

Chapter 12: Integrated Strategy To Achieve Water Quality Goals By 2006

Gary F. Goforth

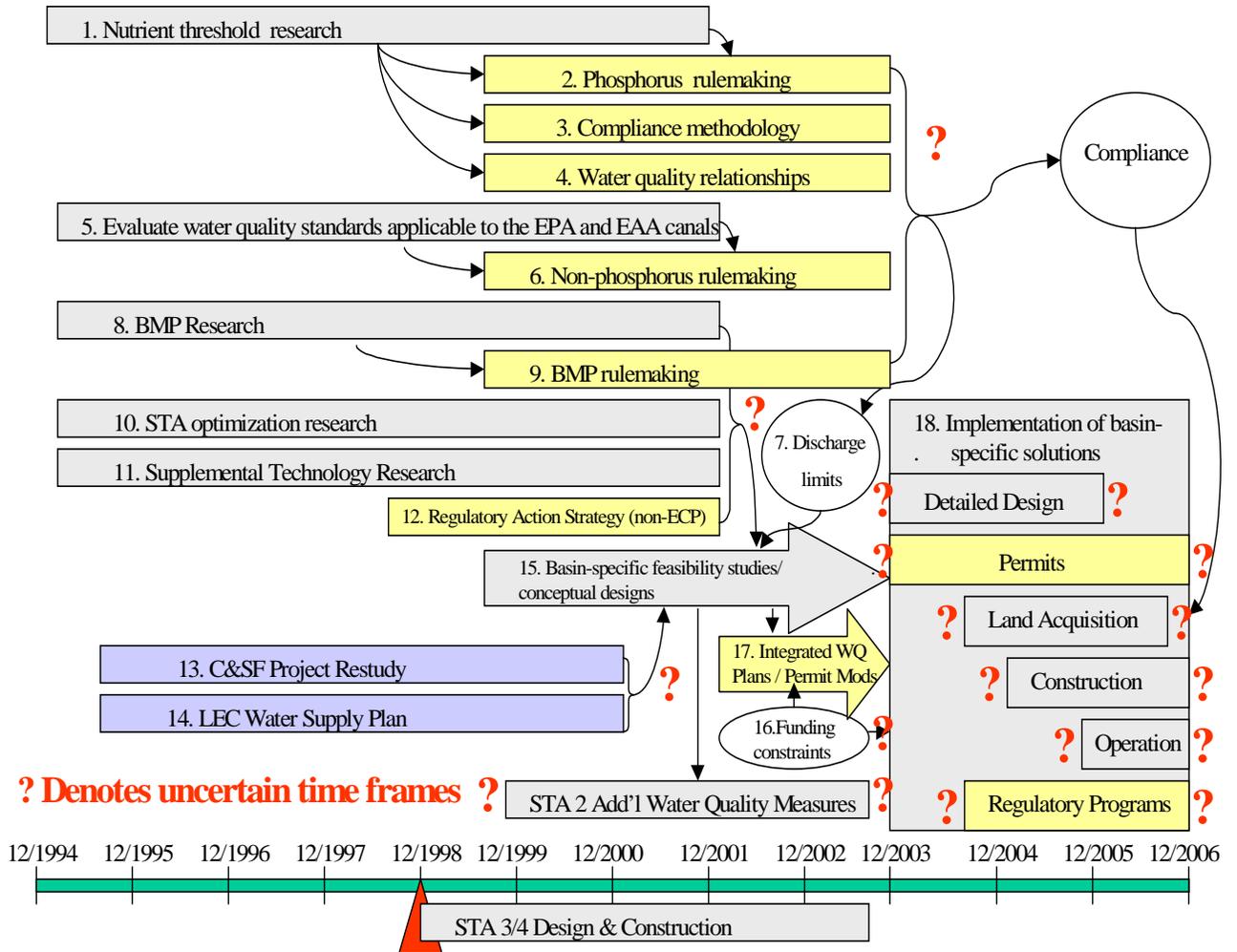
Summary

The South Florida Water Management District (District), in partnership with other agencies and private landowners, is aggressively and successfully achieving interim milestones towards restoration of the Everglades ecosystem. Concurrent with the construction of over 47,000 acres of treatment wetlands, the District and other groups are conducting water quality research, ecosystem-wide planning, and regulatory programs to ensure a sound foundation for science-based decision-making. Florida's 1994 Everglades Forever Act (Act) establishes both interim and long-term water quality goals to ultimately achieve restoration and protection of the Everglades Protection Area. While the Act does not specifically designate two distinct implementation phases, it recognizes that additional measures may or may not be required to achieve compliance with long-term water quality standards. For purposes of this document the District has designated the program designed to achieve the interim goal as "Phase 1" and has designated the long-term program as "Phase 2." Phase 1 encompasses those activities currently underway to reduce phosphorus concentrations to approximately 50 parts per billion (ppb), and includes the Everglades Construction Project and the Everglades Agricultural Area best management practices. The goal of Phase 2 is to combine point-source, basin-level and regional solutions in a system-wide approach to ensure that all waters discharged to the Everglades Protection Area are achieving water quality goals by December 31, 2006. With respect to nutrients, the Phase 2 goal is to reduce nutrient discharges to levels that do not cause an imbalance in natural populations of aquatic flora or fauna.

