for example, with inclusion of metric as well as English units, and inclusion of tables of draft performance measures and indicators along with accompanying, generally well-explained rationale. In addition, a detailed assessment was provided of modifications to Zone B discharges in Lakes Tohopekaliga and East Tohopekaliga. The background material included about the Kissimmee region is very useful for understanding past anthropogenic effects. Explanation of the water cycles and measures of success of restoration are excellent, and help the reader put the work into perspective. The conceptualization of parameters affecting this region, such as the effect of hurricanes on dissolved oxygen, is valuable and can serve as a model for adaptive management. This is one of the few restoration projects that has built in evaluation as a part of the project, including the establishment of performance measures. Establishing evaluation programs is

extremely important to the overall KRRP, and the care given to this aspect should be commended.

Additional Comments and Questions

Use of wading birds as an indicator is a sound approach because they integrate ecological conditions. The data presented indicate that restoration for foraging wading birds suggest that restoration is proceeding well, although it was unclear as to whether there are appropriate nesting sites for colony occupation.

It was unclear as to whether dissolved oxygen sags (concentrations in dark periods) are considered as a PM (Table 11-1, and lines 632-637) of the KRREP, in addition to (or instead of) mean daytime concentrations. Have there been efforts to determine whether dissolved oxygen sags are associated with higher phosphorus release?

What steps are being taken to identify the sources for increased P levels at the southern end of Lake Kissimmee (lines 782-783, 798-800)? The authors' response to this question was unclear.

Hydrilla was only briefly mentioned (e.g., Table 11-5), and information about interactions between water level management and *Hydrilla* control was not included. How serious of a problem was *Hydrilla* abundance in WY2006, and what are expectations about its role in the KRRP?

A key element in evaluation of the KRRP is to assess the effects of restoration methods: that is, how does the methodology used in the restoration impact the system?

Will the mercury information for the Kissimmee system be included in the overall evaluation of mercury in the Everglades?

The chapter discussion of adaptive management suggested a "moving management target". How can the general citizenry judge management progress toward goals if goals may have to be adapted (changed) in recognition of improved understanding? How will accountability of KRRP be evaluated? In response to this question, the chapter authors noted that "targets do not move". If not, then what does "adaptive management" mean for the Kissimmee system? – How is it defined, and how can it be implemented?

It was unclear as to how the management of the Kissimmee relates to management of the rest of the Everglades system. In what ways are the management options coordinated, and how do The actions in the Kissimmee affect Lake Okeechobee and the rest of the Everglades? Is it possible to incorporate the water quality improvement goals of KRRP with the water quality data and information presented in Chapter 3 via graphs/maps showing water quality changes over all of South Florida? The discussion of KRRP suggests that data collected for other purposes are being used for KRRP evaluation purposes. Is this correct, or are data collected directly for KRRP purposes? If the former is the case, the panel is concerned about the consistency of data and information over time and space in tracking restoration progress.

Conclusions

1. Chapter 11 provides an update of activities within the Kissimmee watershed during WY2006, an overview of watershed hydrology, and impacts of the 2005 hurricanes. As a major source of water, pollutants and other materials to Lake Okeechobee and downstream ecosystems, activities and conditions in the Kissimmee basin can have significant effects throughout South Florida. Therefore, the panel considers it very important that the Kissimmee River and upper watershed are included within the 2007 SFER.

2. The chapter provides a generally excellent overview of historical conditions and work during WY2006.

3. The conceptualization of parameters affecting this region, such as the impacts of hurricanes on dissolved oxygen, is very useful and can serve as a model for adaptive management.

4. The evaluation programs established by the District are both commendable and extremely important to overall success of the KRPP.

5. The application of adaptive management in the Kissimmee system, and the extent to which management of the Kissimmee are coordinated and integrated with management of the rest of the Everglades system were not clear.

Recommendations

1. Chapter 11 of the 2007 SFER should be restructured to add an initial outline of the chapter's contents.

2. The description of hurricane effects should include information about how such impacts can be mitigated.

3. Explanation should be added about considerations to ensure that restoration provides sufficient nesting sites for colony occupation by wading birds.

