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APPENDIX A
Selected Passages from the Florida Statutes,
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SELECTED PASSAGES FROM CHAPTER 373, FLORIDA STATUTES

Source: <http://www.flsenate.gov/> on May 12, 2005

373.042 Minimum flows and levels.--

(1) Within each section, or the water management district as a whole, the department or the governing board shall establish the following:

(a) Minimum flow for all surface watercourses in the area. The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

(b) Minimum water level. The minimum water level shall be the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area.

The minimum flow and minimum water level shall be calculated by the department and the governing board using the best information available. When appropriate, minimum flows and levels may be calculated to reflect seasonal variations. The department and the governing board shall also consider, and at their discretion may provide for, the protection of nonconsumptive uses in the establishment of minimum flows and levels.

(2) By November 15, 1997, and annually thereafter, each water management district shall submit to the department for review and approval a priority list and schedule for the establishment of minimum flows and levels for surface watercourses, aquifers, and surface waters within the district. The priority list shall also identify those water bodies for which the district will voluntarily undertake independent scientific peer review. By January 1, 1998, and annually thereafter, each water management district shall publish its approved priority list and schedule in the Florida Administrative Weekly. The priority list shall be based upon the importance of the waters to the state or region and the existence of or potential for significant harm to the water resources or ecology of the state or region, and shall include those waters which are experiencing or may reasonably be expected to experience adverse impacts. By January 1, 2003, each water management district's priority list and schedule shall include all first magnitude springs, and all second magnitude springs within state or federally owned lands purchased for conservation purposes. The specific schedule for establishment of spring minimum flows and levels shall be commensurate with the existing or potential threat to spring flow from consumptive uses. Springs within the Suwannee River Water Management District, or second magnitude springs in other areas of the state, need not be included on the priority list if the water management district submits a report to the Department of Environmental Protection demonstrating that adverse impacts are not now occurring nor are reasonably expected to occur from consumptive uses during the next 20 years. The priority list and schedule shall not be subject to any proceeding pursuant to chapter 120. Except as provided in subsection (3), the development of a priority list and compliance with the schedule for the establishment of minimum flows and levels pursuant to this subsection shall satisfy the requirements of subsection (1).

373.0421 Establishment and implementation of minimum flows and levels.--

(1) ESTABLISHMENT.--

(a) *Considerations.*--When establishing minimum flows and levels pursuant to s. [373.042](#), the department or governing board shall consider changes and structural alterations to watersheds, surface waters, and aquifers and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of an affected watershed, surface water, or aquifer, provided that nothing in this paragraph shall allow significant harm as provided by s. [373.042](#)(1) caused by withdrawals.

(b) *Exclusions.*--

1. The Legislature recognizes that certain water bodies no longer serve their historical hydrologic functions. The Legislature also recognizes that recovery of these water bodies to historical hydrologic conditions may not be economically or technically feasible, and that such recovery effort could cause adverse environmental or hydrologic impacts. Accordingly, the department or governing board may determine that setting a minimum flow or level for such a water body based on its historical condition is not appropriate.

2. The department or the governing board is not required to establish minimum flows or levels pursuant to s. [373.042](#) for surface water bodies less than 25 acres in area, unless the water body or bodies, individually or cumulatively, have significant economic, environmental, or hydrologic value.

3. The department or the governing board shall not set minimum flows or levels pursuant to s. [373.042](#) for surface water bodies constructed prior to the requirement for a permit, or pursuant to an exemption, a permit, or a reclamation plan which regulates the size, depth, or function of the surface water body under the provisions of this chapter, chapter 378, or chapter 403, unless the constructed surface water body is of significant hydrologic value or is an essential element of the water resources of the area.

The exclusions of this paragraph shall not apply to the Everglades Protection Area, as defined in s. [373.4592](#)(2)(i).

(2) If the existing flow or level in a water body is below, or is projected to fall within 20 years below, the applicable minimum flow or level established pursuant to s. [373.042](#), the department or governing board, as part of the regional water supply plan described in s. [373.0361](#), shall expeditiously implement a recovery or prevention strategy, which includes the development of additional water supplies and other actions, consistent with the authority granted by this chapter, to:

(a) Achieve recovery to the established minimum flow or level as soon as practicable; or

(b) Prevent the existing flow or level from falling below the established minimum flow or level.

The recovery or prevention strategy shall include phasing or a timetable which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions of this chapter.

(3) The provisions of this section are supplemental to any other specific requirements or authority provided by law. Minimum flows and levels shall be reevaluated periodically and revised as needed.

SELECTED PASSAGES FROM THE FLORIDA ADMINISTRATIVE CODE

Source: <http://election.dos.state.fl.us/fac/index.shtml> on May 12, 2005

40E-8.021 Definitions.

The terms set forth herein shall have the meanings ascribed to them, unless the context clearly indicates otherwise, and such meanings shall apply throughout the rules contained in this chapter. The terms defined in Rule 40E-8.021, F.A.C., shall apply throughout the District's consumptive use permit rules. In the event of a conflict or difference between the definitions contained in Rule 40E-8.021, F.A.C., and the definitions set forth in other District rules, the definitions in this Rule 40E-8.021, F.A.C., shall control for purposes of this chapter.

(1) Biscayne Aquifer – means the highly permeable surficial strata (hydraulic conductivities generally greater than 500 ft/day) that occur within Monroe, Miami-Dade (excluding those portions of coastal Monroe and Miami-Dade counties that discharge groundwater into Florida and Biscayne Bays), eastern Broward, and portions of eastern Palm Beach counties.

(2) Caloosahatchee River – means the surface waters that flow through the S-79 structure, combined with tributary contributions below S-79 that collectively flow southwest to San Carlos Bay.

(3) C&SF Project – means the project for Central and Southern Florida authorized under the heading 'CENTRAL AND SOUTHERN FLORIDA' in section 203 of the Flood Control Act of 1948 (Chapter 771).

(4) CERP – means the Comprehensive Everglades Restoration Plan contained in the 'Final Integrated Feasibility Report and Programmatic Environmental Impact Statement', dated April 1, 1999, as modified by the Water Resources Development Act of 2000.

(5) Certification or Certify – means the formal determination by the District, through a validation process consistent with state and federal law, of the total amount of water made available by a project or project phase of a recovery or prevention strategy, as appropriate, for natural systems and other uses.

(6) Direct Withdrawal means:

(a) A ground water withdrawal that causes a water table drawdown greater than 0.1 feet, as determined using a model accepted by the District, at any location beneath the MFL surface water body or aquifer, up through a 1 in 10 year drought; or

(b) A surface water withdrawal from facilities physically located within the boundaries of a MFL surface water body.

(7) Everglades – means the lands and waters included within Water Conservation Areas, the Holeyland/Rotenberger wildlife management areas, and the freshwater portions of the Everglades National Park.

(8) Harm – means the temporary loss of water resource functions, as defined for consumptive use permitting in Chapter 40E-2, F.A.C., that results from a change in surface or ground water hydrology and takes a period of one to two years of average rainfall conditions to recover.

(9) Indirect Withdrawal – means the withdrawal of water from a water source for a consumptive use that receives surface water or ground water from a MFL water body or is tributary to a MFL water body.

(10) Lake Okeechobee – means the lands and waters contained within the perimeter of the Hoover Dike.

(11) LEC Plan – means the Lower East Coast Regional Water Supply Plan – May 2000, including all three volumes.

(12) Lower West Coast Aquifers – means the lower Tamiami aquifer, sandstone aquifer and the mid-Hawthorn aquifer that occur within Charlotte, Hendry, Glades, Lee and Collier counties.

(13) LWC Plan – means the Lower West Coast Regional Water Supply Plan – April 2000, including all three volumes.

(14) Minimum Flow – means a flow established by the District pursuant to Sections 373.042 and 373.0421, F.S., for a given water body and set forth in Parts II and III of this chapter, at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

(15) Minimum Flow and Level Exceedance – means to fall below a minimum flow or level, which is

established in Parts II and III of this chapter, for a duration greater than specified for the MFL water body.

(16) Minimum Flow and Level Violation – means to fall below a minimum flow or minimum level, which is established in Parts II and III of this chapter, for a duration and frequency greater than specified for the MFL water body. Unless otherwise specified herein, in determining the frequency with which water flows and levels fall below an established MFL for purposes of determining a MFL violation, a “year” means 365 days from the last day of the previous MFL exceedance.

(17) Minimum Level – means the level of groundwater in an aquifer or the level of surface water established by the District pursuant to Sections 373.042 and 373.0421, F.S., in Parts II and III of this chapter, at which further withdrawals would be significantly harmful to the water resources of the area.

(18) MFL Water Body – means any surface water, watercourse, or aquifer for which an MFL is established in Part II or III of this chapter.

(19) Northwest Fork of the Loxahatchee River: Means those areas defined below:

(a) Northwest Fork of the Loxahatchee River that has been federally designated as Wild, Scenic and Recreational uses (as defined in the Loxahatchee River Wild and Scenic River Management Plan 2000) (see Map 1, incorporated herein), including the river channel that extends from river mile 6.0 (latitude 26.9856, longitude 80.1426) located near the eastern edge of Jonathan Dickinson State Park and continues upstream to the G-92 structure (latitude 26.91014, longitude 80.17578), including the C-14 Canal. The river channel includes the physical water flow courses and adjacent floodplain up to the limits of the floodplain swamp and wetlands within Riverbend Park, as determined by state wetland delineation criteria;

(b) Cypress Creek which extends westward from river mile 10.6 to the intersection of Gulf Stream Citrus Road (latitude 26.96484, longitude 80.1855) located approximately one mile west of the Florida Turnpike and includes its natural river channels and contiguous floodplain as determined by state wetland delineation criteria;

(c) Kitching Creek which extends from river mile 8.1 (latitude 26.9908, longitude 80.1540) northward through Jonathan Dickinson State Park to north of Bridge Road (latitude 27.05513, longitude 80.17580), including its natural river channels and contiguous floodplain as determined by state wetland delineation criteria; and

(d) Hobe Grove Ditch which extends west from river mile 9.1 (latitude 26.9854, longitude 80.1594) westward to the Hobe-St. Lucie Conservancy District pump station outfall (latitude 26.5908, longitude 80.1031) including its natural river channels and contiguous floodplain as determined by state wetland delineation criteria.

(20) Operations – means activities taken by the District for the movement of surface water through works of the District pursuant to Chapter 373, F.S.

(21) Prevention Strategy(ies) – means the structural and non-structural actions approved by the District in regional water supply plans, pursuant to Section 373.0421, F.S., or by rule, for areas where MFLs are currently not violated, but are projected to be violated within twenty (20) years of the establishment of the minimum flow or level, if said prevention strategies are not implemented.

(22) Recovery Strategy(ies) – means the structural and non-structural actions approved by the District in regional water supply plans, pursuant to Section 373.0421, F.S., or by rule, for areas where MFLs are currently violated.

(23) Regional Water Supply Plan – means a plan approved by the District pursuant to Section 373.0361, F.S.

(24) St. Lucie River North Fork – means the surface waters that extend from the Gordy Road Bridge structure (state plane coordinates, x851212.831, y1116105.7470), combined with tributary contributions below Gordy Road and collectively flow south to the confluence with the C-24 canal (state plane coordinates, x873,712.20, y1064,390.41).

(25) St. Lucie River South Fork – means the surface waters that extend from the culverts located at state plane coordinates x902,512.67, y1,001,799.91, north to the confluence of the river and the St. Lucie Canal (C-44).

(26) St. Lucie Estuary – means the surface water body south of the confluence of the St. Lucie River North Fork and C-24, north of the confluence of the St. Lucie River South Fork and C-44, and west of the western boundary of the Intracoastal Waterway, exclusive of canals.

(27) Serious Harm – means the long-term loss of water resource functions, as addressed in Chapters 40E-21 and 40E-22, F.A.C., resulting from a change in surface or ground water hydrology.

(28) Significant Harm – means the temporary loss of water resource functions, which result from a change in surface or ground water hydrology, that takes more than two years to recover, but which is

considered less severe than serious harm. The specific water resource functions addressed by a MFL and the duration of the recovery period associated with significant harm are defined for each priority water body based on the MFL technical support document.

Specific Authority §§ 9, 10 P.L. 83-358, 373.044, 373.113, 373.119, 373.129, 373.136, 373.171 F.S. Law Implemented 373.016, 373.036, 373.0361, 373.042, 373.0421, 373.175, 373.216, 373.219, 373.223, 373.246 F.S. History–New 9-10-01, Amended 11-11-02, 4-1-03.

40E-8.421 Prevention and Recovery Strategies.

(1) At the time of adoption of this rule, the existing flow or level for certain specified water bodies is below, or within 20 years is projected to fall below, the applicable MFL. For this reason, Section 373.0361, F.S., requires regional water supply plans to contain recovery and prevention strategies, including water resource development and water supply development projects that are needed to achieve compliance with MFLs during the planning period. The implementation of such projects will allow for the orderly replacement or enhancement of existing water sources with alternative supplies in order to provide sufficient water for all existing and projected reasonable-beneficial uses, consistent with Section 373.0421, F.S.

(a) MFLs and recovery and prevention strategies will be implemented in phases with consideration of the District's missions in managing water resources, including water supply, flood protection, environmental enhancement and water quality protection, as required by Section 373.016, F.S.

(b) MFLs are implemented to prevent significant harm to the water resources and, where applicable, the ecology of the area due to further withdrawals (Sections 373.042 and 373.0421, F.S.). A consumptive use permitting program is implemented to prevent harm to the water resource (Section 373.219, F.S.). A water shortage program is implemented to prevent serious harm to the water resource (Sections 373.175 and 373.246, F.S.). Additionally, the protection of water resources will, in part, be achieved through the reservation of water for fish and wildlife or public health and safety (Section 373.223(4), F.S.). The conceptual model identifying the relationships between these water resource protection requirements is set forth in Figure I in this Part.

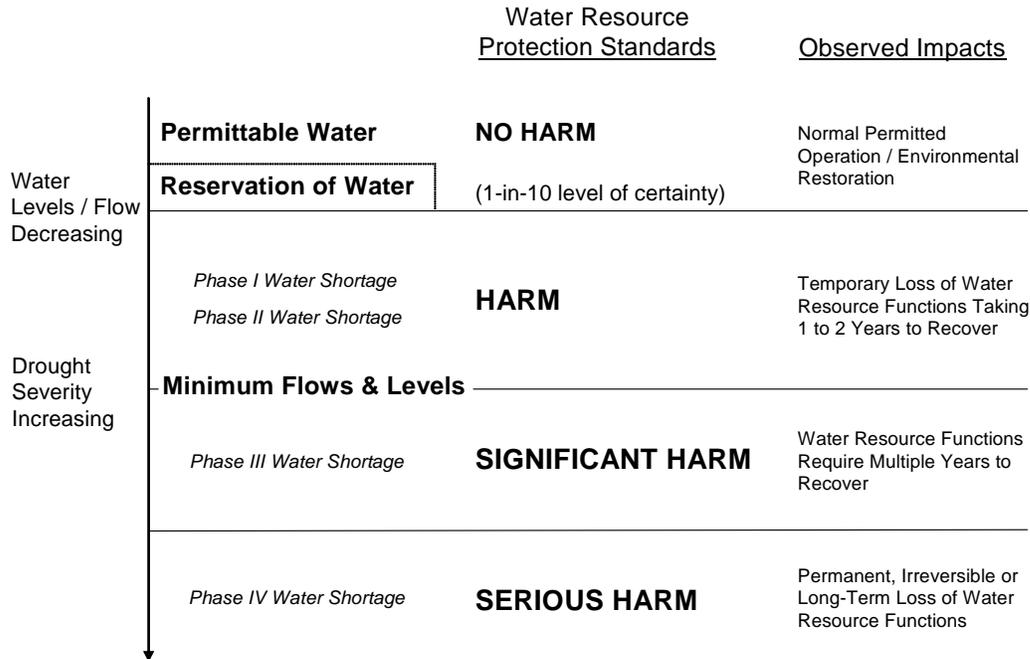
(c) The rules implementing water resource protection tools, including Chapters 40E-2, 40E-8, 40E-20, 40E-21, and 40E-22, F.A.C., identify the specific factors and conditions that will be applied and considered in implementing the conceptual model. Due to the extreme variations in water resource conditions, climatic conditions, hydrologic conditions, and economic considerations that will be faced when implementing these rules, it is critical to apply such criteria flexibly and to reserve for the governing board the ability to implement water resource protection and allocation programs considering all of the District's missions under Chapter 373, F.S., and to balance water supply, flood protection, resource protection and water quality protection needs. Implementation of the recovery and prevention strategies will be achieved in compliance with the assurances to consumptive users and to natural systems contained in the LEC Plan and the LWC Plan.