This chapter describes how numerous research, planning, regulatory and construction activities will be integrated to ensure that implementation decisions incorporate the best available information: true adaptive management in practice. Individual project management plans have been developed for each of these activities (District and DEP, *Everglades Program Management Plan*, 1997). This chapter also identifies the relationships between these concurrent activities to achieve the water quality and hydropattern objectives of Everglades restoration, identifies scheduling conflicts between legislative and regulatory mandates, and identifies the key gaps in the current Phase 2 information base. The interrelationship between these activities and their anticipated time frames are diagrammed in Figure 12-1.

Considering the number and complexity of the many activities required to achieve the long-term water quality goals, the 2006 time frame established by the Act is very ambitious. Delays in the timely completion of these activities, many of which are outside the control of the District, may result in unintended delays, despite the best efforts of the District. Acceleration of necessary research before the December 31, 2001, deadline may be difficult because biological research inherently requires one or more growing seasons to evaluate performance. In order to meet the 2006 deadline, the District may be required to make recommendations for Phase 2 based on incomplete science and engineering information, which carries associated environmental and economic risks. Future annual updates to this peer-reviewed Report will provide greater details on the potential obstacles and other constraints for achieving Phase 2 goals, as well as identify potential remedies.

Figure 12-1. Timeframes for critical activities to meet the water quality goals identified in the Everglades Forever Act.



Long-Term Phosphorus Criterion for the Everglades

Concurrent efforts are underway by District, federal and agricultural industry researchers to provide data for the DEP to establish a Class III numeric water quality criterion for phosphorus in the Everglades Protection Area. The objective of this research is to quantify the specific threshold levels of phosphorus above which undesirable changes occur to the native Everglades populations of aquatic flora or fauna. The DEP established an Everglades Technical Advisory Committee and conducts peer-review of the data to ensure that these research efforts are well coordinated. While the comprehensive research effort will be finished no later than December 31, 2001, research in discrete areas will be completed sooner. Specifically, research in WCA 2A is substantially complete, and District research in the A. R. M. Loxahatchee National Wildlife Refuge (Refuge) should be completed by April 2000. Research in WCA 3A has yet to begin, and establishment of a numeric phosphorus standard for WCA 3A may require using data from other areas of the Everglades unless site-specific information becomes available. Even prior to completion of the entire research effort, the DEP will initiate rulemaking to establish the numeric Class III water quality criterion for phosphorus. Preliminary workshops are anticipated as early as May 1999 and the DEP's current schedule calls for initiating rulemaking by December 2000, a full year ahead of the statutory deadline. If rulemaking is not completed by December 31, 2003, the Everglades Forever Act establishes a default phosphorus criterion of 10 ppb. The phosphorus criterion, whenever adopted, shall supercede the 10 ppb default otherwise established by the Act, but shall not be lower than that natural background conditions of the Everglades Protection Area and shall take into account spatial and temporal variability. Concurrent with rulemaking, the method for determining compliance with these criteria will be finalized in accordance with the framework described in the Everglades Forever Act:

Compliance with the phosphorus criterion shall be based upon a long-term geometric mean of concentration levels to be measured at sampling stations recognized from the research to be reasonably representative of receiving waters in the Everglades Protection Area, and so located so as to assure that the Everglades Protection Area is not altered so as to cause an imbalance in natural populations of aquatic flora and fauna and to assure a net improvement in the areas already impacted. (reference Section 373.4592(4)(e)3, Florida Statutes)

Additionally, the relationship between waters entering the Everglades with the resulting water quality in the Everglades will be developed. These relationships will be used to establish discharge limits for waters entering the Everglades Protection Area. These upstream discharge limits will serve as the Phase 2 phosphorus targets for long-term water quality solutions. As shown in Figure 12-1, establishing the Class III phosphorus criterion and related discharge limits is critical in determining and implementing Phase 2 solutions by December 31, 2006. In advance of these determinations, the District is using a planning-level estimate of 10 ppb for discharge limits for all tributaries to the Everglades Protection Area. If the final discharge limits are significantly different from 10 ppb, the optimal Phase 2 solutions may be altered, with significant cost differences and other implications. Additional details on the nutrient threshold research are provided in Chapter 3.