4. The use of data on dissolved oxygen sags in the PM for that parameter should be clarified, and the extent to which dissolved oxygen sags promote higher phosphorus release from sediments should be examined.

5. Increased phosphorus levels at the southern end of Lake Kissimmee are, as yet, unexplained and could confound management goals. The steps being taken to identify the sources of this elevated phosphorus should be clarified, and progress assessed in the 2008 SFER. A Ph target should be added to the restoration expectations.

6. The Kissimmee and its watershed are the headwater region for the Everglades and, as such, are of vital importance to Everglades system functioning. This chapter requires clarification of how adaptive management is applied to the Kissimmee River and upper watershed, and the extent to which management activities in the Kissimmee are integrated with management for the

rest of the Everglades system. Clarification should include explanation of how the phosphorus and mercury information will be included as part of the overall Everglades evaluation of mercury contamination.

CHAPTER 12: MANAGEMENT AND RESTORATION OF COASTAL ECOSYTEMS

This Chapter targeted the District's progress in programs and projects for selected coastal ecosystems in South Florida, considered as eight systems in WY2006: (1) the Southern Indian River Lagoon and the St. Lucie River and Estuary; (2) the Loxahatchee River and Estuary; (3) Lake Worth Lagoon; (4) Biscayne Bay; (5) Florida Bay; (6) the Caloosahatchee River and Estuary, and southern Charlotte Harbor region (considered in combination this year, rather than separately as last year); (7) Naples Bay; and (8) Estero Bay.

This is the third year that the coastal ecosystems have been included in the *SFER*. Their inclusion is fitting because of their value as overall endpoint indicators of progress in the District's CERP and RECOVER efforts. A major goal of the District in managing the coastal ecosystems was identified (p.12-1), "to manage freshwater discharges to South Florida's estuaries in a way that preserves, protects and, where possible, restores essential estuarine resources. In addition, three major issues causing cumulative impacts on the Coastal Ecosystems were identified as disruption of the natural magnitude and timing of freshwater discharges, increased inputs of nutrients and other pollutants, and continued loss of critical ecosystem habitats and biota.

Several aspects of this comparatively young program are already well developed, especially efforts to describe the hydrology and salinity regimes of the estuaries through both intensive monitoring and modeling. The District also has targeted certain valued ecosystem components (indicator species, as seagrasses and eastern oysters) that are being monitored to varying degrees in the eight ecosystems as targets for restoration. In addition, the District, together with partner agencies, is engaged in various projects designed to stabilize hydrology, reduce pollutant loads, and restore habitat, and make progress in many needed planning activities.

In consideration of the enormous scope of this chapter, the previous year's Review panel recommended that the writing be completely restructured to focus in depth on one coastal ecosystem per year while succinctly summarizing goals and activities for that year in each of the other ecosystems. A more comprehensive overview was to be provided at five-year intervals. The authors were responsive to this counsel, but additional management and oversight in this chapter is needed. Consistency was lacking in a common presentation template that could be applied to the seven more briefly described systems, and the chapter did not clearly describe the District's main activities in each of Coastal Ecosystem during WY2006. Some websites to which readers were referred could not be accessed, or appeared to contain only dated information. The emphasized Loxahatchee system was mostly described within two appendices (more than 600 pages in length) that ranged in quality from a preliminary study (Appendix 12-1) to a finalized restoration plan for a portion of the system (Appendix 12-2, ~470 pages). It was not possible to evaluate the brief information about the Loxahatchee presented in the chapter without reading the latter Appendix. This approach falls short of achieving the purpose of the chapter, to describe goals and activities in the Coastal Ecosystems during WY2006. This shortcoming is unfortunate because, as shown by Appendix 12-2, the District accomplished excellence both in science and in management approaches within the system of focus for WY2006, likely extending to other Coastal Ecosystems - but the chapter does not enable such evaluation. Thus, although progress was made in streamlining the chapter, the panel views it as still a work in progress toward achieving appropriate structure and content.