(d) The phasing and timetables for implementation of structural components in recovery and prevention strategies contained in approved regional water supply plans are found to meet the requirements in Section 373.0421(2), F.S., for the expeditious and practicable recovery of the MFLs.

(e) Upon completion of each project or project phase of a recovery or prevention plan the District will certify the availability of water, as defined in subsection 40E-8.021(5), F.A.C.

(f) In order to ensure that the actual and projected performance of prevention and recovery strategies approved in the regional water supply plans is sufficient to meet water resource needs, including MFLs, and the existing and projected reasonable-beneficial uses, the District will update recovery and prevention strategies on a periodic basis, based on new information and system performance. The performance of the recovery and prevention strategies in comparison to the performance projected in the regional water supply plans, will be assessed by the District for each recovery or prevention strategy phase. Based on the actual performance and new information obtained regarding the water resources, the District will review and revise, if necessary, recovery and prevention strategies through the regional water supply plan update process every five years, or sooner, as required by Section 373.0361, F.S. At that time, the governing board will determine if rule modifications to the MFL or recovery and prevention strategies are necessary to continue to meet the requirements of Sections 373.042 and 373.0421, F.S.

Figure 1: Conceptual Relationship Among the Harm, Serious Harm and Significant Harm Standards



(2) The Everglades and the Caloosahatchee River.

(a) As the effective date of this rule, September 10, 2001, the Everglades and Caloosahatchee River have experienced MFL violations. As a result, the LEC Plan and the LWC Plan contain approved recovery strategies, pursuant to Section 373.0421, F.S. Included in these recovery and prevention strategies is the CERP.

(b) MFLs for many areas within the Everglades and the Caloosahatchee River, served by the C&SF Project, will not be achieved immediately upon adoption of this rule largely because of the lack of adequate regional storage or ineffective water drainage and distribution infrastructure. Although not all locations within the Everglades are currently in violation of the proposed MFL, the Everglades, as a whole, is subject to a recovery strategy. The LEC Plan identifies the structural and non-structural remedies necessary for the recovery of MFL water bodies. These structural and non-structural remedies are also intended to restore the Everglades and the Caloosahatchee River above the MFLs, through Chapter 373, F.S., authorities of the District. The projected long-term restoration of flows and levels in the Everglades resulting from implementation of the LEC Plan and the CERP is documented in the LEC Plan, and are intended to more closely approximate “pre-drainage” conditions. The planned components include implementing consumptive use and water shortage programs, removing conveyance limitations, implementing revised C&SF Project operational programs, storing additional freshwater, reserving water for the protection of fish and wildlife, and developing alternative sources for water supply. These components will be implemented over the next 20 years, resulting in a phased restoration of the affected areas.

(c) The District, as the U.S. Army Corps of Engineers’ local sponsor of the C&SF Project, is charged with implementing the CERP, in accordance with the Water Resources Development Act of 2000 (WRDA), Title VI entitled “Comprehensive Everglades Restoration,” and in accordance with State law. Assurances regarding water availability for consumptive uses and protection of natural systems are set forth in WRDA, Chapter 373, F.S., CERP and the LEC Plan, which will be followed by the District in implementing this chapter. Additional quantities of water for both consumptive uses and the natural systems made available from the CERP and other water resource development projects will be documented and protected on a project basis. For project components implemented under CERP, the additional quantity, distribution and timing of delivery of water that is made available for the natural system for consumptive use, will be identified consistent with purposes of the CERP. Under State law, water reservations and water allocations to consumptive uses will be utilized to protect water availability for the intended purposes.

(3) Lake Okeechobee. The LEC Plan contains an approved prevention strategy for Lake Okeechobee pursuant to Section 373.0421, F.S. The prevention strategy consists of implementing the District's water shortage plan, including supply side management, as simulated in the LEC Plan, and constructing and operating water supply and resource development projects.

(4) Biscayne Aquifer. The LEC Plan contains an approved prevention strategy for the Biscayne Aquifer pursuant to Section 373.0421, F.S., which consists of the following:

- (a) Maintain coastal canal stages at the minimum operation levels shown in Table J-2 of the LEC Plan;
- (b) Apply conditions for permit issuance in Chapter 40E-2 or 40E-20, F.A.C., to prevent the harmful movement of saltwater intrusion up to a 1-in-10 year level of certainty;
- (c) Maintain a ground water monitoring network and utilize data to initiate water shortage actions pursuant to Rule 40E-8.441, F.A.C. and Chapters 40E-21 and 40E-22, F.A.C.;
- (d) Construct and operate water resource and water supply development projects; and
- (e) Conduct research in high risk areas to identify where the portions of the saltwater front is adjacent to existing and future potable water sources.

(5) Lower West Coast Aquifers. The LWC Plan identifies a prevention strategy for the LWC Aquifers, pursuant to Section 373.0421, F.S., as follows:

- (a) Establish "no harm" maximum permittable levels for each aquifer (regulatory levels) for a 1-in-10 year level of certainty;
- (b) Implement rule criteria to prevent harm through the consumptive use permitting process, including conditions for permit issuance in Rule 40E-2.301, F.A.C.;
- (c) Construct and operate water resource and supply development projects; and
- (d) Implement the water shortage plan in Chapter 40E-21, F.A.C., as needed to prevent serious harm during drought conditions in excess of a 1-in-10 year level of certainty.

(6) St. Lucie River and Estuary. The following is the prevention strategy for the St. Lucie River and Estuary:

(a) Discharges from the North Fork will be managed within the operational protocols of the Ten Mile Creek Project scheduled to be completed by 2004. Flow targets will be consistent with the CERP performance requirements for Indian River Lagoon.

(b) A research and monitoring strategy for the North and South Forks of the St. Lucie River will be developed and implemented in coordination with the Upper East Coast Regional Water Supply Plan update.

(7) Northwest Fork of the Loxahatchee River Recovery Strategy: Purpose and Intent.

(a) The Northwest Fork of the Loxahatchee River is currently not meeting the MFL and requires implementation of a recovery strategy to achieve the MFL as soon as practicable, consistent with Section 373.0421, F.S. The recovery strategy consists of projects contained within the following approved plans: the Lower East Coast Regional Water Supply Plan (LEC Plan), the Comprehensive Everglades Restoration Plan (CERP), and the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP). Four phases of recovery are identified in the Technical Documentation to Support Development of Minimum Flows and Levels for the Northwest Fork of the Loxahatchee River, November 2002, which are projected to increase flows to meet the MFL for the Northwest Fork of the Loxahatchee River. As part of the recovery strategy, as provided in this rule, the consumptive use permitting and water shortage requirements in this Chapter and Chapters 40E-2 and 40E-21, F.A.C., shall apply to consumptive use direct and indirect withdrawals from surface and groundwater sources from the Northwest Fork of the Loxahatchee River and those areas directly tributary to the Northwest Fork.

(b) In addition to implementation of this MFL recovery strategy, the District commits to restore freshwater flows to the Northwest Fork of the Loxahatchee River above the MFL through Chapter 373, F.S., and the Comprehensive Everglades Restoration Plan and its associated authorities. The District will continue to partner with the Florida Department of Environmental Protection in establishing a practical restoration goal and plan for the Loxahatchee River watershed. Recognizing that natural seasonal fluctuations in water flows are necessary to ensure that the functions of the Loxahatchee River are protected, this restoration goal and plan will include a more complete set of seasonally managed flow criteria for the river that are driven primarily by natural rainfall and runoff patterns within the watershed.

(c) The District shall continue to operate the G-92 structure and associated structures to provide approximately 50 cfs or more over Lainhart Dam to the Northwest Fork of the Loxahatchee River, when the District determines that water supplies are available.

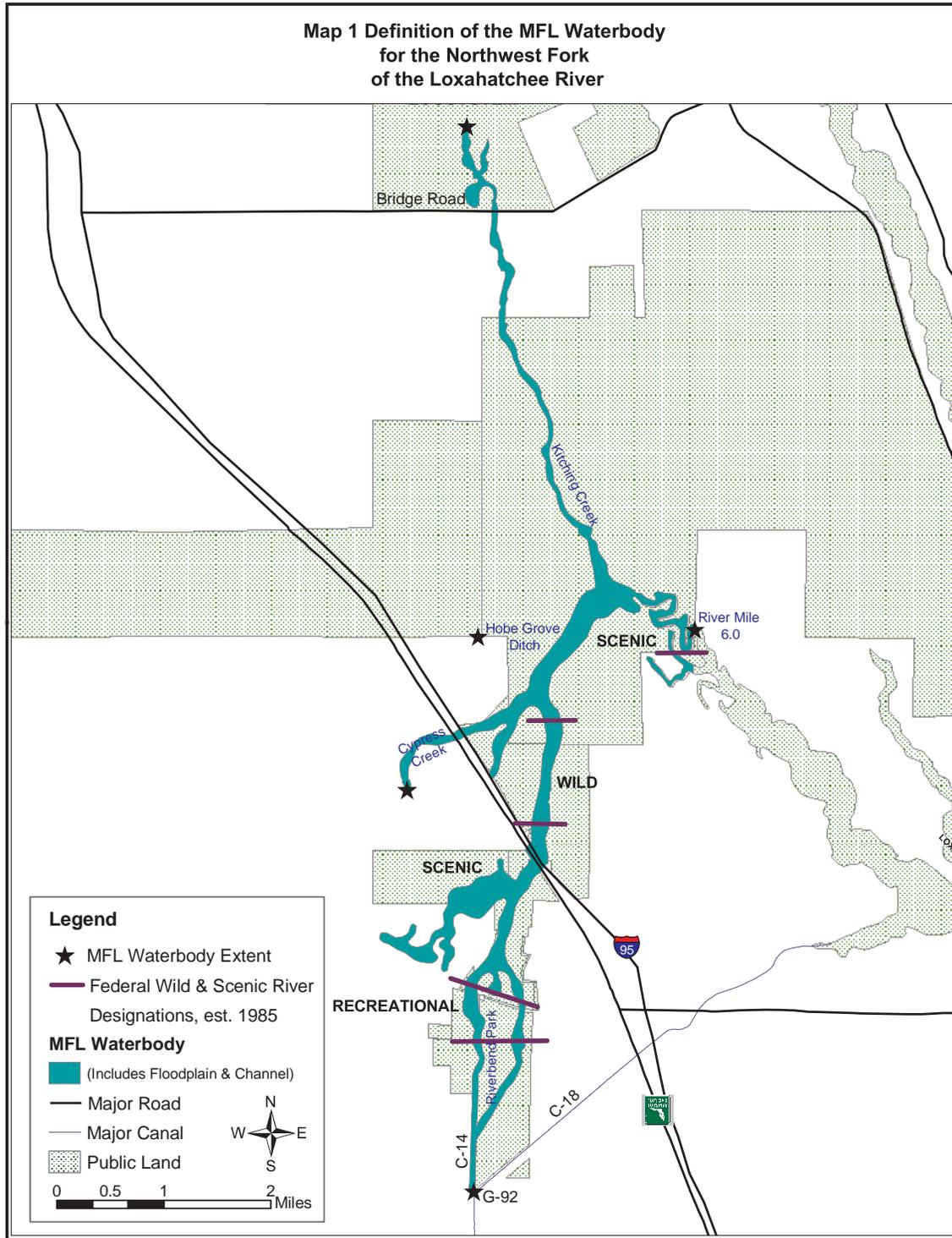
(d) Additionally, it is the intent of the District to continue the current operational protocols of the G-92 structure so as not to reduce the historical high, average and low flows as estimated over the 30 year period

of rainfall record used as the basis for the MFL for the Northwest Fork of the Loxahatchee River.

(e) It is the District's intent to implement, along with other partners, projects to meet the practical restoration goal developed according to paragraph (b). Projects contained in the Comprehensive Everglades Restoration Plan, the LEC Plan and the NPBCCWMP will provide increased storage and conveyance within the basin with a goal of providing more water for restoration of the Northwest Fork of the Loxahatchee River.

(f) To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of these associated projects, the District intends to adopt water reservations for the Loxahatchee River, pursuant to Section 373.223(4), F.S., on a project by project basis over the next 20 years. In addition, the SFWMD intends to adopt an initial reservation to protect existing water used for protection of fish and wildlife, consistent with the practical restoration goal identified for the Loxahatchee River, by 2004. Future reservations related to the Loxahatchee River will be consistent with the reservations being developed for restoration of the Everglades under CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the future allocation to consumptive uses the freshwater intended for restoration of the Loxahatchee River. The reservations will be implemented through the consumptive use permit program, operational protocols, water shortage rules, and other appropriate provisions in Chapter 373, F.S.

(g) As reservations are adopted to restore the Loxahatchee River beyond that to be achieved by the MFL, the District shall revise the minimum flow and level and associated prevention and recovery strategy, as appropriate, under Sections 373.042 and 373.0421, F.S., to be consistent with the reservation.



Specific Authority §§ 9, 10 P.L. 83-358, 373.044, 373.113, 373.171 FS. Law Implemented 373.016, 373.036, 373.0361, 373.042, 373.0421, 373.175, 373.216, 373.219, 373.223, 373.246 FS. History—New 9-10-01, Amended 11-11-02, 4-1-03.

MFL WATER BODY - LETTER FROM SFWMD TO FDEP



SOUTH FLORIDA WATER MANAGEMENT DISTRICT

3301 Gun Club Road, West Palm Beach, Florida 33406 • (561) 686-8800 • FL WATS 1-800-432-2045 • TDD (561) 697-2574
Mailing Address: P.O. Box 24680, West Palm Beach, FL 33416-4680 • www.sfwmd.gov

Joel VanArman

April 1, 2005

Ms. Colleen Castille
Secretary, Florida Department of Environmental Protection
Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Dear Ms. Castille: *Colleen*

In response to Section 373.042(2) Florida Statutes, the South Florida Water Management District (District) submits its revised "2005 Minimum Flows and levels Priority List and Schedule for Establishment" to the Department of Environmental Protection. The District's Governing Board approved the attached list of MFL Priority Water Bodies and Schedule on March 8, 2005.

As has been discussed with the Department's Office of Water Policy, and presented in the attached document, the MFL Priority Water body list has been significantly revised to accommodate the District's new initiative to develop initial water reservations for the Everglades (i.e., the Water Conservation Areas, Everglades National Park and N.E. Florida Bay), the Caloosahatchee and St. Lucie estuaries, the Kissimmee River, northern Biscayne Bay and the N.W. Fork of the Loxahatchee River.

We look forward to the Department's approval of the attached list so that it can be published in the Florida Administrative Weekly. If you have any questions, please contact Carlyn Kowalsky at 561-682-6240.

Sincerely,

Henry Dean
Executive Director

c: Carlyn Kowalsky

Attachments

GOVERNING BOARD

Kevin McCarty, *Chair*
Irela M. Bague, *Vice-Chair*
Amela Brooks-Thomas

Alice J. Carlson
Michael Collins
Nicolas J. Gutierrez, Jr., Esq.

Lennart E. Lindahl, P.E.
Harkley R. Thornton
Malcolm S. Wade, Jr.