Water Quality Standards Other than Phosphorus

The Everglades Forever Act requires the District and DEP to address not only phosphorus concerns in the Everglades, but to evaluate other water quality standards applicable to the Everglades Protection Areas and the Everglades Agricultural Area canals. Paragraph 4(e) of the Act requires that DEP's evaluation include the state's antidegradation standards and EAA canal classification, and directs DEP to recognize by rulemaking existing beneficial uses of the EAA conveyance canals. Should the evaluation indicate that revised standards are necessary, additional rulemaking would be required to revise the standards. Although the Act does not set a specific deadline for this rulemaking, the requirement for the District to submit an integrated plan by December 31, 2003 to address all water quality parameters suggests that all related rulemaking should be completed by December 31, 2003. As shown in Figure 12-1, completion of this additional rulemaking is in the critical path for determining and implementing Phase 2 solutions by December 31, 2006. If rulemaking for these standards is not completed by December 31, 2003, when the District must submit its Phase 2 plans, the District will be required to make recommendations for Phase 2 based on incomplete science and rulemaking, with associated environmental and economic risks. Additional details on these water quality data evaluations are provided in Chapters 2 and 7 of this report.

Everglades Agricultural Area Best Management Practices

The reduction of phosphorus discharged from farms, towns and other land uses within the Everglades Agricultural Area (EAA) has been effectively implemented through best management practices (BMPs). An EAA-wide target of 25% load reduction compared to the May 1979 - April 1988 pre-BMP period was established by District rulemaking. Over the last three years, cumulative phosphorus loads from the EAA farms, towns and other land uses have been reduced by fifty-five (55) percent as compared to the calculated load that would have occurred during the pre-BMP period (adjusted for hydrologic variability). Phosphorus concentrations have also been reduced significantly from the pre-BMP period to approximately 100 ppb, and while this is a positive improvement, additional phosphorus reduction downstream in the regional stormwater treatment areas (STAs) is necessary in order to achieve the Act's interim goal of 50 ppb. The Act provides economic incentives for farmers to continually exceed the minimum 25% basin load reductions through tax credit incentives. The agricultural industry, with support from state and federal agencies, is continually investigating additional measures to enhance the existing BMP programs. The District's BMP rule (40E-63) has been amended to implement a comprehensive program of research, testing and implementation of BMPs which addresses all water quality standards that are not being significantly improved by the STAs and the current levels of BMPs. Enhanced BMPs may play a more important role in the final mix of STAs, supplemental technologies and BMPs used to achieve compliance with water quality standards than was apparent when the Act was developed in 1994. If proven cost-effective, additional BMPs could be implemented to reduce the overall costs and scale of Phase 2. Additional details on the BMP programs are provided in Chapter 5.

The Everglades Construction Project

In accordance with the direction and schedules of the 1994 Everglades Forever Act and the proposed modifications to the federal Everglades Settlement Agreement, state and federal agencies are currently engaged in the design, permitting, construction and operation of the Everglades Construction Project (ECP). The primary nutrient removal components of the ECP are six (6) large constructed wetlands, also known as Stormwater Treatment Areas (STAs), encompassing over 47,000 acres. A prototype STA, the 4,000-acre Everglades Nutrient Removal project, has removed approximately 63 metric tons of phosphorus since August 1994, and has maintained an average discharge concentration of 22 ppb. This prototype STA was initiated voluntarily by the District prior to the 1988 federal lawsuit to demonstrate the potential capability of a constructed wetland to remove nutrients from runoff entering the Everglades. While proceeding expeditiously with the Everglades Construction Project, the District has incorporated the best available information from on-going research and monitoring programs. Virtually all of the STA designs have been refined according to standard engineering practice to incorporate new information that was not available during the earlier design phase, and to address concerns raised by external parties through a public STA design review process. This adaptive management will continue throughout implementation of the ECP. The period of time between commencement of operations for Phase 1 and commencement of operation for Phase 2 varies from 9 years for STA 6 Section 1 to just over 3 years for STA-3/4. Clearly, very little time is available to implement Phase 2 retrofits (if needed) after Phase 1 is complete. Flexibility and adaptive management will be key to the successful design and construction of STA-3/4. Additional details on the effectiveness of the STAs are provided in Chapter 6.

STA Optimization

A combination of field research, evaluation of available data for similar systems, and application of appropriate wetland water quality models is being used to identify ways to optimize the nutrient removal performance of the STAs. Research has been underway in the large treatment cells of the Everglades Nutrient Removal (ENR) project since 1994. In addition, activities are planned in the smaller ENR test cells where greater water control and statistical replication are available. The results will include recommendations for enhancing the nutrient-removal performance of STAs through refining system operations (e.g., water depths and hydraulic retention times). This optimization research will be completed no later than December 31, 2001, however, results will be incorporated into STA operations as soon as sufficient information becomes available. Also, as the early STAs come on-line, their operations will be continuously evaluated, with valuable feedback incorporated into other STA operations. As shown in Figure 12-1, completion of STA optimization research is in the critical path for determining and implementing Phase 2 solutions by December 31, 2006. Completion of the STA optimization research before the December 31, 2001, deadline may be difficult because biological research inherently requires one or more growing seasons to evaluate performance. The District may be required to make recommendations for STA optimization for Phase 2 based on incomplete science and engineering information, with associated environmental and economic risks. Additional details on STA optimization research are provided in Chapter 6.