Additional Comments and Questions

Loxahatchee (considering information from Chapter 12 and Appendix 12-2)

- In WY2006 the District culminated nearly a decade of effort in finalizing the Restoration Plan for the Northwest Fork of the Loxahatchee River and Estuary. While briefly described in Chapter 12, accompanying Appendix 12-2 presents the solid science and step-by-step approach that was used to develop this Plan. The Plan is based upon development of restoration flow alternatives and selection of a Preferred Restoration Flow Scenario (PRFS). A major assumption is that the additional water needed to achieve the PRFS would be available. The means to accomplish the PRFS are still being developed and will require many actions. If the Preferred Restoration Flow Scenario can be achieved, additional efforts would be important next steps for improving the estuarine system.
- Missing from the Loxahatchee section in Chapter 12 was clarification, beyond the Northwest Fork, of how the District plans to address major issues for this Ecosystem – the important "next steps".
- The monitoring frequency and number of sites for oysters, an important indicator, during WY2006 were not clarified in the chapter, and it was also unclear as to why a monitoring station apparently has not been included in the most extensive oyster bed (southern portion of the central island).
- Flow gauges are operational apparently in only 7 of the 12 sub-basins of the Northwest Fork. This would seem to be a serious problem that would limit the planning and modeling for this system.
- The water quality monitoring also seems inadequate, considering that the Loxahatchee system was emphasized in District activities/reporting for WY2006, and that the District identified increasing inputs of nutrients and other pollutants as one of three major impacts on the coastal ecosystems. Many segments of the Loxahatchee system have been described as degraded by nutrient over-enrichment and other pollutants. For example, the aquatic preserves and JDSP are Outstanding Florida Waters and have the highest standards for protection of water quality. Yet, monitoring for various standard parameters (for example, nutrients) presently is sparse (more than 40 locations but bimonthly or less, depending upon the station). As another example, sediment loading to Cypress Creek and the Northwest Fork were identified as one of four major water resource problems, but there was no mention (in the chapter or appendices) as to whether/ where suspended sediments are monitored more frequently than bimonthly.
- Mangroves were described as capable of surviving in freshwaters, so no declines in mangrove abundance were anticipated, but would mangroves be significantly stressed in such environments?
- Regarding effects of various parameters on larval fish density and species composition, what factors are being considered besides changing water levels and salinities?
- The District plans to collect water quality data to evaluate potential linkages with seagrass and macroalgal abundance. Will nutrients be included? Nutrients are known to be a major factor influencing both seagrasses and macroalgae.
- A Digital Evaluation Model under development will provide details of micro-relief that are described as critical for determining water inundation in the floodplain area of the Northwest Fork. What are the District’s expectations as to how this model will alter conclusions about optimal flows?

- Because most emphasis has been directed toward balancing freshwater flows for improved growth of floodplain vegetation, the conditions created for the eastern oyster indicator are acknowledged as generally sub-optimal. How well will the selected flow regime (Appendix 12-2, p.8-20) approach the critical flow of 230 cfs needed for oysters at RM 4.13 (p.7-54)?
- The oyster indicator is an important indicator for the Loxahatchee, including the Restoration Plan for the Northwest Fork. Yet, Chapter 9 describes invasive green mussels as posing a serious threat to continued survival of the eastern oysters in the Loxahatchee as well as the St. Lucie and other estuaries. There is no mention in Chapter 12 or its appendices as to how this problem will be accounted for in evaluating PMs for oyster restoration.