EXECUTIVE OFFICE

Henry Dean, *Executive Director*

South Florida Water Management District
2005 Minimum Flows and Levels Priority List and Schedule for Establishment
 4/1/05

<i>Region</i>	<i>Priority Water Body</i>	<i>Year Established</i>
Kissimmee basin	Lake Istokpoga	2005
Lower East Coast	Florida Bay	2005
	Biscayne Bay - South	2006
	Loxahatchee River (Tributaries ¹ to N.W. Fork)	2007

(1) = Tributaries include Kitching Creek, Hobe Grove Ditch, Cypress Creek and Loxahatchee Slough

Basis for Proposed Changes for the April 1, 2005 MFL List

Considerations for Developing the 2005 Priority List

The previous SFWMD Minimum Flows and Levels (MFL) Priority List, and Schedule, dated February 2004, proposed development of 23 MFLs between 2004 and 2008, including 1 MFL in 2004, 6 in 2005, 14 in 2006, 1 in 2007 and 1 in 2008. So far, in the six years since MFL development efforts were initiated by the SFWMD in 1998, the District has completed technical studies and adopted MFL criteria by rule for 7 water bodies. Based on our experience with adoption of these MFLs, we recognize that the large numbers of MFL projects proposed for 2005 and 2006 cannot be completed, given the available resources, modeling, peer review and public involvement processes needed to support these efforts.

The SFWMD is also beginning efforts to develop initial water reservations for critical natural areas within its jurisdiction. The most critical resources are those that are linked to regional water management facilities, are subject to restoration efforts such as CERP and Acceler8 but, prior to completion of these projects are threatened by pending requests for increased consumptive use withdrawals. The water bodies that are most at risk from these perspectives include the Everglades, Northwest Fork of the Loxahatchee River, Caloosahatchee River, northern Biscayne Bay, St. Lucie Estuary and the Kissimmee River.

Whereas the MFL criteria are appropriately used to protect resources that are presently experiencing or likely to experience significant harm, the District perceives that the initial water reservations will provide additional water resource protection for some of these areas. Reservations may also provide a more appropriate basis for restricting consumptive use water allocations than is provided by the MFL, but it will take some time and experience with the use of this tool to determine its effectiveness. Some areas may require development of both MFL criteria and a water reservation to ensure adequate resource protection.

The MFL Priority List for 2005 was therefore revised considerably relative to previous lists, based on the following considerations:

- The workload for development of MFLs (i.e. number of MFL studies that need to be completed) is increasing rapidly in the next few years. However, due to competing, high-priority restoration initiatives, no additional District staff resources are available for this effort.
- The SFWMD is initiating a major effort and a new prioritization process to establish initial water reservations for critical water bodies within its jurisdiction. This effort will require many of the same staff that are presently developing MFLs.
- The 2005 list proposes a more realistic approach to MFL prioritization that will focus efforts to develop MFLs in areas that have the most critical needs and areas where MFL criteria development efforts are actively underway. The scope of the list has therefore been reduced to three years. As the list is updated each year, more water bodies will be added, as areas with the most critical needs are prioritized, associated planning and restoration efforts proceed and MFL or water reservation studies are initiated. Each area will be carefully evaluated to determine which of these tools (MFLs or reservations) can provide the most effective protection of South Florida's water resources
- The policy issues surrounding development of MFLs have become more complex in areas where there is significant competition for available water resources. More emphasis is being placed on protection of resources in these critical areas. In order to focus more resources on these critical areas, water bodies where competition for available water is not an immediate issue were removed from the list
- Some MFL efforts have been delayed to provide better coordination with restoration plans. It has been very difficult in the past to convince the public that the MFL criteria would provide protection for the resource, unless restoration plans and criteria were also provided. Therefore, development of MFLs needs to be closely coordinated with regional restoration (e.g. CERP) and water supply plans and projects. These activities typically constitute the MFL recovery and prevention strategies, and provide assurances to the public and other agencies that the resource will continue to be properly managed, to protect and enhance the condition of the resource in the future, as water supply demands increase over time.
- The District has also identified the need to better coordinate development of MFL criteria for aquifers with the development of MFL criteria for closely related surface water bodies, such as adjacent estuaries.
- The approach proposed for the 2005 list will focus MFL efforts on areas that have the most critical needs and areas where MFL studies are actively underway. As the list is updated each year, more water bodies will be added as ongoing studies are completed, associated planning and restoration efforts proceed, and new MFL or water reservation studies can begin. Each area will be carefully evaluated to determine which of these tools (MFLs or reservations) can provide the most effective protection of regional water resources

Technical and policy considerations for specific water bodies, which were factored into this revised list, are summarized below.

Explanation of Changes from Previous List

Biscayne Bay MFL

The 2004 MFL Priority List proposed that the SFWMD would develop MFL criteria for three areas of Biscayne Bay – South Central, Northern and Southern. This year we are modifying the scope and timing of these efforts as summarized below

- 1) The South-Central area extends from the vicinity of the C-100 Canal north of Black Point, south to the northern edge of Card Sound, including the coastal section of Biscayne National Park and the Biscayne Bay Coastal Wetlands CERP Project. Although MFL development has been delayed due to technical issues, the District intends to complete this effort during 2006. Management of water levels in the southern Biscayne Aquifer is a critical component of providing minimum levels of freshwater flow to Biscayne Bay during periods of reduced rainfall and will be addressed in this analysis.
- 2) The northern area of Biscayne Bay extends from north of C-100 Canal to Dumfoundling Bay, including the Central, Miami River/Government Cut, Northern and Snake Creek/Oleta River subunits. These areas were identified last year as needing additional evaluation. We have subsequently determined that northern Biscayne Bay can be better protected by establishment of a water reservation, rather than MFL criteria. We are proposing to develop this reservation during 2006.
- 3) Southern Biscayne Bay, including Manatee Bay, Card Sound and Barnes Sound were also further evaluated. It was determined that neither MFL criteria nor a water reservation should be established at this time. Rather, we propose that appropriate water reservation(s) for this area will be appropriately scheduled and established as part of the CERP process, development of operational plans, and construction of facilities for the C-111 and CSOP projects.

Estero Bay MFL and Lower West Coast Aquifers MFL

Estero Bay was originally placed on the MFL Priority List based on concerns expressed by FDEP in 2000 about reduced river flows and associated saltwater intrusion. The District determined that it would be appropriate to link development of MFL criteria for the Estero Bay with the development of MFL criteria for the Lower West Coast surficial aquifer. A number of efforts by the District and other agencies have been initiated to provide improved resource protection in these areas. These include specific studies of resources in the Estero Bay estuary, development of associated performance measures to protect these resources, criteria for protection of isolated wetlands in the watershed, and the ongoing South Florida Feasibility Study. Some of the reasons why Estero Bay was removed from the list are noted below:

- Use of the surficial aquifer in this area is limited by proximity of the coastal salt water interface and low yield
- Groundwater also has a high concentration of iron
- Much of the area is developed; most of these demands are met by other, more abundant sources

- There are few existing users within 2 miles of the coastline
- Water use permitting criteria (“B List Rules and “no harm” criteria) are felt to provide adequate protection to prevent over-development of surface or groundwater resources.
- Review of the number and types of permits issued in this basin show that CUP withdrawal quantities are not a major problem – the primary concern is water quality.
- Water quality issues are being addressed both through FDEP’s impaired waters and TMDL program and a proposed Special Southwest Florida Basin Rule, under development by the District, to require additional water quality management requirements for new developments.

These ongoing activities suggest that the threats to groundwater and surface water resources, due to impacts of existing and immediate future consumptive use withdrawals, are less severe than originally perceived, and are less immediate than in other areas of the District. Therefore we propose to postpone development of additional resource protection criteria (water reservations or MFL criteria) for these areas. The needs will be reevaluated through the water supply planning process for possible inclusion on a future priority list.

Kissimmee River and Kissimmee Lakes

The Kissimmee River and lakes in the Kissimmee Basin were initially placed on the SWIM priority List in 1988 due to perceived water quality problems. In the early 1990s, the SWIM priority list and MFL list were merged. Initial modeling studies of this region, as described in the Kissimmee Basin Regional Water Supply Plan (SFWMD), indicated a potential threat to water levels in some lakes within the region by groundwater withdrawals. More recent work now suggests that this threat is not immediate or severe and that water levels in these lakes are not currently threatened by consumptive use withdrawals. The District will proceed with developing a Water Reservation for the Kissimmee River by 2008 in conjunction with ongoing restoration efforts, but proposes to postpone efforts to develop MFLs for the Kissimmee Basin lakes beyond the 2008 time frame, with the following additional considerations:

- Most of the lakes in the Kissimmee Basin, and the various sections of the Kissimmee River, are controlled by regulation schedules that prevent excessive lowering of water levels in these systems.
- There is very little, if any, direct consumptive water use withdrawal from these lakes, and current withdrawals from the adjacent surficial aquifer do not seem to directly impact the lake water levels.
- Groundwater use in the Kissimmee Basin is primarily from the Floridan Aquifer, which is not directly linked to the surficial aquifer system and hence to lake levels, throughout much of the region.
- A number of restoration efforts are underway within the Kissimmee Basin that are designed to provide long-term protection and management for these systems, including the ongoing Kissimmee River restoration and development of a Long Term

Management Plan for the Kissimmee Chain of Lakes. The data collection and modeling efforts associated with the Long Term Management Plan will provide a better basis and understanding for development of MFL criteria or water reservations, whichever tool(s) seem most appropriate. These efforts should be largely completed by 2008.

Lake Okeechobee MFL

The SFWMD developed MFL criteria for Lake Okeechobee in 2001. The MFL rule includes a mechanism and process for periodically reviewing and updating MFL criteria, and including revisions as part of the regional water supply process. Therefore, we see no need to identify this forthcoming update as a separate item on the MFL Priority List. The SFWMD is presently reviewing the operational plan and regulation schedules for Lake Okeechobee. A review of the effect of these changes on the existing MFL criteria will be conducted as a step in the analysis and, the MFL criteria will be modified in accordance with procedures outlined in Ch 40E-8 F.A.C. and Ch 373 F.S.

TRIBAL WATER RIGHTS AGREEMENT

AGREEMENT BETWEEN
THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT
AND THE SEMINOLE TRIBE OF FLORIDA
AND WATER SUPPLY PLAN FOR THE BRIGHTON RESERVATION
IMPLEMENTING SECTION VI.B. OF THE WATER RIGHTS
COMPACT AND SUBPARAGRAPH 3.3.3.2.A.3 OF THE CRITERIA MANUAL
(AGREEMENT NO. C-4121)

WHEREAS, the South Florida Water Management District (District) has entered into a Water Rights Compact (Compact) with the State of Florida and the Seminole Tribe of Florida (Tribe); and

WHEREAS, pursuant to Part VI., Section B of the Compact and subparagraph 3.3.3.2.A.3 of the Criteria Manual for the Compact, there is specific authority for the District to take actions to ensure that the Tribe receives the fifteen percent (15%) entitlement set forth in the Compact for the Brighton Reservation; and

WHEREAS, the District makes water supply releases from Lake Istokpoga to maintain the canals at or near optimum until such time as the level of Lake Istokpoga reaches the water supply minimum level as outlined in the regulation schedule for Lake Istokpoga, hereby attached and incorporated as Exhibit "A"; and

WHEREAS, historically, water shortages have been declared for Lake Istokpoga and the Indian Prairie Basin when Lake Istokpoga reaches the water supply level as outlined in the regulation schedule and the canals reach the minimum levels established in Rule 40E-22.072, Florida Administrative Code, hereby attached and incorporated as Exhibit "B"; and

WHEREAS, the District issued a preliminary report in December, 1988, which concluded that, at times, the lower reaches of the Indian Prairie Basin canals traversing the Seminole Brighton Reservation did not get a fair share of the discharge from Lake Istokpoga and/or run-off generated and that, for various reasons the fifteen percent (15%) minimum entitlement was not always available to the Reservation; and

WHEREAS, the preliminary report also determined that implementation plans would be developed employing specific strategies to assure maximum reliability in delivering the Tribe's fifteen percent (15%) share to the Reservation; and

WHEREAS, the District installed pumps on the C-41 and C-40 canals at S-71 and S-72, respectively, to provide additional water supply from Lake Okeechobee.

NOW, THEREFORE, the District and the Tribe hereby agree, in order to provide the Tribe with its entitled share of surface water for the Brighton Reservation, to implement the provisions of section VI.B. of the Compact and subparagraph 3.3.3.2.A.3 of the Criteria Manual by the following method:

1. No Declared Water Shortage

The District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels provided that neither Lake Istokpoga nor Lake Okeechobee are in declared water shortages. Optimum levels shall be 19.2 feet mean sea level (msl) in the segment of the C-41 canal between S-70 and S-71 and 20.2 feet msl in the segment of the C-40 canal between S-75 and S-72.

2. Declared Water Shortage in Lake Istokpoga

If Lake Istokpoga is in a declared water shortage and Lake Okeechobee is not in a declared shortage, the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels unless and until a shortage is declared for Lake Okeechobee. In order to accomplish this, when Lake Istokpoga is at or below the water supply level of the regulation schedule, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals.

3. Declared Water Shortage in Lake Okeechobee

If Lake Okeechobee is in a declared water shortage, the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels through releases from Lake Istokpoga unless and until a shortage is declared for Lake Istokpoga or until Lake Istokpoga reaches the water supply level of the regulation schedule.

- a. When sufficient water is not available in Lake Istokpoga to maintain water levels in these canals at optimum levels, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when Lake Okeechobee is at or above elevation 10 (ten) feet National Geodetic Vertical Datum (NGVD), or utilize available storage in District canals, to supply the minimum water amounts to which the Tribe is entitled under the Compact, as set forth in Table 7 of the December 1988 Technical Report entitled "A Technical Report on Water Availability Estimates for Brighton Reservation." Table 7 of this report is hereby attached and incorporated as Exhibit "C."

- b. The District shall use its best efforts to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when the level of Lake Okeechobee falls below 10 (ten) feet NGVD as long as mechanically possible without damaging the pumps, in order to provide the minimum amounts of water identified in Table 7 of the December 1988 Technical Report. The District cannot guarantee that the pumps will operate if the level of Lake Okeechobee falls below 10 (ten) feet NGVD.
- c. If in any given month the Tribe requests the District to withhold deliveries, in whole or in part, the District will not be responsible for delivery of the quantity of water withheld in a later month.

4. Reserved Lake Okeechobee Water

A sufficient volume of water from Lake Okeechobee, (See column 4 of Table 7 of the December 1988 Technical Report) shall be reserved and set aside in order to satisfy the District's obligations under section VI.B. of the Compact, as specified above in Sections 2 and 3 of this Agreement and Plan. This volume of water shall not be available for other users of water.

5. Education and Training

The District will provide Tribal representatives with appropriate training and education and necessary available data concerning the regulation schedules of both Lake Istokpoga and Lake Okeechobee.

6. Other Provisions

- a. This Agreement and Plan may be modified with the consent of the parties, and shall be reviewed as operational data becomes available concerning the mechanical operations for the pumps when the elevation of Lake Okeechobee falls below 10 (ten) feet NGVD.
- b. This Agreement and Plan is in full satisfaction of the District's obligations under subsections VI.B.1, 2 and 3 of the Compact and subsection 3.3.3.2 of the Manual.
- c. The Tribe warrants that approval of this Agreement and Plan by the Seminole Tribal Council will bind the Tribe to its terms and will provide the District with an opinion of counsel to that effect or, at the option of the Tribe, to obtain any approval by federal authorities that may be necessary.
- d. The District warrants that approval of this Agreement and Plan by the District's Governing Board will bind the District to its terms.

- e. This Agreement shall commence on the date of execution and continue in full force and effect until such time as it is terminated by the parties by mutual written consent.
- f. This Agreement shall be subject to the procedures established pursuant to Section VII F and VIII of the Water Rights Compact with respect to disputes and court actions.
- g. If it is subsequently determined by a federal court of competent jurisdiction that either of the approvals specified in subsections (c) and (d) of this section were not effective, then this Agreement and Plan shall be null and void.