Evaluation of Potential Supplemental Technologies

Since the early 1980s, alternative on-farm and regional water quality measures have been evaluated to reduce nutrient levels discharged into the Everglades. In 1996, the District completed a comprehensive evaluation of promising phosphorus reduction technologies, ranging from low-intensity management of constructed wetlands to full-scale chemical treatment (PEER Consultants, P.C./Brown and Caldwell, 1996). Various combinations of the highest ranked technologies were evaluated on the basis of nutrient removal performance, implementation costs and environmental criteria. This evaluation confirmed that STAs are indeed the best interim step towards achieving the long-term water quality and hydropattern restoration goals of the Everglades. In addition, the most promising technologies were identified, and the remaining technological uncertainties were documented as a basis for future research. The U. S. Army Corps of Engineers (Corps) included a condition in their construction permit for the STAs to expand the list of potential supplemental treatment technologies to be investigated.

The DEP, District and other interests have initiated research efforts on these technologies to further determine critical design criteria such as performance efficacy, hydrologic operating characteristics, land requirements, initial and annual costs, and identification of potential environmental impacts. These technologies are being investigated prior to the final decision on if, and how, supplemental technologies can be incorporated into the final Phase 2 solution. Many of these have the potential as both on-farm treatment of hot spots and regional application. In order to ensure that comparable information is obtained from each supplemental technology study, the District developed a Standard of Comparison for use during each research project. The Standard of Comparison standardizes data collection and analyses, as well as defines common methodology for evaluating the individual technologies. Additional details on the supplemental technology research and the Standard of Comparison are provided in Chapter 8.

STA-3/4 and Supplemental Technologies. Subject to availability of sufficient information (scientific, engineering, economic, ecologic, regulatory, etc.) and necessary funding, implementation of Phase 2 solutions could begin with STA-3/4. Final design of STA-3/4 is scheduled for 1999 through mid-2001 and will incorporate the best available information from the various research, planning and rulemaking activities discussed above, subject to timely receipt of results and appropriation of sufficient funds. The final design of STA-3/4 is considering refinements that would facilitate and expedite incorporation of supplemental technologies as soon as sufficient need and design requirements are demonstrated, subject to funding availability. This approach is consistent with the Everglades Forever Act which establishes that construction of STA-3/4 cannot begin sooner than 90 days after this first annual peer-reviewed report is submitted to the Governor and the Legislature. STA-3/4 is scheduled to be constructed by October 1, 2003.

As shown in Figure 12-1, completion of supplemental technology research is in the critical path for determining and implementing Phase 2 solutions by December 31, 2006. Completion of this research before the December 31, 2001, deadline may be difficult because biological research

inherently requires one or more growing seasons to evaluate performance. The District may be required to make recommendations on Phase 2 based on incomplete science and engineering information, which carries associated environmental and economic risks.

Other Ongoing Planning Activities

Other key initiatives are underway that will influence the final Phase 2 solutions, particularly the quantity, distribution and timing of flows.

- a. Lower East Coast (LEC) Regional Water Supply Plan - Assisted by an Advisory Committee of urban, environmental and agricultural stakeholders, the District completed an interim plan for water supply for the area south and east of Lake Okeechobee in the spring of 1998. There is explicit linkage between the LEC Plan and the implementation of Everglades restoration activities, particularly in the quantity, timing and distribution of flows through the system. One specific example of potential impacts to STA-3/4 is the proposal in the interim plan to modify the present discharges from STA 3/4 to help rehydrate WCA 3A. Another example of a potential impact is modifying the STA inflow based on proposed changes to the regulation schedule of Lake Okeechobee, that will increase the regulatory releases over the 1979-88 Base Period levels. The Final LEC Plan, to be consistent with the 1997 Water Resources legislation and to incorporate findings of the Restudy, is anticipated to be complete by April 2000. Additional information on the LEC Plan are provided in Chapter 9.
- b. Comprehensive Review Study of the Central and Southern Florida Flood Control Project (C&SF Project Restudy) – Pursuant to federal legislation, the Corps and the District are conducting a comprehensive review study to evaluate the feasibility of making structural and operational modification to the C&SF Project to restore the ecological integrity of the south Florida ecosystem while continuing to provide flood protection, agricultural and urban water supply and other project purposes. Evaluation of alternatives was conducted with significant input from an interagency Restudy Team, as well as input from stakeholders and the general public. A draft comprehensive report was completed in the fall of 1998, and the final report will be submitted to Congress by July 1999. The final product will consist of a comprehensive feasibility report with a programmatic environmental impact statement. It is anticipated that the C&SF Project Restudy will (1) determine the total water storage capacity required to achieve the hydropattern restoration goals for the Everglades, and (2) define requirements for temporal and spatial distribution of flows to the Everglades. Interim and final results from the Restudy will be integrated into STA 3/4 design and Phase 2 implementation activities subject to funding and timing constraints. One specific example of potential impacts to STA-3/4 is the Restudy recommendation of 60,000 acres of multi-purpose reservoirs in the EAA, which would have significant influence on the timing and quality of inflows to the STAs. Additionally, the proposed purchase of the 52,000-acre Talisman holdings in the EAA would effect the location of these reservoirs. After submittal of the comprehensive feasibility report to Congress in July 1999, detailed design activities will be initiated for specific project features. These detailed design activities will incorporate the latest information from Phase 2 research and demonstration projects. Additional information