Other Coastal Estuaries

- The cyanobacteria bloom that developed in Biscayne/Florida Bays was discussed with respect to the relative impacts of road construction versus hurricanes on phosphorus and chlorophyll *a* concentrations. The data offer an opportunity for further evaluation of sources of phosphorus that supported the bloom.
- Although seagrasses are an important indicator targeted by the District for the St. Lucie Estuary, there is no salinity recorder for seagrass areas near the mouth of the estuary. Are there plans to add an instrument there?
- Considering that the model for Florida Bay (lines 882-892) calculates nutrient flows, are nutrient flows factored into predicting seagrass abundance? The writing indicates that the model only focuses upon predicting effects of salinity on seagrasses. How are interactive effects of salinity and other variables considered? The 2006 SFER mentioned the Florida Keys; does the District plan to eventually include them for emphasis?
- Considering the large distance between stations 4 and 5 in the Caloosahatchee Estuary (p.12-45, Figure 12-27), should another station be added? Was hydroacoustic sampling of SAV conducted at site 4 and if not, why not (line 1105)? It is unclear if/when the inoperable Sanibel recorder in an important sampling site will be replaced (Figure 12-25).

Conclusions

1. The major goal of the District and other lead/collaborating agencies in managing the eight Coastal Ecosystems is, insofar as possible, to manage freshwater discharges (timing of delivery, quantity and water quality) so as to preserve, protect and, where possible, restore essential estuarine resources.

2. Three major impacts on the Coastal Ecosystems are disruption of the natural magnitude and timing of freshwater discharges, increased inputs of nutrients and other pollutants, and continued loss of critical ecosystem habitats and biota.

3. Several aspects of this comparatively young, complex program are already well developed, especially efforts to describe the hydrology and salinity regimes of the estuaries through monitoring and modeling.

4. The District has targeted certain valued ecosystem components (VECs or indicator species, as seagrasses and eastern oysters) that are being monitored to varying degrees in the Coastal Ecosystems as targets for restoration. Sound rationale is given in Appendix 12-2 (example, Loxahatchee) for emphasis on these organisms as VECs.

5. The District, together with partner agencies, is engaged in various projects designed to stabilize hydrology, reduce pollutant loads, and restore habitat, and in many needed planning activities.

6. In WY2006 the District culminated nearly a decade of effort in finalizing the Restoration Plan for the Northwest Fork of the Loxahatchee River and Estuary. Accompanying Appendix 12-2 presents the elegant, solid science and step-by-step approach that was used in developing this management plan. Overall, the Plan is excellent in quality. The authors acknowledge, however, that emphasis was on restoration of floodplain vegetation in freshwater and slightly brackish segments – thus, the conditions created if the PRFS can be achieved will be sub-optimal for eastern oysters, an important targeted indicator species of estuarine health. In addition, invasive green mussels (described in Chapter 9, rather than Chapter 12) pose a major threat, apparently unaccounted for in the Plan, to continued survival of eastern oysters in the Loxahatchee and other estuaries.

7. Description of these eight coastal ecosystems, and the District's actions and plans in managing them, is a massive subject for one chapter. Additional management and oversight of this chapter is needed to strengthen its utility for evaluating the District's goals and activities in the coastal ecosystems for WY2006.

Recommendations

1. The panel recommends inclusion of an overview in the Introduction of Chapter 12, with charts, tables and supporting text (as exemplified in Chapter 1A), to clarify the District's plan in managing the eight coastal ecosystems. Clarification of management strategies and quantifiable targets will allow the District to take greater advantage of opportunities to optimize use of estuaries as excellent "integrative natural barometers" in evaluating the overall success of watershed management activities. In addition, the Chapter should reflect consideration in the District's management approach (at least in an abbreviated way, through literature consulted) of efforts in other Gulf Coast and Atlantic states that have (i) developed, implemented and evaluated coastal zone management methodologies, and (ii) shown responsiveness to legislative mandates to determine freshwater inflow requirements into the future, in the face of competing municipal, industrial and irrigation uses of water.

2. The panel recommends that the District continue to develop plans to take advantage of opportunities to coordinate work on South Florida's estuaries.

3. The panel recommends adoption of a common presentation template for each of the Coastal Ecosystems, including identification of major issues within each, summary information on the explicit restoration goals (in numerical terms where possible) and supporting rationale, invasive species, and a table of information on lead and collaborating agencies' activities (new projects/progress, and continuing projects/ progress).