Dated this 30th day of November, 1992.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT,
BY ITS GOVERNING BOARD

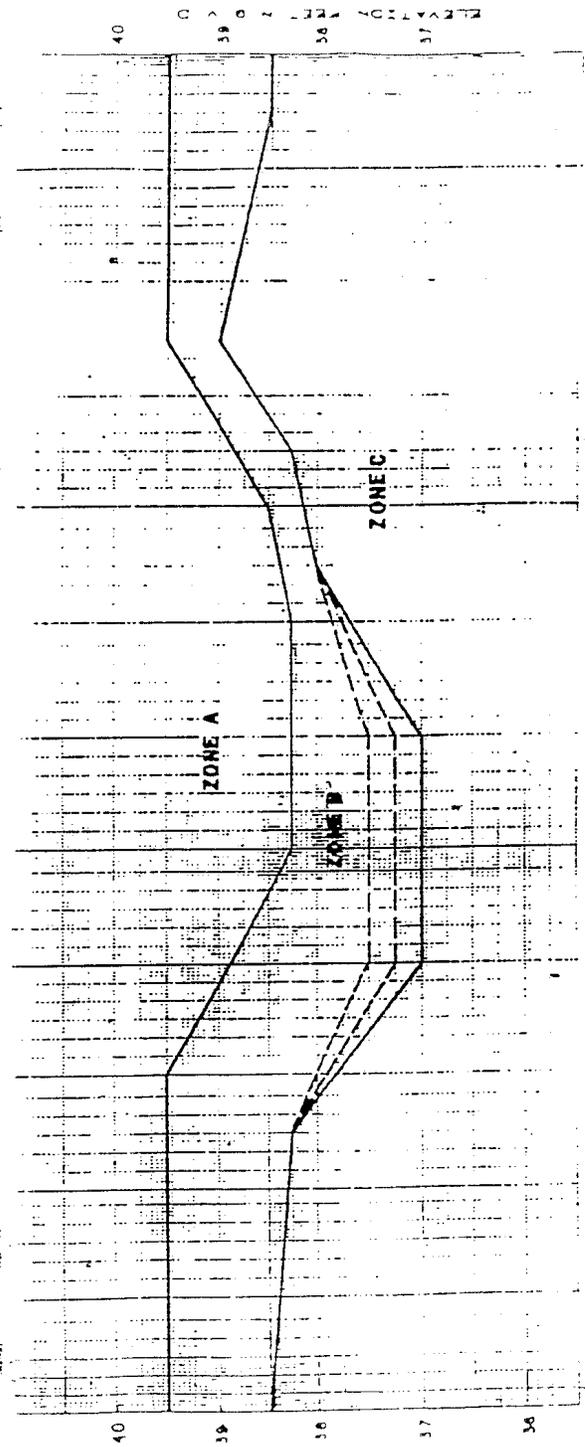
Legal Form Approved

By: Thomas K. Wolf

By: Aaron Miller Jr
Chairman

SEMINOLE TRIBE OF FLORIDA

By: [Signature]
Title: Chairman



PROPOSED 31 AUGUST 1966
COORDINATED 31 DECEMBER 1966

REGIONAL AND SOUTHERN FLORIDA
INDIAN RIVER DRAIN

REGULATION SCHEME
LAKE ISTOKPOGA

SPECIAL CONDITIONS	
UPPER WATER SUPPLY LINE WILL BE USED FOR ZONE B AND C ONCE THE PROPOSED PUMPS ADJACENT TO B-71 AND B-78 ARE IN OPERATION BY LOCAL INTERESTS	
MIDDLE WATER SUPPLY LINE WILL BE USED ONCE THE PROPOSED PUMP ADJACENT TO B-71 IS IN OPERATION	
IT MIGHT BE NECESSARY TO DRAIN THE LAKE DOWN TO 37.5 FEET IF THIS LEVEL HAS NOT YET BEEN REACHED FOR AN EXTENDED PERIOD OF TIME.	

ZONE	RELEASES
A	REGULATORY RELEASES MADE THROUGH ALL GATES: 3-68 FIRM CAPACITY 3,000 CFS 5-68 SECONDARY CAPACITY UP TO 6,000 CFS 1810M FIRM CANAL CAPACITY UP TO 600 CFS
B	WATER SUPPLY RELEASE MADE IF NEEDED
C	NO RELEASES MADE

40E-22.072 Minimum Levels.

The following minimum levels shall be maintained.

(1) Lake Istokpoga

(a) The minimum levels for Lake Istokpoga are shown in Figure 22-2.

(b) The District may, after public notice, allow the minimum levels in Figure 22-2 to be temporarily lowered for environmental or water quality reasons.

(2) Primary Canals (feet above mean sea level)

<u>CANAL</u>	<u>LEVEL</u>
(a) Canal 39-A above Structure 75	22.5
(b) Canal 40 above Structure 72	17.7
(c) Canal 41 above Structure 71	17.0
(d) Canal 41 above Structure 70	22.5
(e) Canal 41-A above Structure 84	21.7
(f) Canal 41-A above Structures 82 and 83	29.0
(g) Borrow Canal of Interceptor Levee 59	17.7
(h) Borrow Canal of Interceptor Levee 60	17.7
(i) Borrow Canal of Interceptor Levee 61	17.0

Specific Authority 373.044, 373.113 F.S.
Law Implemented 373.042, 373.086, 373.103(4) F.S.
History—New 9-3-81.
Formerly 16K-30.03, 16K-30.05, 40E-21.072.

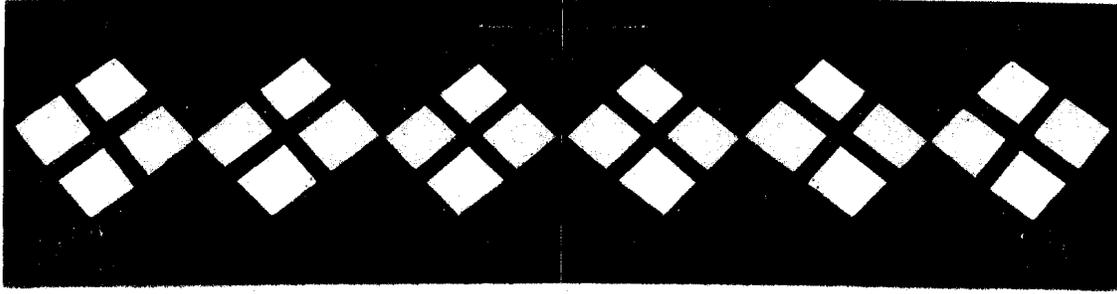
EXHIBIT B

Table 7
Water Availability Estimates
(acre-feet)

Month	(1) Water Available in Lake Istokpoga	(2) Runoff Generated in the Basin	(3) Water Available to the basin (1) + (2)	(4) Presumptive Water Availability for the Reservation 15% of (3)
January	10,148	2,002	12,150	1,823
February	10,856	2,498	13,354	2,003
March	22,369	3,583	25,952	3,893
April	17,801	1,755	19,556	2,933
May	15,447	5,352	20,799	3,120
June	17,180	21,090	38,270	5,741
July	19,859	19,950	39,809	5,971
August	22,909	16,950	39,859	5,979
September	19,475	17,250	36,725	5,509
October	15,717	8,760	24,477	3,672
November	10,482	1,927	12,490	1,861
December	7,109	1,983	9,092	1,364



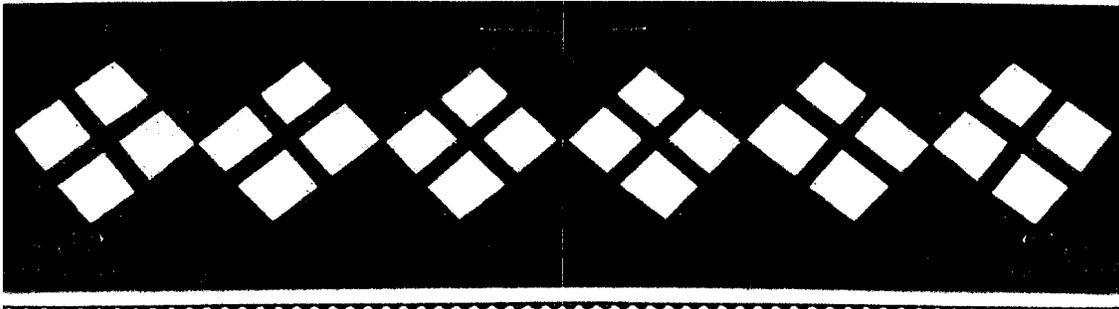
TRIBAL WATER RIGHTS COMPACT



Seminole



Compact





WATER RIGHTS COMPACT
AMONG THE
SEMINOLE TRIBE OF FLORIDA,
THE STATE OF FLORIDA
AND
THE SOUTH FLORIDA
WATER MANAGEMENT DISTRICT

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**WATER RIGHTS COMPACT
AMONG THE SEMINOLE TRIBE OF FLORIDA,
THE STATE OF FLORIDA AND THE
SOUTH FLORIDA WATER MANAGEMENT DISTRICT**

WHEREAS, the parties to the Compact recognize the importance of tribal self-determination and economic development to the Tribe and the people of the State of Florida; and

WHEREAS, the parties to the Compact recognize the importance of protection of the environment and natural resources to the well being of all; and

WHEREAS, the parties to the Compact recognize that the general public interest is served by supporting the self-determination goals of the Tribe, by protecting and enhancing the environment, and by exercising prudence in the use of natural resources; and

WHEREAS, the parties to the Compact desire to protect the interests of all in available waters through cooperation and planning for present and future needs of the Tribe and others; and

WHEREAS, the Seminole Tribe of Florida claims paramount rights to the use of water under Federal law and freedom from State regulation; and

WHEREAS, the parties to the Compact disagree as to the scope and/or existence of the rights; and

WHEREAS, the regulation of consumptive water use and surface water management under Florida law within that portion of the State of Florida encompassing the Seminole Tribe's Federal

Reservations and Tribal Trust lands has been delegated by the State to the South Florida Water Management District; and

WHEREAS, the Seminole Tribe does not presently recognize the authority of the State or the District to regulate consumptive water use and surface water management on the Seminole Federal Reservations and Tribal Trust lands; and

WHEREAS, the parties to the Compact desire to avoid the expense and uncertainty of large scale water rights litigation; and

WHEREAS, the State and the District have recognized an obligation to assist the Tribe in the development of its Reservations by appropriate utilization of the waters on the Reservations so that the Tribe may become economically self-sufficient; and

WHEREAS, the Tribe has agreed to cooperate with the State and the District in the regulation of water use and water management; and

WHEREAS, the Compact is intended to create a comprehensive and effective system of regulation applicable to the Seminole federal Reservations and Tribal trust lands that protect the Tribe's water rights and development potential and is in harmony with the essential terms and principles of the State system; and

WHEREAS, this system would provide for the protection of surface and ground water within and outside of the Tribe's federal Reservations and Tribal Trust lands and prevent adverse environmental impacts; and

WHEREAS, the comprehensive system provides a procedural mechanism for resolving conflicts and establishes respective burdens of the Tribe, the State, the District, and other parties in fairly resolving water use and water management issues; and

WHEREAS, the Seminole Tribe has withdrawn its objections to the Modified Hendry County Plan pending approval before the United States Army Corps of Engineers in return for assurance that Tribal water rights will be protected under the Compact; and

WHEREAS, the Compact is not intended to disturb vested rights; and

WHEREAS, the State, the District, and the Tribe have agreed to cooperate and use their best efforts to identify the extent and quality of water resources available to the Tribe.

NOW, THEREFORE, the parties to the Compact agree as follows:

I. DEFINITIONS

The following terms as used in the Compact shall have the meaning assigned in this section, and shall not be understood as having the same meaning as terms defined by state law or by judicial interpretation of state law, unless otherwise expressly stated in the Compact.

- A. Action in Federal District Court Actions commenced in the United States District Court for the Southern District of Florida to enforce rights and obligations under the Compact.
- B. Board -- The Governing Board of the District with the general powers and duties set forth under Chapter 373, (1986 supp.) of the Florida Statutes, and its successors.
- C. District -- The South Florida Water Management District, an agency of the State of Florida created by Chapter 25270, Laws of Florida (1949) and operating pursuant to Chapter 373 Florida Statutes, and its successors.
- D. District Rules, Orders, and Regulations -- All lawfully promulgated rules, orders, and regulations adopted by the District or affecting the operations of the District.
- E. Essential Terms and Principles of the State System -- Non-procedural provisions of the Florida Water Resources Act of 1972 as presently codified in Chapter 373 of the Florida Statutes (supp. 1986) and which are necessary to provide for the beneficial use and management of water and related land resources; to promote the conservation, development, and proper utilization of surface and groundwater; to prevent damage from floods, soil erosion,

and excessive drainage; and to protect natural resources, fish, and wildlife.

- F. Florida Water Code -- The Florida Water Resources Act of 1972 as codified in Chapter 373 of the Florida Statutes (1986 supp.).
- G. Manual -- The Evaluation Criteria Manual approved by Tribe, State and the Board containing specific technical and procedural criteria.
- H. Reservations -- Lands designated by the United States Department of the Interior as of the effective date of the Compact, as federal Seminole Indian Reservations physically located within the geographic area under the authority of the District.
- I. State -- The State of Florida, its agencies (other than the District), political subdivisions, constitutional officers, officials of its agencies and subdivisions (other than officials of the District).
- J. Substantially Affected Third Persons -- Persons, groups, or entities who demonstrate a non-frivolous interest substantially affected by the exercise of rights under the Compact. The Florida Department of Environmental Regulation, the Florida Department of Natural Resources, the Florida Department of Community Affairs, and the Florida Game and Freshwater Fish Commission, successor agencies, and owners of lands within the basin affected by exercise of rights under the Compact are presumed to be substantially affected third parties. This presumption can be rebutted by an affirmative showing that the state agency or landowner does not have an interest that would be substantially affected by the exercise of rights under the Compact.

- K. **Tribal Trust Lands** -- Lands held in trust by the United States for the benefit of the Seminole Tribe, including the Immokolee lands held by the Tribe in fee status in Section 10, Township 47S, Range 29E, Collier County, Florida, as of the effective date of the Compact, and which are physically located within the geographic area under the authority of the District.
- L. **Tribal Water Code** -- A Code adopted by the Tribe which is consistent with the provisions of the Compact and which ensures compliance with the Compact by persons conducting activities on Reservation and Tribal Trust lands.
- M. **Tribe** -- The Seminole Tribe of Indians of Florida or the Seminole Tribe of Florida, a tribe of American Indians recognized by the United States and organized under section 16 of the Indian Reorganization Act of 1934, 25 U.S.C. section 476, and recognized by the State of Florida pursuant to Chapter 285, Florida Statutes.
- N. **Wetlands** -- Areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, wet prairies, river overflows, mud flats and natural ponds.
- O. **Work Plan** -- One or more work plans as described under Part VII., Section A. of the Compact.

II. GENERAL PROVISIONS**A. Obligations of the Tribe in Exercising Rights Under the Compact**

1. The obligations of the Tribe in developing its reservations and Tribal Trust lands in exercising its rights under the Compact are limited to those expressly stated in the Compact, the Manual, or applicable federal laws. Nothing in the Compact is intended to divest the State of Florida of any jurisdiction it has as of the effective date of the Compact within the borders of the Seminole Reservations and Tribal Trust lands.
2. Those State laws and District rules, orders, and regulations which are applicable to the Tribe under the terms of the Compact as specified hereafter are expressly incorporated into federal law, and apply to the Tribe as federal law.
3. The Tribe may use any form of testing and monitoring to fulfill obligations under the Compact, if such testing and monitoring is reasonably equivalent to the accuracy and reliability of testing and monitoring customarily used or required by the District.
4. The Tribe shall give permission for the District to make on-the-ground inspections of Tribal facilities affected by the Compact, upon twenty-four (24) hour advance notice. Costs associated with such inspections shall be borne by the District.
5. Upon twenty-four (24) hour advance notice, the Tribe shall allow the District reasonable access to Reservation and Tribal Trust lands for the purpose of performing

testing necessary to fulfill the District's obligations under the Compact.

6. The Tribe is responsible for enforcing the provisions of the Compact, the Manual, and for complying with the terms and conditions of approved work plans on Reservation and Tribal Trust lands. The Tribe has the authority to promulgate a Tribal Water Code to implement and enforce the Compact, the Manual, and the terms and conditions of approved work plans.

B. Tribal Representative

All communication with the Tribe concerning rights and obligations under the Compact shall be through the Tribal office created for such purpose, or through such other party as is expressly designated by Tribal Council Resolution.

C. Notice

All notices provided for under the Compact shall consist of written communication by registered or certified mail to the addresses of the parties or as specified in the Manual. All notices, pleadings, or other materials required to be filed with the District Clerk shall be deemed filed on the date of actual receipt by the District Clerk. All other notices, pleadings or other materials shall be deemed filed upon mailing first class, postage prepaid.