on the Restudy are provided in Chapter 10.

Everglades Stormwater Program

The Everglades Forever Act directs the District to develop strategies and schedules to ensure that all District-controlled structures that discharge water into, within or from the Everglades Protection Area, achieve and maintain compliance with all appropriate water quality standards to the maximum extent practicable. The Everglades Construction Project covers 7 of the 14 major basins that discharge into the Everglades Protection Area. The water quality strategies for the remaining 7 basins and the interior waters of the Everglades were identified in the permit issued in April 1998, referred to as the “non-ECP” permit. These schedules and strategies are being implemented through the District’s Everglades Stormwater Program. The Everglades Stormwater Program includes a combination of regulatory analyses, water quality monitoring and evaluation, and other water quality improvement measures. For all basins that discharge into the Everglades Protection Area, but are not covered by the Everglades Construction Project, the District developed and is implementing a Regulatory Action Strategy. This Strategy will ensure adequate water quality data are collected, assess the water quality of the discharges, and develop a basin-specific regulatory program to ensure compliance with all water quality standards by December 31, 2006. Other components of the program include intergovernmental cooperative projects, an education campaign, and developing a method for re-imbursement of expenditures through a special assessment. The Everglades Stormwater Program is described more fully in Chapter 11.

Funding for Phase 2

The Everglades Forever Act allocated several state sources for funding the implementation of the Everglades Construction Project, including agricultural privilege taxes, ad valorem taxes, Alligator Alley toll revenues, Preservation 2000 funds and Surface Water Improvement and Management funds. In addition, federal funds have been appropriated for STA 1 East. However, funding for Phase 2 implementation has not been appropriated, though research designed to support Phase 2 decisions is already underway. Phase 2 costs will be dependent on the basin-specific optimal combination of enhanced BMPs, STAs, supplemental technologies and/or additional regulatory programs required to achieve the long-term water quality goals of Everglades restoration.

While it is possible to estimate costs for research costs to support Phase 2 decisions, it is impossible at this time to develop a firm estimate of the total costs for Phase 2 until additional research and basin-specific studies are conducted. Conceptual-level cost estimates will be developed as part of basin-specific feasibility studies, anticipated to begin by January 2000. In addition, the Florida Legislature may consider the public/private mix of funding in concert with the recent “polluter pays” amendment to the Florida constitution. This Phase 2 funding picture may be further complicated due to competition for public funds with projects stemming from the C&SF Restudy.

Integrated Strategy to Achieve Phase 2 Goals

The long-term water quality goal of the Everglades Forever Act is to implement the optimal

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combination of enhanced BMPs, STAs, supplemental technologies and/or regulatory programs to ensure that waters discharged to the Everglades Protection Area achieve water quality standards no later than December 31, 2006. The Everglades Forever Act intended “to provide a sufficient period of time for construction, testing, and research so that the benefits of the Everglades Construction Project will be determined and maximized prior to requiring additional measures.” (373.4592(1)(g), Florida Statutes). If the Everglades Construction Project and other discharges to the Everglades Protection Area are not in compliance with state water quality standards, the Everglades Forever Act requires that the District submit an integrated water quality plan by December 31, 2003 for achieving compliance with state standards by December 31, 2006. If discharges to the Everglades Protection Area are in compliance with state water quality standards, the Everglades Forever Act requires that the District submit an integrated plan by December 31, 2003 for maintaining compliance with standards.