4. The panel recommends inclusion of a separate section on EACs and VECs following the Introduction, including clarification by ecosystem of where these criteria have been developed/planned/in progress. This section should include brief definitions and rationale for selection of the targeted VECs, and tables of the range of environmental conditions where the indicator species occur, thrive, and are stressed (e.g., including salinity, nutrients [TP, inorganic N forms, TN], and light for seagrasses and the freshwater/brackish species,

Vallisneria americana; salinity and dissolved oxygen for eastern oysters). Published descriptions of data from other states that border the Gulf of Mexico and the Atlantic should also be considered in modifying the summary tables, e.g., for freshwater inflow requirements for commercial and other valued species of finfish and shellfish, salinity tolerances and optima, and water quality modeling to determine freshwater flows needed to meet those optima.

5. The panel recommends that this chapter contain tables/diagrams that summarize the main programs, entities, and integrative efforts involved in the coastal ecosystem of focus (for WY2006, the Loxahatchee restoration effort). The map of the coastal ecosystems should further clarify the boundaries of each.

6. The panel recommends strengthened consideration of water quality data collection (parameters, frequency of sampling) at key or core stations in each coastal ecosystem, and clarification of how water quality data other than salinity will be incorporated into modeling efforts to understand and predict restoration success. Certain parameters, such as inorganic nitrogen, can contribute to the degradation of these coastal ecosystems and compromise their recovery even when problems with hydrology can be corrected.

7. The panel recommends that for coastal ecosystems in highly urbanized areas, the District should encourage development of a plan to examine the history of eutrophication (e.g., via examination of sediment cores), and a plan to examine the history of toxic substance accumulations in the sediments and impacts on the benthic food webs.

8. The panel recommends that additional insights be gained about the role of phosphorus in supporting the cyanobacteria bloom that developed in Biscayne/Florida Bays, by using the available data to assess (i) the mass of total phosphorus in the Sounds during the period of elevated total phosphorus concentrations; (ii) the mass of total phosphorus that could be derived from the cutting and mulching of mangrove trees, soil tilling and soil stabilization in the period immediately following the operation, to estimate the leaching potential; and (iii) the mass of total phosphorus that could have been released by the top 2-5 centimeters of the Sounds' sediments being resuspended and stirred by waves in these shallow systems when the hurricanes moved through. This information can be used, in turn, to assess which estimated total phosphorus mass better approximates the mass of total phosphorus that was empirically measured in the Sounds during the period of elevated total phosphorus concentrations.

9. The panel recommends that exotic invasive species (major taxa and issues in the coastal ecosystems) be described in more detail in this chapter, considering that Chapter 9 emphasizes terrestrial and freshwater species. Exotic species represent a compelling major threat to the District's restoration efforts. As exemplified by the eastern oyster/green mussel situation in the coastal ecosystems, exotic estuarine/coastal marine species should be carefully considered in development of restoration management plans, including modeling efforts designed to evaluate performance measures for indicator species.

APPENDIX 12-1: RIVERINE AND TIDAL FLOODPLAIN VEGETATION OF THE LOXAHATCHEE RIVER AND ITS MAJOR TRIBUTARIES

The purpose of this study was to provide a description of the baseline/long-term floodplain vegetation monitoring program that the District (working with the FDEP Park Service District) has established in 2003 for the Loxahatchee River including the North and Northwest Forks and major tributaries. The scope of the study was to (1) determine the composition and structure of floodplain plant communities and their associated hydrological characteristics; (2) identify indicator forest communities; (3) identify key soil types that are indicative of the various forest types; and (4) assess the impact of invasive exotic plants on this system. The baseline information will be compared with data over time to determine whether additional freshwater flows sent down the river system are improving or impairing the structure of the vegetative communities and/or groundwater, to verify the success or failure of established restoration performance measures (as was done in Appendix 12-2 for the Northwest Fork of the Loxahatchee). Additional data are to be collected at 6-year intervals for canopy communities, and at 3-year intervals for groundcover/shrubs. The program is important; it has provided valuable information on the floodplain communities of the Loxahatchee. Figure 11 nicely depicts the overall conceptual framework.