D. Lands To Which Compact Rights Apply

This Compact, the Manual, the Tribal Water Code, and applicable federal laws constitute the sole sources of regulation of consumptive water use, and the management and storage of surface water and groundwater on Reservation and Tribal Trust lands.

E. Effective Date of Compact

This Compact among the Tribe, the State, and the District, shall not become final and shall be without binding force and effect until all requirements enumerated in section 2 of the Settlement Agreement between the parties to Seminole Tribe of Indians of Florida v. State of Florida, No. 78-6616-CIV (S.D. Fla) (to which the Compact will be attached as Exhibit C) have been satisfied. This Compact, in the form approved by the Board on May 15, 1987, shall be null and void on December 31, 1988 unless it has received all necessary approvals and/or ratifications by that date.

F. Inapplicability of Compact to Existing Facilities, Projects, and Improvements on Reservations and Tribal Trust Lands

1. Existing facilities, projects, and improvements, other than works of the District, which are located on Reservations or Tribal Trust lands, and which may be inconsistent with the criteria and standards set forth in the Compact, shall be required to meet the criteria and standards set forth in the Compact and the Manual only if:
 - a. the Tribe intends to integrate such existing facilities, projects and improvements into new developments under the Tribe's work plan when:
 - i) the additional flow to be routed to the existing facilities, when combined with current design flows, exceeds the design capacity of the existing facilities;
 - ii) the additional flow to be routed to the existing facilities will originate from areas of significantly different land use;

- iii) the existing facilities will be modified to accommodate the new water supply or water management development; or
 - b. such existing facilities, projects, and improvements substantially harm, or pose a threat of serious irreparable harm, to lands other than Reservation and Tribal Trust lands. Such existing facilities, projects, and improvements shall be required to meet the criteria and standards of the Compact only to the extent necessary to mitigate the demonstrated harm.
 - 2. Such existing facilities, projects, and improvements which are located on Reservations and Tribal Trust Lands and which may be inconsistent with the criteria and standards set forth in the Compact shall not be required to meet the criteria and standards set forth in the Compact except in the circumstances set forth under subsection 1. of this section.
 - 3. Notwithstanding any other provision of the Compact or Manual, the Tribe shall not be required to institute mandatory water utility pressure reductions during a declared water shortage on systems serving Big Cypress or Brighton Reservations.

G. Description of Numbering System for Compact

Letters and numbers designating provisions of the Compact shall be in the following order, and shall be identified in the following manner: "I" is a Part; "A." is a section; "1." is a subsection; "a." is a paragraph; and "i)" is a subparagraph.

H. Computation of Time

In computing any period of time prescribed or allowed under the Compact, the day of the act from which the designated period of time begins shall not be included. The last day of the period shall be included unless it is a Saturday, Sunday, or legal holiday, in which event the periods shall run until the end of the next day which is not a Saturday, Sunday, or legal holiday. Legal holidays include those days so designated under State and federal law. The date of final District action under Part VII. of the Compact shall be the date on which the written order specified in Section I. of this Part is filed with the District Clerk.

I. Requirement for Written Orders / Final District Action

Any act or event which constitutes final District action under the Compact shall be reduced to a written order, filed with the District Clerk, and served on the Tribe within ten (10) days of such act or event. Service on other persons shall be as provided under Part VII. of the Compact.

J. Relationship Between Compact, Manual and Tribal Water Code

1. Provisions of the Compact listed in paragraphs a. through e. of this subsection shall be implemented according to the Manual:

- a. Part III.B.; III.C.6.; III.D.; and
- b. Part IV.; and
- c. Part V.A.; V.B.; V.C.; V.D.; and
- d. Part VI.B.; VI.D.; and
- e. All of Part VII.

2. If the Tribe complies with the applicable requirements and objectives of the Compact, then the Tribe, with the exception of the procedural chapter of the Manual, does not need to meet the specific criteria outlined in the Manual. If the Tribe satisfies the specific criteria outlined in the Manual, a presumption shall arise that the Tribe has met the requirements and objectives of the Compact.
3. Following the procedures set forth under Part VII.G. of the Compact, the parties to the Compact may modify, amend, or otherwise change the Manual.
4. One of the purposes of the Manual is to further define and explain the conditions, criteria and objectives of this Compact. Any ambiguities in the Compact should be resolved, if possible, by reference to the Manual. However, in no event, shall the Manual be used to alter or modify terms or provisions contained in the Compact which are not facially ambiguous. Conflicts between the Compact and the Manual shall be resolved by adhering to the Compact. Conflicts between provisions of the Tribal Water Code and the Compact shall be resolved by adhering to the Compact. Conflicts between provisions of the Tribal Water Code and the Manual shall be resolved by adhering to the Manual.
5. In any instance where the District establishes a new program of general applicability throughout the District or institutes changes in any rules, regulations, or procedures, which are of general applicability throughout the District, or institutes changes to rules,

regulations or procedures affecting only the basin or area within which Tribal lands to which the Compact applies, and which are inconsistent with or not addressed by the Compact or Manual:

- a. The District shall notify the Tribe of said changes in writing upon initiation by the District of rulemaking; and
- b. Within sixty (60) days of adoption the Tribe shall elect to proceed under either the new provision or under the prior provision if any. If the Tribe elects to proceed under the new provisions, the Manual shall be appropriately amended.

K. Promulgation and Amendment of Tribal Water Code

The Tribe shall provide the District with a copy of proposed provisions and proposed amendments of the Tribal Water Code at least ten (10) days before adoption by the Tribe of such provisions and amendments.

III. CONSUMPTIVE WATER USE

A. Protection and Regulation of Tribal Water Use

1. The principles set forth in this part of the Compact are intended to prescribe and protect the Tribe's rights to the use of water.
 2. The Tribe's rights shall not be adversely affected or limited by any change subsequently made in the State system or the District rules, regulations, and orders affecting preference or priority of water use. The Tribe shall have a preference or priority equal to any preference or priority which may be established for the same use under State law for any other party after the effective date of the Compact.
 3. After the effective date of the Compact the Tribe will have an opportunity for significant input into water related land use decisions on lands surrounding the Reservation. In return for this increased input from the Tribe, surrounding landowners should be able to rely on past land use decisions without fear that later exercise of tribal rights will negatively impact them. Present surrounding land uses do not present any inherent conflicts.
4. It is consistent with the public interest to take steps and means to avoid the undesirable effects of inflexibility in the transfer of water rights while retaining adequate security for any such existing rights. Water rights exercised under any existing system should not become so inflexible that water resources cannot meet new needs and demands by transfer from existing uses to new uses which are more beneficial.

B. General Criteria

The Tribe must give reasonable assurances that any proposed consumptive water use:

1. will not cause significant inland movement of either surface saline water or the underground saline water interface; will not cause either significant upconing of saline water that may be beneath freshwater or vertical leakage of connate saline water; or otherwise reduce the amount of potable water;
2. will not have a significant adverse impact on lawful land uses including wetlands located on lands other than Reservation and Tribal Trust lands;
3. will not cause significant adverse environmental impacts;
4. will not cause significant pollution of the surface water or the aquifer;
5. is a reasonable-beneficial use ;
6. will not interfere with presently existing legal uses of water and users of water protected under the Compact; and
7. is consistent with the essential terms and principles of the State system as defined in the Compact.

C. Competing Uses

1. The Tribe shall be given a preference in approval of Work Plans involving withdrawal and use of the

groundwater resources underlying Reservation and Tribal Trust lands.

- a. **The Tribe shall be entitled to a preference when its proposed use conflicts with a proposed use by a non-Tribal user and the recognition of such preference is reasonably necessary to the accomplishment of the Tribe's lawful purposes.**
 - b. **The Tribe shall be entitled to a preference to a reasonable share of available resources when its proposed use conflicts with a then pending application by a non-Tribal user to renew or increase its authorized use of water and the recognition of such preference is reasonably necessary to the accomplishment of the Tribe's lawful purposes.**
2. **The Tribe through its exercise of rights under this Compact, is afforded an opportunity to perfect its rights to water as though it had been an existing user and had elected to perfect its rights to water on or after March 2, 1974 (the date of implementation of Part II, Chapter 373, Florida Statutes).**
 3. **If two (2) or more proposed uses which otherwise comply with the provisions of this part are pending for a quantity of water that is inadequate for both or all, such proposed competing uses must first satisfy the standard conditions for approval which apply to each applicant. The Board shall consider the reasonable beneficial uses for the water as well as the extent to which the proposed use is reasonably necessary for the Tribe to achieve its purposes.**

4. No Tribal preference shall be asserted in a manner that will cause catastrophic changes to aquifer systems. No Tribal preference shall be asserted directly or indirectly for the purpose of exporting water for use offsite of Reservations and Tribal Trust lands.
5. Determination of any tribal claim that offsite activities or water consumption have caused water quality problems in aquifer systems underlying Reservation and Tribal Trust lands shall be made without regard to any preferred rights of the Tribe under this section.
6. **Drawdown Limitations**

This subsection specifies maximum drawdowns in artesian aquifers. Actual drawdowns permitted by the District pursuant to the Compact with respect to the Tribe or Chapter 373, Florida Statutes, with respect to adjacent landowners may be substantially less than these maximums.

- a. **Exercise of Tribal Preference**

In exercising its preference rights, the Tribe shall not cause more than a twenty (20) foot drawdown of the potentiometric head of any artesian aquifer system at the boundaries of the Reservation or Tribal Trust lands involved unless it has specific written authority or agreement from affected landowners.

- b. **Adjacent Landowners**

No development of groundwater resources on lands adjacent to any of the Seminole Reservations or Tribal Trust lands will be

permitted by the District if the drawdown of the potentiometric head of any artesian aquifer system will be more than twenty (20) feet at the boundary of the Reservation unless it has specific written authority or agreement from the Tribe.

7. All water use permits issued by the District after the date this Compact is approved by the Board to non-Tribal users whose permit rights may be affected by the Tribal rights confirmed under the Compact, shall include a special condition advising the permittee of the Compact and its potential impact on any future permit renewals. Appropriate notice of Tribal rights under the Compact shall be sent to all potentially affected holders of existing permits.
8. The Tribe shall mitigate adverse impacts on lawful single family home domestic users existing as of the date the Compact is approved by the Board, where such adverse impacts are caused by the exercise of Tribal rights under the Compact. Adverse impact shall be determined according to the Manual.

D. Water Shortage

1. Reductions in Tribal water use due to water shortages shall be made in the same manner and percentage as the equivalent class of use, source, and manner of withdrawal as required under the District water shortage plan. The Tribe may request a variance from water use restrictions imposed pursuant to this Section, using the procedures and criteria in the Manual. Variances shall not be unreasonably denied. The Tribe shall not be required to reduce its water sources, uses, and methods of withdrawal more than the reduction in sources, uses, and methods of withdrawal of the

least restricted user of the same source, use, and method of withdrawal class except as authorized under Chapter 7 of the Manual.

2. Declared water shortages occurring solely on Reservation and Tribal Trust lands shall be governed solely by the Tribal Water Code provided that the Tribal provisions satisfy the objectives of the District and that the applicable Tribal procedures are consistent with the Compact.

IV. MANAGEMENT AND STORAGE OF SURFACE WATERS

A. General Criteria

The Tribe must give reasonable assurances that the proposed surface water management system:

1. provides adequate flood protection and drainage;
2. will not cause significant adverse water quality and quantity impacts on receiving waters and non-Tribal lands;
3. will not cause discharges to ground or surface waters which result in any violation of State water quality standards;
4. will not cause significant adverse impacts on surface and groundwater levels and flows;
5. will not cause significant adverse environmental impacts;
6. can be effectively operated and maintained;
7. will not adversely affect public health and safety;
8. will not otherwise be harmful to the water resources of the District; and
9. is consistent with the essential terms and principles of the State system as defined in the Compact.

V. MISCELLANEOUS ENVIRONMENTAL**A. Water Well Construction**

The Tribe must give reasonable assurances that the construction, alteration, operation, maintenance, and abandonment of any water well on Reservation and Tribal Trust Lands will not be harmful to the water resources of the District and will not be inconsistent with the purposes of the Compact.

B. Underground Injection

1. The Tribe must give reasonable assurances that the construction, alteration, operation, maintenance, and abandonment of any underground injection facility will not be harmful to the water resources of the District and will not be inconsistent with the purposes of the Compact.
2. The District shall, independently of the federal authority having jurisdiction over the matter, review requests by the Tribe for installation and operation of underground injection systems in accordance with the provisions of the Manual.

C. Water Quality Criteria

Tribal activities shall not cause significant pollution of ground or surface waters. The Tribe shall comply with those water quality standards imposed by the District as provided in the Compact, the Manual, and with federal pesticides requirements on Reservation and Tribal Trust lands. The Tribe shall use only pesticides, herbicides, fertilizers, and other agricultural chemicals which have been approved by the Environmental Protection Agency and the U.S. Department of Agriculture for use in Florida and shall apply the pesticides, herbicides, fertilizers, and other agricultural chemicals in strict accordance with the

label directions. Upon written Tribal Council Resolution by the Tribe, the District shall condition permits or other requests for approval reasonably expected to affect Tribal interests by requiring adherence to those water quality standards imposed by the law. The District shall cooperate with the Tribe and appropriate State and federal agencies to enforce the requirements of this subsection against the use of pesticides, herbicides, fertilizers, and other agricultural chemicals by third persons on lands other than Reservation or Tribal Trust lands in a manner which causes water quality violations. The District's cooperation may include, but not be limited to, requiring reasonably appropriate monitoring by permittees and other appropriate actions authorized by state or federal law.

D. Wetlands Protection

1. The Tribe will provide reasonable assurances that wetland values and functions will be maintained. Wetlands and proposed impacts on wetlands shall be evaluated using sound engineering and ecological principles.
2. Wetlands greater than forty (40) acres, or covered under subsection 3. of this section, will be **protected** in accordance with the criteria set forth in the Manual.
3. Wetlands of forty (40) acres or less which are incorporated within a surface water management system or are otherwise protected, shall be governed by subsection 2. of this section.
4. Wetlands of forty (40) acres or less which are not incorporated within a surface water management system or are not otherwise protected, may be disturbed, provided that an upland system of equivalent size is set aside in an area committed for passive uses. The wetland and upland areas to be

traded shall be specifically described in any Work Plan proposed under Part VII., Section A. of the Compact. The District may waive the requirement for uplands set aside under such circumstance as would justify such a waiver for non-Tribal interests.

VI. SPECIAL PROVISIONS APPLICABLE TO SPECIFIED RESERVATION AND TRIBAL TRUST LANDS

A. Landowner Agreements

The Tribe and any landowners who may be affected by operations of the Tribe under a tribal Work Plan, may be protected and governed by site specific criteria applicable to groundwater withdrawals and, if applicable, to surface water withdrawals, determined by private agreement, which may include provisions for arbitration. Criteria for groundwater withdrawals may apply to well placement, construction and operation. Similar criteria for surface withdrawal pumps or other works will be identified, if appropriate, to implement the purpose and intent of this subsection. Any such private agreement may be presented to the District for approval and if so approved by the Board the agreement shall have, as between the parties to such agreement, the force and effect of the Compact and, specifically, shall prevail in any dispute between the parties to such private agreement in the event of a conflict with the Compact, the Manual or with other applicable permitting criteria of the District. Nothing herein shall affect the authority of the District to evaluate Work Plans, permit applications, or other requests for approval under other provisions of the Compact or state law. Nothing herein shall be construed to preclude a third person from asserting that such Work Plan, permit application, or other request for approval adversely affects their substantial interests. The private agreement between the Tribe and United States Sugar Corporation entered into prior to May 15, 1987 is attached hereto as Exhibit A and made a part hereof. The private agreement between the Tribe and Lykes Bros., Inc. entered into prior to May 15, 1987 is attached hereto as Exhibit B and made a part hereof. Both private agreements are hereby approved.