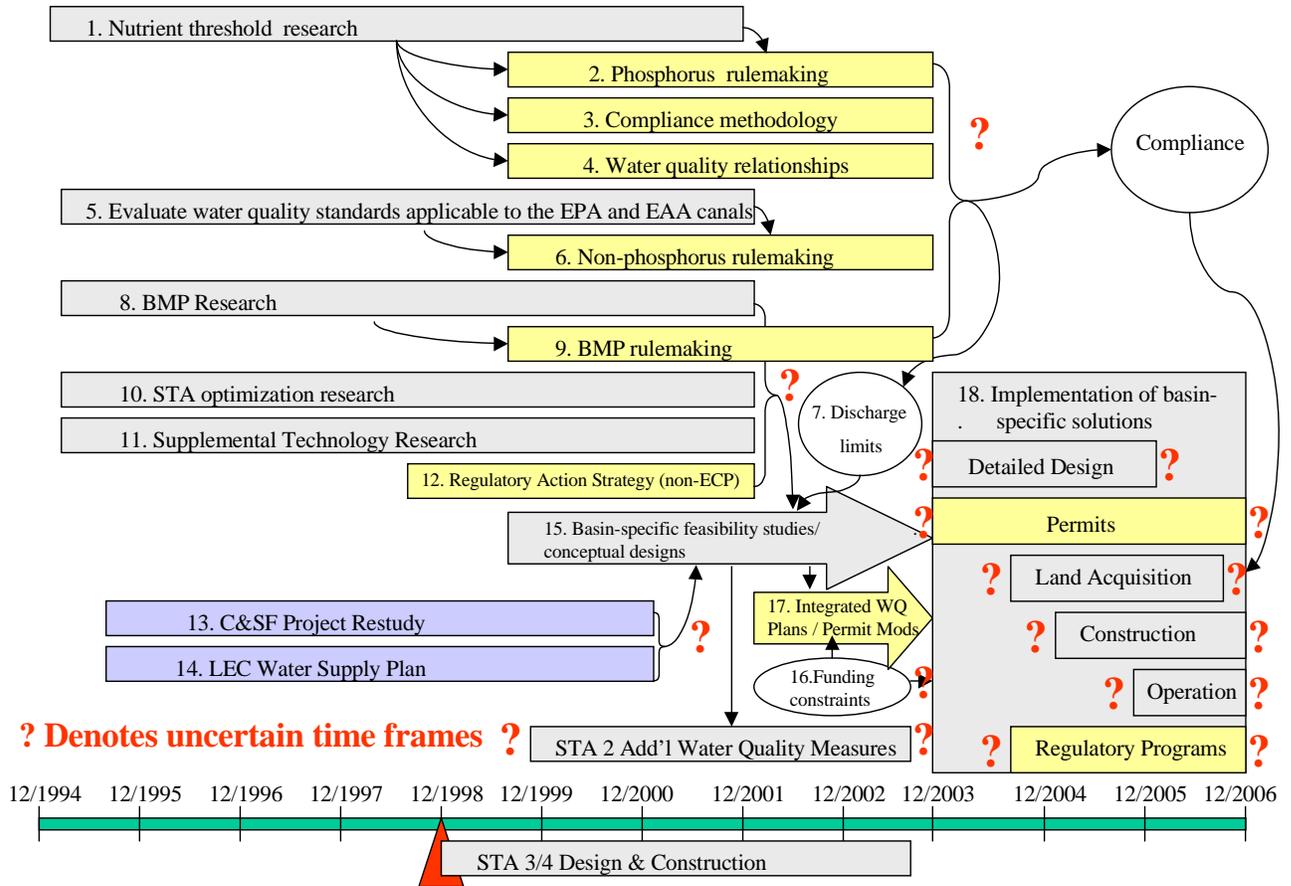
By contrast, the Corps construction permit (“404 permit”) for the Everglades Construction Project requires the transmittal of a water quality strategy almost three years earlier (January 1, 2001) to ensure that discharges from the STAs (except STA 1 East) to the Everglades Protection Area are in compliance with long-term water quality standards by December 31, 2006. A preliminary draft of this strategy is due by January 1999 and a revised draft is due by January 2000. Both the integrated water quality plan required by the Act and the water quality strategy required by the Corps permit will incorporate the best available information from the on-going research, rulemaking and/or other regulatory programs.

Also in accordance with the Corps construction permit for the Everglades Construction Project, the District will make best efforts to implement additional water quality treatment measures for the waters discharged from STA 2 within four years of first discharge into WCA 2A. Subject to operating permit authorization, initial discharge is expected in October 1999; hence the Corps permit condition could require implementation of additional water quality treatment measures by October 2003. This ambitious time frame target is over three years in advance of the December 31, 2006 mandate of the Everglades Forever Act, and is subject to many factors outside the control of the District. Based on these permit time frames, the District may be required to make recommendations on Phase 2 based on incomplete science, engineering and regulatory information, which carries associated environmental and economic risks. Potential obstacles to overcome include: lack of specific Everglades water quality criteria; uncertain potential for STA optimization and BMP enhancements; insufficient scientific, economic, and environmental impact information on supplemental technologies; lack of funding; and insufficient time for design, land acquisition, permitting, construction and operation of additional measures. For planning purposes, a discharge limit of 10 ppb will be assumed. If the final discharge limits are significantly different from 10 ppb, the optimal Phase 2 solution may be altered, with significant cost differences and other implications. Future annual updates to this peer-reviewed report will provide greater detail on the potential obstacles and other constraints for achieving this ambitious goal, as well as identify potential remedies.