Major enhancement/restoration issues identified included; (1) minimal post-development inundation of the floodplain swamp community, (2) insufficient inundation to discourage intrusion of transitional, upland and exotic plant species, (3) displacement of younger canopy species into multiple forest types, and (4) insufficient inundation for aquatic life to use floodplain swamp habitat. The study approach, methodology used to select transect locations and to identify and characterize the vegetation, and the analysis of the data are generally adequate to address the purpose and scope of the study, except in the tidal reaches where additional transects are needed. This study is in its early stages and thus far statistical community analyses have not been included, although PC ORD analysis is planned. The baseline data generally were adequate for subsequent use to determine the minimum inflows needed to sustain the indicator communities. Figure 11 nicely depicts interrelationships among projects used to evaluate the floodplain plant communities, and Table 6 clearly summarizes hydrological conditions, soil textures and dominant canopy species of identified forest types in the floodplains. The supporting appendices to this Appendix include a very interesting historic timeline and other helpful information.

Additional Comments and Questions

The Executive Summary of the Appendix was unclear about how the vegetation study was conducted (major reaches considered, major vegetation types, determination of ranks and importance values). It was also unclear that the study basically consisted of two components: in 2000, a comparison of aerial photos taken in 1940 vs. 1985; and in 2003, a transect study with comparison to some transects that were also analyzed in 1983-4 and 1993-4.

The background history of studies is inconsistent in providing information about the number of plots, plot size, and number of transects.

Methodological information was not confined to the Methods section but, rather, occurred throughout the Appendix. The status of water quality in the study area was not clearly described (e.g., p.73).

There is no mention of freshwater submersed aquatic vegetation (SAV). Has freshwater SAV been previously abundant in the Northwest Fork? What is its status at present? Does the District plan to include freshwater SAV in its future efforts?

What was the basis for the planned sampling frequencies for canopy communities and groundcover/shrubs?

How were ranks and importance values calculated?

When was the DEM modeling effort initiated, and when is the projected completion date?

Of the 10 transects and 138 plots included in the study, about half of the plots were in the Riverine reach, 37% in the Upper Tidal, and 14% in the lower tidal; moreover, only 1 transect was lower tidal.

Is work planned to assess the impacts, as well as the occurrence, of exotic species on the floodplain communities?

In some cases, only one to a few individuals of a species were measured for dbh. Can the value of such data be clarified, since such information is not statistically viable?

Conclusions

1. The Appendix is somewhat confusingly organized (for example, the study area description and methods information), and some additional basic information on historic studies and methods for the present study is inconsistently presented or missing.

2. The transect design is unbalanced for statistical inferences, particularly from the standpoint of obtaining information about the LT communities.

3. Although analysis of impacts of exotic species was identified as a major component of the project scope, only the occurrence of major exotic species was assessed.

Recommendations

1. The panel recommends that the Appendix should be restructured to include a background study area description and methods information within one main section. A glossary of acronyms should also be added. A table summarizing information on background historical studies should be added.

2. The panel recommends that explanation should be added to address how the District plans to resolve the identified major enhancement and restoration issues for the Loxahatchee.

3. The panel recommends that PC-ORD and other tools for community analysis be applied to the dataset to gain further insights about factors controlling species groupings and community structure, such as TWINSPAN (two-way indicator species analysis), DECORANA (detrended correspondence analysis), and CLUSTR (cluster analysis).

4. The panel recommends that explanation should be added about how ranks and importance values were calculated, since these evaluations are critical components of the study.

5. The panel recommends that supporting rationale should be added for certain information, such as measurement of only one to a few individuals within a population for dbh, the basis for the planned sampling frequencies for canopy communities and groundcover/shrubs, and omission of mention of submersed aquatic vegetation.

6. The panel recommends addition of a section that summarizes what was found about exotic and native invasive species, and what is known about their impacts on the floodplain plant communities of the Loxahatchee. This information is important in establishing the reference conditions.