B. Brighton Reservation

1. The Tribe shall be entitled to fifteen percent (15%) of the total amount of water which can be withdrawn from the District canals and from District borrow canals by all users from surface water within the Indian Prairie Basin as described in Rule 40E-21.691(6)(a), Florida Administrative Code (1987), (legal description to be corrected in Florida Administrative Code) calculated by the District on a monthly basis. The Tribe shall not be entitled to any preference to withdrawals in excess of fifteen percent (15%) from such District canals. The Tribe shall withdraw its fifteen percent (15%) share of the waters in the specified canals under procedures detailed in the Manual which, in the light of experience, are reasonably designed to assure the Tribe of the opportunity to make its entitled withdrawals on a monthly basis. Notwithstanding the provisions of the Manual, the Tribe shall have the opportunity to demonstrate that it is not receiving its entitled share of the waters in the specified canals because of the actions of the District or of some third party. The Tribe shall have the burden of proof on this issue and shall assert any such violations of the Compact under the provisions of Part VII. of the Compact and the Manual.
2. The Tribe shall have access to a fractional share of surface waters from Lake Okeechobee for use on the lands of the Reservation located within the Lakeshore Perimeter Basin as described in Rule 40E-21.691(3)(d), Florida Administrative Code (1987), for water use as it exists on the effective date of the Compact. Such fractional share shall be calculated from the ratio of the total area of the water supply service area as it exists on the effective date of the Compact to the total

land area of the Brighton Reservation within the Lakeshore Perimeter Basin for water use as it exists on the effective date of the Compact.

3. Expansion by the District of the geographical boundaries of the area receiving surface water from a specific source for water use purposes shall entitle the Tribe to a fractional share of any additional available water in the District canals and District borrow canals for use on the Brighton Reservation. Such fractional share shall be calculated from the ratio of the total land area of the Brighton Reservation within the expanded service area to the total land area of the expanded service area. This subsection, however, shall not serve to diminish the percentage of surface water of the Indian Prairie Basin which was available to the Tribe before the expansion of the service area, and which the Tribe may elect to retain pursuant to subsection 1. of this section.

C. Hollywood (Dania) Reservation

1. On the Hollywood (Dania) Reservation, the Tribe shall have the rights set forth under Part III. of the Compact, except that with respect to public water supply permittees of the District whose permits are approved as of the effective date of the Compact, the Tribe shall have no more than the rights accorded public water supply permittees of the District whose permits are approved as of the effective date of the Compact.
2. After receiving notice pursuant to the Manual of an application potentially affecting Tribal rights under the Compact, the Tribe may:

- a. Object to the application pursuant to the Manual; or
- b. Require the District, if the potentially competing use request is granted, to order the permittee to accept the Reservation as a bulk consumer of the permittee's system. The District shall adjust the permittee's allocation to include the additional water needs of the Tribe, if such needs are not included in the allocation granted. The District shall place a condition in the permittee's permit that the permittee must allow the Tribe to connect to the permittee's system and must charge the Tribe at a rate not to exceed the most favorable consumer rate charged to any consumer of the permittee's system. If the additional water needed to supply the Tribe cannot be withdrawn without causing significant adverse impacts, the District shall place a condition in the permit that the permittee must satisfy the reasonable-beneficial needs of the Tribe before satisfying the additional needs of non-Tribal users. It is understood that this procedure is not intended as a precedent for any other situation.

D. Big Cypress Reservation

The Tribe shall be entitled to withdraw from any surface water resources on the Big Cypress Reservation that percentage of the water available within the South Hendry County/L-28 Gap Water Use Basin as described in rule 40E-21.691(7)(c), Florida Administrative Code (1987), as the lands of the Big Cypress Reservation bear to the total land acreage within the basin.

VII. ADMINISTRATIVE PROCEDURES

A. Submission Approval and Amendment of Work Plans

The Tribe, before commencing any work that is covered by the provisions of this Compact, shall submit a work plan to the District, or, where required, an amendment to any work plan, under the procedures specified in the Manual. Such procedures shall give interested parties adequate notice of Tribal plans and an opportunity to be heard, in accordance with the timeframes set forth in the Manual. Such procedures shall also give the District staff sufficient information to properly evaluate the proposals in accordance with the criteria and principles contained in Parts I. through VI. of the Compact and in accordance with the detailed provisions of the Manual.

B. Implementation of Work Plans After District Action

Following District action, the Tribe may request the Board for a rehearing or shall give notice of its intent to implement the Work Plan as approved following final District action or implement the proposed Work Plan or amendment without complying with part or all of final District action in accordance with the timeframes and procedures set forth in the Manual. Initiation of federal court action by the District or third parties shall be in accordance with the timeframes set forth in Part VIII. of the Compact and the procedures contained in the Manual.

C. Dispute Resolution; Exhaustion of Administrative Remedies Before Court Action

The Tribe and the District shall use best efforts to resolve disputes concerning the enforcement of rights and obligations created by the Compact through informal meetings, mediation, arbitration or third party facilitation. Before commencing action, in accordance with the provisions of Part VIII. of the Compact in

the federal district court for violations of the Compact by any party to the Compact or third party, notice shall be given to the Tribe or the District, as the case may be, and remedies provided in the Manual shall be exhausted under procedures established in the Manual.

D. Tribal Water Code

The Tribe, through a Tribal water code, shall enforce the provisions of the Compact and the Manual and terms and conditions of approved Work Plans against persons conducting activities on Reservation and Tribal Trust Lands. Notwithstanding this provision, the Tribe may in individual cases through Tribal Council resolution request the District to enter Reservation and Tribal Trust Lands for the purpose of enforcing the provisions of the Compact against persons other than the Tribe conducting activities on Reservation or other Tribal Trust Lands in accordance with procedures established in the Manual.

E. Tribal Challenge to District Approval of Applications by Third Parties

If the Tribe perceives that permit applications or other requests for approval by third parties from the District would conflict with Tribal rights under the Compact, the Tribe shall give the District adequate notice and shall raise its objections with respect to such permit applications or other request for approval in accordance with the timeframes set forth in the Manual before challenging such permit applications or requests in federal district court. The District shall timely notify the Tribe by certified mail, return receipt requested of such permit applications or other requests for approval. The dated return receipt from the U.S. Postal Service shall be attached to the staff report or other proposed District action and shall be conclusive evidence that the Tribe has been properly noticed pursuant to this section. The District's failure to comply with this section shall not deprive the

Tribe of rights it would have been able to assert had the District complied with this section. In the case of third party permit applications where a request for administrative hearing is filed, the Tribe shall have thirty (30) days from the date of either filing of the request for hearing, or Board evaluation of a Tribal notice of objection, whichever occurs later to make one of the elections set forth in the Manual. If one of these elections is made, the Tribe may not file any action in federal district court until final District action has occurred. A court action filed under this paragraph must be filed within thirty (30) days of final District action. The Tribe shall not file any such action in federal district court until final District action has occurred.

F. Violations of the Compact, the Manual, or the Terms of any Approved Work Plan by the Tribe or the District

Any substantially affected third parties who are substantially affected by actions of the Tribe or the District which are perceived to be in violation of any of the provisions of the Compact, the Manual or the terms and conditions of any approved Work Plan shall have the right to challenge such actions in procedures established in the Compact and the Manual. Persons other than the State or the District with claims over which the Tribe has jurisdiction must exhaust Tribal remedies.

Substantially affected third persons may file a written complaint with the District Clerk alleging violation of the Compact, Manual or the term of any approved Work Plan. Upon receipt of a complaint, the District shall conduct an investigation and make a determination of its intended action in accordance with the procedures set forth in the Manual. The Complainant or Tribe may file a request for a hearing before the Board within fourteen (14) days of notice of the District's findings.

VIII. COURT ACTION

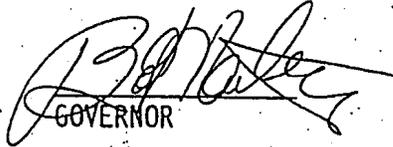
- A. The parties to the Compact will seek federal legislation giving the District Court for the Southern District of Florida original jurisdiction of all civil actions brought by or against the Seminole Tribe to enforce the Compact's provisions, including enforcement of agreements to arbitrate under the authority of the Compact.
- B. No action in federal district court shall be instituted under the Compact unless the party has complied with administrative procedures specified under Part VII. of the Compact and the Manual. Unless otherwise specified in the Compact, any action brought by any person who is not a party to the Compact shall be brought ex rel the District. A party proceeding ex rel may not challenge the validity of any final District action.
- C. In any action commenced under the Compact, a special master shall be appointed to report to the federal district court on questions of fact and law, unless the court makes a determination, in the exercise of sound judicial discretion, that use of a special master is not warranted. Actions under the Compact shall be decided on an expedited basis.
- D. Except for those persons having Tribal remedies, the judicial procedures specified in this part and the administrative procedures specified in Part VII. of the Compact shall be the exclusive procedures for resolution of any matter or dispute arising under the terms of the Compact or involving Tribal water use and any determination made under these procedures shall be final for all purposes, subject only to appeal from decisions of the federal district court presently allowed by federal law.

- E. In an action brought under the Compact for permanent injunctive relief or in any final determination on the merits, the substantially prevailing party shall be entitled to costs and attorney's fees.
- F. The Seminole Tribe of Florida, the State of Florida and the South Florida Water Management District expressly waive any immunity each may have to civil actions for injunctive relief commenced to enforce the Compact and its implementing federal legislation.
- G. The District or any person who timely requested a hearing or filed a notice of reliance, as set forth in the Manual, shall have thirty (30) days after the Tribe files notice of its intent with regard to the Work Plan, to commence suit in federal court. Such action shall not be ex rel the District. Persons who requested a hearing or filed a notice of reliance shall have an additional ten (10) days following expiration of the thirty (30) days to commence suit in federal court ex rel the District to enforce final District action.
- H. The Tribe may file suit in federal district court on a third party's permit within thirty (30) days of final District action.
- I. 1. Any action filed in federal court shall deal separately with disputed issues of District procedure, interpretations of law, determinations of fact or policy within the District's exercise of delegated discretion. If the federal court determines that either the fairness of the proceeding or the correctness of the action may have been impaired by a material error in procedure or failure to follow prescribed procedure, then the federal court shall remand the case for further District action. If the federal court finds that the District erroneously interpreted a provision of law and that a correct interpretation compels a particular action, it

shall either set aside or modify the District action or remand the case to the District for further action under a correct interpretation of the provision of law.

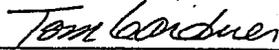
2. This subsection applies when a formal hearing has been held pursuant to section 120.57, Florida Statutes (1985). If the District's action depends on any fact found by the District in a proceeding meeting the requirement of section 120.57, Florida Statutes, the federal court shall not substitute its judgment for that of the District as to the weight of the evidence on any disputed finding of fact. The federal court shall, however, set aside the District's action or remand the case to the District if it finds that the District's action depends on a finding of fact that is not supported by competent or substantial evidence in the record. The federal court shall remand the case to the District if it finds that the District exercise of discretion is either outside the range of discretion delegated to the District by law; inconsistent with a District rule; inconsistent with an officially stated District policy or prior District practice, if deviation therefrom is not explained by the District; or otherwise in violation of a constitutional or statutory provision. However, the federal court shall not substitute its judgment for that of the District on an issue of discretion. Such review shall not be de novo. Section 373.114, Florida Statutes (1985), shall not apply.
- J. No action in federal district court may be commenced until the Board has taken final District action, unless delay would cause irreparable injury and the relief requested is a temporary restraining order.

IN WITNESS WHEREOF, the parties hereto have affixed their hands and seals on the dates set forth below.


GOVERNOR

10-29-87

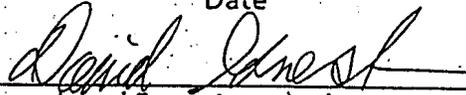
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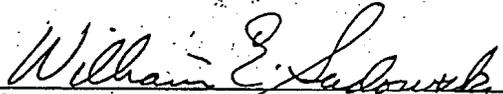
DEPARTMENT OF NATURAL RESOURCES

9/3/87

Date

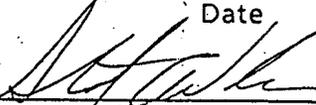


Legal Form Approval

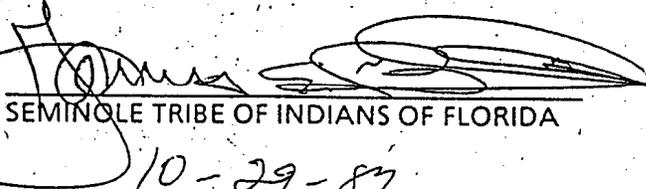


SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Date



Legal Form Approval


SEMINOLE TRIBE OF INDIANS OF FLORIDA

10-29-87

Date

Legal Form Approval

IN WITNESS WHEREOF, the parties hereto have affixed their hands and seals on the dates set forth below.

<p>GOVERNOR</p> <p><i>[Signature]</i></p> <p>DATE</p>	<p><i>Tom Landrum</i></p> <p>DEPARTMENT OF NATURAL RESOURCES</p> <p>9/3/87</p> <p>Date</p> <p><i>David Gast</i></p> <p>Legal Form Approval</p> <p><i>William E. Sedowich</i></p> <p>SOUTH FLORIDA WATER MANAGEMENT DISTRICT</p> <p>5/15/87</p> <p>Date</p> <p><i>[Signature]</i></p> <p>Legal Form Approval</p> <p><i>Hub Smith</i></p> <p>SEMINOLE TRIBE OF INDIANS OF FLORIDA</p> <p>Date</p> <p><i>Jerry Strauss</i></p> <p>Legal Form Approval</p>
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Agreement Between the Seminole Tribe and United States Sugar Corporation
for Allocation of Water from the Lands of the Big Cypress Seminole Reser-
vation and the United States Sugar Corporation Lands Adjacent Thereto

WHEREAS, the UNITED STATES SUGAR CORPORATION (the "Corporation") owns certain lands adjacent to the Seminole Big Cypress Reservation (the "Reservation"); and

WHEREAS, the Corporation has received certain permits from the South Florida Water Management District for development of groundwater and surface water on these lands; and

WHEREAS, the Seminole Tribe (the "Tribe") has negotiated a water rights compact with the South Florida Water Management District and the State of Florida; and

WHEREAS, the Tribe and the Corporation are desirous of avoiding any controversy over these matters; and

WHEREAS, it appears possible to avoid any conflict between the Tribe and the Corporation by entering into a site specific agreement allocating the designated water resources; and

WHEREAS, the essential principles of an agreement have been agreed to by the Tribe and the Corporation; and

The Tribe and the Corporation agree as follows:

1. An area of land comprising Sections 31, 32, 33, 34, 35, 36, Township 47 South, Range 34 East and Sections 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, Township 48 South, Range 34 East of the Corporation's land and comprising certain lands owned by the Tribe which lands will be identified by August 15, 1987, will be identified as a Zone of Influence within which water withdrawals may have an impact on available water supplies beyond the boundary of each party's ownership (such lands together referred to herein as the "Zone of Influence"). If it is determined, based upon pump test data acquired by the Tribe and the Corporation that water withdrawals in or beyond this Zone of Influence will have impacts which are inconsistent with this Agreement, then

the party creating these impacts will mitigate them by limiting the amounts and methods of withdrawal within the Zone of Influence. For purposes of determining the maximum allowable withdrawals from the Zone of Influence, the entire general area suitable for agricultural development will be considered as a single agricultural development regardless of the timing of development by the Tribe and the Corporation. Within the Zone of Influence, water supplies will be allocated and amounts and methods of withdrawals authorized so that the Tribe and the Corporation accommodate and protect the water needs of each other and conduct economic activities without operational interference. Within the Zone of Influence neither party will utilize inefficient methods of withdrawal or use or otherwise consume water by wasteful means resulting in adverse impacts or limitations beyond the ownership of each party to the degree that adequate supplies become unavailable to the other. It is understood that the Tribe or the Corporation may use the water withdrawn anywhere for non-agricultural purposes although the amount of withdrawals will be limited to amounts normally allowed by the District as of the date of the Compact for agricultural uses on available acreages. For purposes of determining maximum allowable withdrawals, withdrawal needs shall be determined based upon agricultural uses to include, without limitation, citrus, other fruits, vegetables, and improved pasture. Agricultural uses assumed for purposes of withdrawal must be feasible based upon soils and other natural resource or climate limitations. The determination of withdrawal limitations and methods shall be based only upon the provisions of this Agreement and on any subsequent agreement or supplement hereto and not upon rights or priorities otherwise available under the Compact or under state or federal law.