Although the Everglades Forever Act timelines for developing and implementing long-term water quality plans are longer than the timelines in the Corps 404 permit, the Act’s timelines could

also prove difficult to achieve. As shown in Figure 12-1, reprinted below for convenience, a tremendous amount of research, data analyses, rulemaking, planning and basin-specific evaluations

Figure 12-1. Timeframes for critical activities to meet the water quality goals identified in the Everglades Forever Act.



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must be completed and integrated in an ambitiously short time in order to develop the basin-specific water quality plans by December 31, 2003. After submittal of the plans, the Act's timelines only allow three years for implementation of Phase 2 solutions by December 31, 2006. At least eighteen (18) steps, some in parallel, some in sequence, must be completed in order to determine, fund and implement the optimal combination of enhanced BMPs, STAs, supplemental technologies and/or additional regulatory programs. Delays in the timely completion of these activities, many of which are outside the control of the District, may result in unintended delays of the long-term water quality and hydropattern objectives of the Everglades, despite the best efforts of the District. The interrelationship between these steps and the anticipated time frames for each are diagrammed in Figure 12-1 and summarized below.

1. The **long-term Everglades phosphorus research** must be completed no later than 12/31/2001 (District and agricultural industry responsibilities); US Dept of Interior research may extend beyond the 2001 time frame based on currently-available schedules (US Department of Interior responsibility).
2. This research will provide the foundation for **rulemaking to establish a numeric phosphorus criterion for the Everglades**, to get underway by 12/31/2000 and to be completed no later than 12/31/2003. (DEP responsibility)
3. The DEP must **finalize the method for determining compliance** with these criteria and the location of representative receiving water stations. This activity is planned to get underway by 12/31/2000 and should be completed by 12/31/2003. (DEP responsibility)
4. The DEP and District must **develop the relationship between waters entering the Everglades with the resulting water quality in the Everglades**. This activity is planned to get underway by 12/31/2000 and to be completed no later than 12/31/2003. (DEP lead; District support)
5. The DEP and the District must **complete all research required to evaluate all water quality standards other than phosphorus** applicable to the EPA and EAA canals by December 31, 2001 (District and DEP responsibility)
6. The DEP must **complete rulemaking to revise water quality standards the EPA and EAA canals**, recognizing the existing beneficial uses of the EAA canals. Although the Act does not set a specific deadline for this rulemaking, it is assumed that it will be completed by December 31, 2003 (DEP responsibility).
7. A key use of the relationship developed in Step 4 above and the rulemaking in Step 6 above will be to **establish discharge limits or levels** for waters entering the Everglades Protection Area. It is these upstream discharge limits or levels that will serve as the Phase 2 targets for long-term water quality solutions. This activity is planned to get underway by 12/31/2001 and should be completed by 12/31/2003. (DEP responsibility)
- 8-11. To **determine the most cost-effective performance of enhanced BMPs, STAs and supplemental technologies**, the research from these three efforts will be completed no later than 12/31/2001. During each 5-year Rule 40E-63, FAC, shall be amended as needed to implement a comprehensive program of research, testing and implementation of BMPs that will address all water quality standards within the

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- Everglades Protection Area and the EAA. (District lead)
12. For all basins that discharge into the Everglades Protection Area that are not covered by the Everglades Construction Project, **the District developed and is implementing a Regulatory Action Strategy** to develop a basin-specific regulatory program to ensure compliance with all water quality standards no later than December 31, 2006. (District responsibility)
 13. It is anticipated that the C&SF Restudy analyses will yield **long-term hydropattern design targets for the Phase 2 solutions and potential EAA reservoirs**, hopefully by July 1999. (Corps responsibility; District support)
 14. Completion of the final Lower East Coast Regional Water Supply Plan will **further define the hydrologic environment for Phase 2** (e.g., discharge locations, timing of deliveries and overall quantities); this activity is planned by April 2000. (District responsibility)
 15. As soon as sufficient information is obtained from the BMP, STA optimization, supplemental technology research and regulatory action strategy, **basin-specific feasibility studies must be conducted** to determine the optimal combination of water quality measures required to achieve the phase 2 water quality goals, in consideration of basin variations in hydrology and water quality. For planning purposes, an end-of-pipe discharge limit of 10 ppb will be assumed. If the final discharge limits are significantly different from 10 ppb, the optimal Phase 2 solutions may be altered, with significant cost differences and other implications. It is anticipated that the basin-specific feasibility studies will include conceptual-level engineering designs, and will be completed on an individual basis between 12/31/2002 and 12/31/2003. (District lead) As part of the Everglades Stormwater Program, on-going work will be completed for specific tributaries, including in Western C-11 basin, the C-111 basin, Lower Western basins, and the Dade County Lake Belt plans (District lead).
 16. **Funds need to be appropriated for Phase 2 implementation.** (It is assumed that the Florida Legislature will have an active role in this.)
 17. By December 31, 2003, the District must submit to the DEP **permit modifications and/or applications for the Phase 2 (long-term) water quality measures**, as needed. These will include the integrated water quality plans required by the Everglades Forever Act and will be refined from the water quality strategy submitted to the Corps by 1/1/2001. In addition to the information developed in the basin-specific feasibility studies, the integrated water quality plans will include funding strategies and implementation schedules.
 18. Ultimately, if all the preceding steps are completed on time, and if the integrated water quality plans are authorized by all appropriate State and federal agencies, the District must **design, acquire necessary lands, establish necessary regulatory programs and otherwise implement the Phase 2 solutions** by December 31, 2006.