2. In periods of drought or otherwise limited water supplies, the Tribe and the Corporation will be required to limit withdrawals of surface water or groundwater from the Zone of Influence, as

the case may be, so that available respective ground or surface supplies are shared equitably between them. The site specific abundance of water supplies available to the Tribe or the Corporation may allow a greater withdrawal of water by either so long as withdrawal from a particular supply does not inequitably limit the other.

3. In order to achieve agreed methods and amounts of withdrawal within the Zone of Influence of available water supplies as specified in Paragraphs 1 and 2 above, site specific ground water criteria for well placement, construction, pump type, pump depth and operation and criteria for surface water withdrawal works shall be established by a subsequent supplement to this Agreement. Identification of the Reservation lands comprising part of the Zone of Influence and site specific criteria described above shall be based upon pump test data acquired by the Corporation within its land and pump test data acquired by the Tribe within the Reservation. The Tribe shall perform a pump test in the general vicinity of the Northwest Quarter of Section 23, Township 48 South, Range 34 East, and acquire the data therefrom no later than August 15, 1987. In the event that the Tribe does not acquire data from the Reservation by August 15, 1987 then the Tribe's portion of the Zone of Influence and site specific criteria shall be based upon test data acquired by the Corporation from its land and other existing data, including data compiled by the South Florida Water Management District from test wells on Reservation lands. The Zone of Influence and specific criteria based upon this data will be modified, if necessary, based upon further data acquired by the Tribe from the Reservation, provided, however, that operational or construction modifications will not apply to wells or surface water works constructed in accord with the original criteria.
4. If operating experience in all or any portion of the Zone of Influence demonstrates that any specific operating criteria such

as withdrawal rates developed under this agreement for wells and withdrawal works are overly or underly restrictive and require modification by relaxing or increasing restrictions to achieve the intent and purpose of this Agreement, then such criteria may be modified by agreement.

5. In the event of failure to reach subsequent agreement required under Paragraphs 1 and 3, the matter shall be resolved by binding arbitration conducted by a panel of three technical experts applying the technical standards established by these paragraphs and any supplements to this Agreement and evaluating the data offered by either party for these purposes. If a subsequent agreement has not been reached within ninety days (90) after identifying data upon which determinations of the Zone of Influence and site specific criteria will be based, then arbitration shall commence on the request of either party. The Tribe and the Corporation shall each select one panel member and a third panel member shall be selected by the two panel members previously selected by the parties. Upon the failure of the two panel members to select a third, this panel member shall be appointed by the U. S. District Court for the Southern District of Florida ("The Court"). All determinations shall be made by majority vote of the panel members. The decision of the arbitration panel shall be made in writing at the time fixed by the panel or ordered by the Court. All expenses of the panel shall be paid equally by the parties. Upon application of a party, the Court shall vacate a decision of the panel that was procured by fraud, corruption or action which is beyond the powers of the panel. Alternatively, upon application made within sixty (60) days of a written decision, the Court may modify or correct a decision when there is an evident miscalculation of figures or mistake in the description of any thing or property referred to in the arbitration decision. Upon confirming or modifying a decision of the panel, the Court shall enter a judgment which may be enforced as any other judgment.

- 6. Any arbitration decision or subsequent agreements needed to complete or amend this Agreement shall not affect the authority of the District to evaluate work plans or permit applications under provisions of the Compact or state law or the rights of substantially affected third parties from participating in District proceedings.
- 7. This Agreement shall be effective as of the date of execution hereof and, upon the Compact becoming effective, shall remain in effect so long as the Compact is in existence. In the event the Compact is not approved or finally effective or held to be invalid, this Agreement will remain in effect and the Corporation and the Tribe shall make their best efforts to cause this Agreement to be binding and effective, including but not limited to, making efforts to obtain any required approval of any government agency or body.
- 8. The parties agree to share all data in their possession on the lands located within the Zone of Influence, including but not limited to, data from test wells. Neither will disclose data provided to any other private or public person or entity.

DATED this 15th day of May, 1987.

WITNESSES:

Armen Billie-Mottlow

Jim Strane

WITNESSES:

John B. Boy

Judy Good

SEMINOLE TRIBE OF FLORIDA

By: James Shore, General Counsel

UNITED STATES SUGAR CORPORATION

By: John B. Boy, President

**Agreement Between the Seminole Tribe of Florida
and Lykes Bros., Inc. on Withdrawal of Groundwater
on the Brighton Reservation and the Lykes Bros.
Land Adjacent and Contiguous Thereto**

The parties to this Agreement, the Seminole Tribe of Florida (the "Tribe") and Lykes Bros., Inc. (the "Corporation"), made under authority of Part VI, Section A of the Water Rights Compact among the Seminole Tribe of Florida, the State of Florida and the South Florida Water Management District, agree as follows:

1. The determination, as between the parties, of limitations on groundwater withdrawals on the lands owned by the parties on May 15, 1987 within the Indian Prairie Basin as described in Rule 40E 21.691(6)(a) Florida Administrative Code (1987) shall be based upon the provisions of this Agreement and on any subsequent agreement between them and not upon rights, priorities or preferences otherwise available to the Tribe or the Corporation under the Compact or under State or Federal law, and neither party shall have standing to object to groundwater withdrawals made or proposed by the other on such lands, provided, however, that each party shall be bound by the rules set forth in section 3 of this Agreement for lands within the "well placement and set-back zone" defined below.

2. The lands of both parties in the following sections abutting the common boundary between the Tribe and the Corporation lands delineated on the map attached hereto, are designated

Exhibit B

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as the "well placement and setback zone" of groundwater withdrawals:

Sections 19, 30, 31, Township 38 South, Range 33 East; Sections 24, 25, 34, 35, 36, Township 38 South, Range 32 East; Sections 1, 2, 3, 4, 9, 10, 16, 17, 21, 22, 27, 28, 33 and 34, Township 39 South, Range 32 East; Sections 4, 5, 8, 9 and 16, Township 40 South, Range 32 East.

3. In the "well placement and setback zone" defined in Section 2 of this Agreement, the following rules will be observed in development of groundwater in the Floridan and Shallow Aquifers:

(a) Floridan Aquifer (greater than 150 feet)

1000 feet set-back from boundary,
no more than 2 wells per quarter section.

(b) Shallow Aquifer (less than 150 feet)

700 feet set-back from boundary,
no more than 4 wells per quarter section.

4. Any wells presently existing in the "well placement and setback zone" shall be exempt from the limitations imposed by Section 3 of this Agreement, provided that no new wells may be added in any quarter section if they would cause the total

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new and existing wells to exceed the limit defined in Section 3 in that quarter section. However, the parties agree to use best efforts to operate all presently existing wells in such manner as to minimize interference with the groundwater operations of the other party.

5. Construction of wells shall follow applicable District requirements, including but not limited to requirements as to casing.

6. This Agreement shall be retroactively effective as of May 15, 1987 and, as between the parties, shall have the force and effect of the Compact.

7. It is understood that this Agreement can have no force and effect until approved by the Governing Board of the South Florida Water Management District, adopted by the Seminole Tribal Council and until the Compact which authorizes it is finally approved by Congress. The parties agree that the Agreement must be submitted for approval in the form approved by the Governing Board on May 15, 1987, and that no change in the Agreement will be effective unless agreed to by both parties.

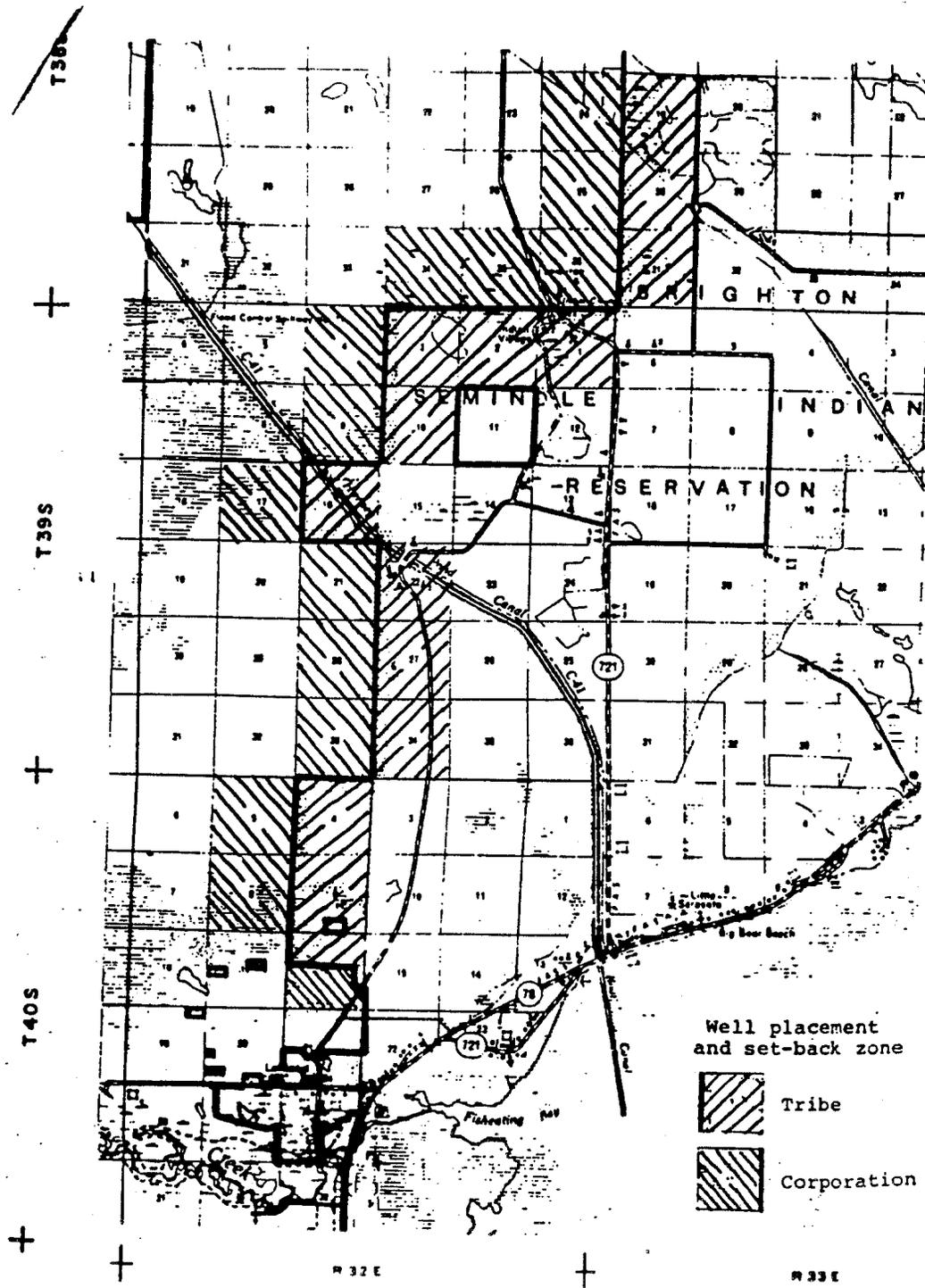
-4-

This Agreement will be null and void on December 31, 1988 unless it has received all necessary approvals and/or ratifications by that date.

Tom J. Rankin

Lykes Bros., Inc.
By: Tom J. Rankin, President

Seminole Tribe of Florida
By: James Shore, Esq.
General Counsel



IN WITNESS WHEREOF, the parties hereto have affixed their hands and seals on the dates set forth below.

BOB MARTINEZ
GOVERNOR

DATE

Thomas E. Gardner

THOMAS E. GARDNER, as Executive Director of the Department of Natural Resources on behalf of the Department of Natural Resources and on behalf of the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida.

9/3/07

Date

David Grant

Legal Form Approval

William E. Sadowski

WILLIAM E. SADOWSKI, as Chairman of the Governing Board of the South Florida Water Management District.

Date

William E. Sadowski

Legal Form Approval

JAMES BILLIE, as Chairman of the Seminole Tribe of Indians of Florida.

Date

Legal Form Approval

APPENDIX B

Review Comments

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 1.

MEMORANDUM

Thomas E. Lodge Ecological Advisors, Inc.
2420 Indian Mound Trail, Coral Gables, Florida 33134
(305) 446-6568 (voice); (305) 444-8224 (fax)
tel_ea@bellsouth.net

To: John Zahina, SFWMD project manager for Lake Istokpoga MFL
From: Thomas E. Lodge, Ph.D., CEP, Science Peer Review Chairperson
Date: July 18, 2005
Subject: Proposed Lake Istokpoga Minimum Flows and Levels (MFL), Final
Science Peer Review Panel Report

This report presents the science review panel's opinions resulting from document review, a field trip on Lake Istokpoga on June 27, and two public workshops held in Lorida, Florida on June 28, 2005. The purpose of these workshops was to evaluate the sufficiency of science used in the "First Draft Technical Documentation to Support Development of Minimum Levels for Lake Istokpoga" developed by the SFWMD Water Supply Department, dated May 2005. The science review panel consisted of Dr. Thomas E. Lodge (chairman), Dr. Joel C. Trexler of Florida International University Department of Biological Science, and Dr. D. Derek Aday of The Ohio State University Department of Evolution, Ecology and Organismal Biology (currently relocating to the North Carolina State University).

CONSENSUS

The science panel agreed on the following:

1. The Lake Istokpoga draft MFL document covers the areas of science needed to establish the MFL criteria. No evidence is presented nor known to the panel indicating that the selected criteria are incorrect, but some areas are weak in scientific credibility, and there is too much use of qualitative language in defending MFL criteria instead of quantitative documentation. With additional data, as defined below, the draft MFL criteria might be shown correct or should be or modified accordingly.
2. Of the criteria, the panel agreed that the level (36.5 ft. NGVD, set at the lower elevation of the emergent littoral zone) and its duration (20 weeks) appeared reasonably defensible. Only the return frequency of the low water level (once in

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 2 (Continuation).

*Proposed Lake Istokpoga MFL, final Science Peer Review Panel Report
Thomas E. Lodge, chairperson*

*July 18, 2005
Page 2 of 6*

four years) is questionable and may be too often, but the panel understood that the MFL criteria are not to be confused with a drawdown schedule. The MFL criteria would only allow such a drawdown frequency without causing a violation. As such, the frequency was viewed as not encumbering a drawdown schedule if CERP or other lake improvement initiatives determine that a new fluctuation schedule with low excursions will be ecologically beneficial.

3. The lack of cypress recruitment among lake's larger, old cypress (seen by the panel on the field trip) clearly demonstrates that the lake has been harmed by the modern restricted fluctuation schedule. Thus, establishing the legal framework for a new schedule that allows for lower levels – part of the function of the MFL – serves to help alleviate significant harm that has already occurred.
4. The gamefish data from before and after the 2001, single-drawdown event are insufficient to demonstrate that recovery actually occurred. The limited time of evaluation after the 2001 drawdown may be too short for the conclusions reached. The heavy dependence on these limited angler data for this single event is the document's weakest aspect.
5. Regarding gamefish data, Table 10 (p. 54) needs to be modified with supporting information in order to provide a credible basis for its use in supporting the MFL criteria. Its weaknesses are:
 - No measure of repeatability
 - Uncertainty is not defined
 - Standard error is not included
 - More explanation is needed to interpret some parameters, e.g., equivalency of combined bluegill and redear sunfish angler success with their separate listings after 1997. If the split data can be totaled to be equivalent to the combined number, it should be so noted.
6. The document should draw upon more literature and data. For example, information, including references, was provided in a letter dated August 16, 2004 from Dr. Mike S. Allen, UF-IFAS, Dept. of Fisheries and Aquatic Sciences, to Beacham Furse, FFWCC for the Lake Istokpoga Ecologic/Hydrologic Performance Measures panel workshop on August 26, 2004). Other useful information would include:
 - larval fish data
 - electrofishing data
 - recruitment data
 - trap net data

If these data cannot be obtained, it is recommended that a monitoring program be developed to improve data collection accordingly.