Risks Associated with Premature Selection of Phase 2 Solutions

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Florida's Everglades Forever Act establishes an orderly process of research and rulemaking to develop a science-based foundation for making Phase 2 decisions. This process was described in Sections 3.1 through 3.9 above and remains the ideal strategy for achieving long-term compliance with all water quality goals. This approach accomplishes the Legislature's intent to allow a sufficient time for construction, testing, and research, so that the benefits of the Everglades Construction Project and the EAA BMPs will be determined and maximized prior to requiring additional measures. If the Phase 1 program alone cannot achieve the long-term goals, this orderly approach will enable sound science-based decisions for the selection of additional water quality treatment options.

If critical decisions on Phase 2 solutions were made prematurely, i.e., without sufficient time to assess the current program, establish appropriate discharge limits and investigate alternative measures, they would carry associated environmental and economic risks.

Examples of potential environmental risks include

1. the possibility that the selected solution may not actually achieve the long-term phosphorus target,
2. the possibility that the selected solution may not achieve the long-term water quality goals for parameters other than phosphorus,
3. unintended adverse impacts to the Everglades due to parameters other than phosphorus, and
4. potential sludge or other byproduct disposal problems.

Examples of potential economic risks include

1. capital as well as annual operation and maintenance costs;
2. unnecessarily taking additional lands out of agricultural production in the EAA; and
3. challenges to the sufficiency of science and engineering information used in the decision process.

The orderly process of research and rulemaking described above was designed to provide sufficient science and engineering information, and to reduce the uncertainty in associated factors, thereby satisfying both the intent of the Everglades Forever Act and minimizing the environmental and economic risks associated with Phase 2 solutions.

Conclusion

Concurrent with the implementation of Phase 1 projects, the District and other groups are conducting water quality research, ecosystem-wide planning, and regulatory programs to ensure a sound foundation for science-based decision-making for Phase 2. However, in order to meet the ambitious time frames in the Everglades Forever Act, the District may be required to make recommendations on Phase 2 based on incomplete science, engineering and regulatory information, which carries associated environmental and economic risks. The **key gaps** in the information base for Phase 2 decisions, described throughout this chapter, are summarized below:

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1. The Class III numeric phosphorus criterion for the Everglades Protection Area
2. The methodology to be used to determine compliance with the Class III numeric phosphorus criterion for the Everglades Protection Area
3. The relationship between waters entering the Everglades and the resulting water quality in the Everglades
4. Revised water quality standards for parameters other than phosphorus applicable to the Everglades Protection Area and EAA canals
5. Basin-specific discharge limits for waters entering the Everglades Protection Area
6. Technical efficacy and cost effectiveness of enhanced BMPs
7. Means to improve operations of STAs
8. Technical efficacy of supplemental technologies, along with examination of costs and benefits of phosphorus reduction alternatives, and implementation schedules
9. Water quality evaluation for tributaries in addition to the ECP
10. Modifications to the flows and phosphorus loads resulting from C&SF Restudy components, along with implementation schedules
11. Hydrologic regimes from the LEC Plan, along with implementation schedules
12. Phase 2 funding constraints and time frames, including Amendment 5 issues,
13. Basin-specific combinations of BMPs, STAs, supplemental technologies as needed and/or additional regulatory programs

Considering the number and complexity of the many activities required to achieve the long-term water quality goals, the 2006 time frame established by the Act is very ambitious. Delays in the timely completion of these activities, many of which are outside the control of the District, may result in unintended delays, despite the best efforts of the District. Acceleration of necessary research before the December 31, 2001, deadline may be difficult because biological research inherently requires one or more growing seasons to evaluate performance. In order to meet the 2006 deadline, the District may be required to make recommendations for Phase 2 based on incomplete science and engineering information, which carries associated environmental and economic risks. Future annual updates to this peer-reviewed Report will provide greater details on the potential obstacles and other constraints for achieving Phase 2 goals, as well as identify potential remedies.

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