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 3 (Continuation).

Proposed Lake Istokpoga MFL, final Science Peer Review Panel Report
Thomas E. Lodge, chairperson

July 18, 2005
Page 3 of 6

7. There is a need to state clearly why water quality is not related to water level considerations for the purpose of establishing the MFL criteria. The panel understood that external loading of phosphorus is Lake Istokpoga's principal water quality problem, coupled with internal nutrient releases from aquatic weed (*Hydrilla*) control. While the overall water-level regime of lakes does affect water quality, the MFL criteria cannot reasonably be used to affect water quality in Lake Istokpoga. The MFL criteria only provide a guideline to avoid significant harm due to low water levels and are not part of a regulation schedule that could be beneficial in improving water quality. However, setting of the MFL criteria should not constrain the reasonable development/implementation of regulation schedules for improving water quality, habitat, etc. It is the panel's opinion that the proposed criteria do not represent a constraint.
8. With reference to the above, the lack of a water quality relationship between the selection of MFL criteria and *Hydrilla* control should be stated. For example, poor water quality resulting from herbicidal control of *Hydrilla* is not related nor under the reasonable control of the MFL criteria.
9. The question of possible mercury contamination in the food chain from drawdown is not sufficiently documented.

DOCUMENT REFINEMENTS NEEDED

1. Incorporate a better context for the Lake Istokpoga 2001 drawdown:
 - Lake Istokpoga fisheries data from pre-and-post-drought/drawdown are currently inadequate to measure benefit/decline in fish populations
 - Expand data base used in the document, including experience on other, comparable lakes
 - There should be more discussion and documentation on benefits other than direct fishery benefits (which must be further evaluated for verification). The value of the 2001 drawdown included the ability of affected landowners and other navigational interests to clean out then-dry navigational channels and boat basins, the removal of accumulated muck sediments from the littoral zone, the removal of tussocks, and the whole-lake treatment of *Hydrilla*, made possible by the low water volume of the lake at that time.
2. Consider modification of the MFL only if additional fisheries data warrant a change in the level, duration, or return frequency demonstrate that significant harm may occur by implementation of the draft MFL criteria.
3. Provide a better explanation for Figure 9 (p. 20). The value of the map cannot be understood by a reader without additional information, and there is an assumption that it is poorly printed rather than a composite of incomplete historic map data.

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 4 (Continuation).

Proposed Lake Istokpoga MFL, final Science Peer Review Panel Report
Thomas E. Lodge, chairperson

July 18, 2005
Page 4 of 6

4. The term “significantly altered” as used by SWFWMD needs to be defined, (or noted that no precise definition is available).
5. Develop a discussion with data on the lack of recruitment of cypress in the littoral zone where large, old trees occur without younger trees. Testimony at the hearing stated that recruitment began to occur as a result of the 2001 drawdown, only to have seedlings perish as water levels rose. This information is important for establishing that the modern regulation schedule has been damaging because of its insufficient low-water excursions.
6. Make the following edits to the report:
 - Page iii. Significant harm is referenced in Chapter 373 requirements to include flood control, water quality protection, water supply and storage, fish and wildlife protection, navigation and recreation. However, on page iv, it is stated that significant harm “...for Lake Istokpoga is based primarily on impacts to the lake’s biological resources...” The basis of not including the broader suite of categories needs a clearer explanation.
 - Page 3, paragraph under “Legal and Policy...” heading: It should be clarified why “flow” is not an issue in Lake Istokpoga (and most lakes), so that water level is the focus.
 - Page 14, second paragraph. The “Paleogene Epoch” should be changed to the “Paleogene epochs” as it represents the combined time of the Paleocene, Eocene, and Oligocene epochs.
 - Pages 24 (bottom) and 25. The text data do not all agree with the Figure 14. For examples, at 35 ft. the lake volume on Figure 14 is 48,075 ac-ft., not 62,500 ac-ft.; and neither graph extends to 43 ft. as inferred in the text. Also, the “linear” description of the relationship of stage and area might better be “asymptotic.” The text and/or figure should be corrected for agreement.
 - Page 25. Elevations are described here in terms of sea level rather than NGVD as used earlier. It is suggested that the document should be consistent and NGVD is recommended as the standard.
 - Page 39, Table 6. The eastern mosquitofish is *Gambusia holbrooki*; the tadpole “darter” should be the tadpole madtom; and both bullheads listed are now in the genus *Ameiurus*, not *Ictalurus*. Also, a table in a paper by Furse, Champeau, Ford and others dated August 26, 2004 (presented at the Lake Istokpoga performance measures science review panel workshop of that date) included the following additional species, several of which may be ecologically important: blue tilapia (*Oreochromis aurea*), bowfin (*Amia calva*), brown hoplo (*Hoplosternum littorale*), channel catfish (*Ictalurus punctatus*), sailfin molly (*Poecilia latipinna*), walking catfish (*Clarias batrachus*), and white catfish (*Ameiurus catus*). Finally, the grass carp (*Ctenopharyngodon idella*) is mentioned (p. 35) as having been used in aquatic plant control. Is it still present in the lake? A clarification should be

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 5 (Continuation).

Proposed Lake Istokpoga MFL, final Science Peer Review Panel Report
Thomas E. Lodge, chairperson

July 18, 2005
Page 5 of 6

- included as well as better documentation of fish surveys, especially those that relate to the lake fishery.
- Pages 40-41: Conclusions about recruitment and age classes, etc., cannot be inferred from figures 20 and 21. There is no evidence to support the statements and the figures are not useful. It is suggested that a graph be inserted showing length by age or otherwise indicate cohorts on the length-frequency histograms to make it useful.
 - Page 42, Plants and Animals of Special Concern. There is no mention of the snail kite – it should be included.
 - Page 52, first paragraph. No citations for the burhead sedge (*Osyrcarium cubense*) could be found except as a synonym for the current name, Cuban bulrush (*Scirpus cubensis*). It is suggested the latter names be used or referenced as synonyms.
 - Page 54, first paragraph last line. The proper name for the referenced aquifer is “Floridan” aquifer.
 - Page 64, line 2, delete word, “a”.
 - Page 83, second paragraph. The panel disagrees that addressing environmental impacts from water level stabilization is beyond the project’s scope. *Significant harm* of low water is relative to level fluctuations, and therefore tied to the history of fluctuation stabilization. Setting the level at the low elevation of the existing emergent littoral zone addresses the situation, so the document and selected MFL are still valid, but the wording should reflect that setting a low level is relative to fluctuations that are ongoing and have caused harm by being too restrictive – thus the importance of the MFL being set below the existing control schedule.
 - Page 98, bottom paragraph. “...the annual average hydroperiod for lake wetlands may be reduced below the typical range for these community types.” This statement is so vague and general that its value is limited. There is much more specific information available from other lake drawdowns that could be cited. It is suggested this statement be reworded to reflect fishery recovery time and perhaps excessive interference with navigation and recreation, unless specific deleterious effects on littoral zone communities can be documented/referenced.

PANEL’S RECOMMENDATIONS

1. All relevant data for Lake Istokpoga from the Florida Fish and Wildlife Conservation commission and other sources should be obtained and used in the document. It is emphasized that size-specific fish data should be included from relevant studies conducted through more time than the short, post-2001 drydown event for Lake Istokpoga. Dependence on angler surveys should be minimized if alternative sources are available. Useful data would typically come from:
 - Electrofishing for large fish
 - Trap nets for small fish

Exhibit B-1. Lake Istokpoga Peer Review Panel Summary – Page 6 (Continuation).

Proposed Lake Istokpoga MFL, final Science Peer Review Panel Report
Thomas E. Lodge, chairperson

July 18, 2005
Page 6 of 6

If fishery data from the sources recommended above are insufficient, institute a monitoring program to begin collecting this information (also see Item 6 under Consensus).

2. Improve the explanations in document for:
 - Why water quality is not related to setting the MFL minimum level criteria as explained under consensus, above.
 - The lack of cypress recruitment in the littoral zone occupied by the large, aesthetically notable cypress trees. The panel recognized that cypress recruitment is outside of the scope of establishing the MFL criteria – that it would logically be addressed in developing the revised regulation schedule under CERP or other projects. However, a statement should be included that acknowledges the problem and the lack of a relationship to setting the MFL criteria, comparable to clarifying the relationship of water quality to the MFL criteria.
3. Clarify that the timing of drawdowns is outside of this project scope but will be addressed by CERP and other projects.
4. Vegetation monitoring should be implemented (or reported if such data/studies are available). Such monitoring should be:
 - Done through the long term – to detect slow successional changes, for example
 - Appropriate type for use in MFL and CERP pre-project
 - Systematic
 - Stress cypress recruitment because of the high importance of the large cypress trees around the lake (e.g. for osprey nesting and other habitat benefits, aesthetics, etc.)

The panel will agree, if consensus/document refinements and panel recommendations are completed, that the MFL criteria are based upon best available science and are reasonable.

Exhibit B-2. Review Comments by Dr. D. Aday – Page 1.

*Review of MFL for Lake Istokpoga
D. Derek Aday
The Ohio State University
June 27-29, 2005*

Overview:

In general, I found the summary documentation to be thorough and well presented. Most chapters contained necessary information for adequately understanding the system being managed, the ongoing biological and ecological issues of concern, historical aspects of the Lake Istokpoga ecosystem, and current and future management plans and initiatives. It is clear that the staff has spent considerable time and energy on the development of the document, and the result is a report that is comprehensive and, in most cases, scientifically defensible. In this review I summarize the main points of each chapter and provide specific comments related to concerns that I have about the information provided. Many of the comments are minor, and focus on editorial issues or material presentation. More substantive comments and questions are provided in the sections relating to fisheries ecology and management (my areas of research experience).

I begin with an overview of the entire document and attempt to address the questions asked in the “request for expert assistance”. However, more detailed comments are provided on a chapter-by-chapter basis.

General review of entire document:

Here I attempt to address the questions listed in the “Request for Expert Assistance” for the document in its entirety:

1. Does the MFL document present a defensible scientific basis for setting initial minimum flows and levels within this water resource? Are the approaches or concepts described in the document scientifically sound based on “best available information?”. *In general, I would conclude that the document indeed presents a reasonable argument for establishing the MFL criteria proposed. I do, however, have a few primary concerns.*

A. The main area of concern I have relates to fisheries issues. As documented on a chapter-by-chapter basis below, I believe that there is simply not enough information provided to thoroughly assess the potential impacts of the proposed water-management strategies on fish populations and communities. There are a number of things that aren't particularly clear in the report, including 1) what data have actually been quantified and for what populations, 2) what were the spatial and temporal components of the data collections, 3) what attempts (if any) have been made to quantify data for non-game fish species, 4) when and how were angler surveys conducted, 5) what (specifically) monitoring strategies will be used going forward to determine the influence of the water-management plan on fish populations and communities? I believe this information is fundamentally important in the evaluation of the MFL document in relation to the potential influence of the proposed water-management strategies on fish populations and communities. This issue relates both to “scientific defensibility” and “best available information”. To consider the proposals scientifically defensible, the document should clearly establish what fish data are available, how and when they were collected and analyzed, and what will be monitored going forward.

With that in mind, I make three recommendations. First, I recommend that the authors

Exhibit B-2. Review Comments by Dr. D. Aday – Page 2 (Continuation).

go back to the Florida game and fish commission and make sure that all available data are included in the proposal. Second, I suggest that the authors draw on relevant literature to document the ways in which similar water-management strategies might influence fish populations and communities. This should be easy to do given the availability of studies conducted on similar systems in Florida (in particular, the authors should consult work done by Dr. Mike Allen of the University of Florida) and elsewhere (I have included some additional citations in the chapter-by-chapter summary below). Finally, I suggest that the authors carefully document what monitoring protocol should be developed as the project moves forward. In particular, I would suggest that the authors monitor size-specific abundance and distribution of important game and non-game fishes in Lake Istokpoga. It is also important that these data are collected in a way that minimizes bias (e.g., electrofishing, seining, etc.) rather than through angler surveys. Although angler surveys may provide good supplemental data, they are too biased and limited to serve as the backbone for analyses on the status of fisheries in the lake.

As one small caveat, I would point out that I commend the authors for generally taking an ecosystem-level approach to considering the impacts of these water-management strategies, and I certainly recognize that occasional tactics that may cause short-term harm to fisheries resources may ultimately translate into a net benefit for the system.

B. Another concern relates to the argument made for not including water quality considerations in the MFL decision. Although I believe it may be fair to argue that water-quality data are inadequate, I don't think the arguments and assumptions, as stated, are scientifically defensible. I think that there is likely to be a strong link between water level and water quality, particularly in relation to nutrient inputs. I think better support for this argument is necessary, along with, perhaps, inclusion of a discussion of and/or references for the "alternative stable states" hypothesis or other primary ecological theory related to nutrients, the dynamics of macrophyte-algal interactions, and associated influences on water quality (e.g., Hargeby et al. 2004). As well, there may be system-specific reasons that these water-quality/water-level relationships exist. Regardless, those should be more clearly documented in the proposal so that the reader clearly understands the assumptions your MFL rests upon.

C. Finally, I wonder about the importance the authors place on the data from the 2001 drawdown. In a number of cases, they suggest a generally positive outcome on floral and faunal communities in the ecosystem. However, because many of the species present are long-lived and have long generation times, I'm not certain that it is scientifically defensible to use this recent drawdown as a foundation for comparison, particularly in the context of recommending future drawdowns. It would seem that much longer-term collections would be necessary to adequately assess the influence of that drawdown on the ecology of the system and its inhabitants. Although I don't necessarily recommend excluding the discussion of the drawdown itself (and perhaps the data collected thus far), I do think the authors tend to overstate the positives when the actual impact of the 2001 drawdown may not yet be fully recognized (and even the presumed short-term benefits may not yet be completely understood). I think there needs to be more discussion of the limitations of the data collected so far and a better consideration of some of the potential drawbacks associated with similar events in the future. I don't believe that referencing this one-time, relatively recent drawdown, necessarily presents a defensible argument for recommending similar strategies in upcoming years. I recommend a more balanced treatment of the 2001 drawdown, including some consideration of the possibility that negative impacts have not yet

Exhibit B-2. Review Comments by Dr. D. Aday – Page 3 (Continuation).

been quantified due to the short time frame or inadequate data collections. In particular, the authors should reference work by Dr. Mike Allen on the potential negative influences of drawdowns on fish spawning and recruitment.

2. Are the proposed criteria logically supported by “best available information” presented in the main body of the document? What specific additions, deletions or changes are recommended by the expert to enhance the validity of the document? *As indicated in my answer to question one, I do not believe that the authors have supported their fisheries-related concerns with the best available information. This can be solved in two ways. First, they should be explicit about what data currently exist regarding fish populations and communities in Lake Istokpoga (particularly associated with the drawdown event in 2001), and make sure that all available (relevant) data are included in the proposal so that the potential impacts of the MFL can be adequately assessed. Second, they should cite current literature related to the influence of water-management strategies and water-level drawdowns on fish populations and communities. As indicated above, there are a number of good sources on systems similar to Lake Istokpoga that could be used for reference.*

3. Are there other approaches to setting the criteria that should be considered? Is there available information that has not been considered by the authors? If so, please identify specific alternatives to setting the MFLs and the data available to validate the alternative approach. *I think that the approach the authors used was adequate and logical. As indicated in my response to questions one and two, I do think that there are instances in which their arguments might be strengthened by broadening the context to other systems (including, if possible, some outside of the state). I have made some specific reference suggestions in the sections below. I don't believe that this would change the arguments made or the outcome of the decision. I do think, however, that it would strengthen the case they are making in certain instances. This is particularly true in the areas of general ecological and fisheries theory (e.g., water quality, influence of water-level fluctuations on fish habitat and fisheries), which are not system-specific concerns.*

Chapter summaries and comments:

I. Executive Summary:

A. Background Information: The executive summary concisely documents background information on the Lake Istokpoga ecosystem and details plans associated with its management. The major points of importance covered in the executive summary included:

- Lake managed for flood prevention, recreation, fish/wildlife habitat, and water supply
- New water diversions have changed the ecology of the watershed
- Definition of significant harm, and references Chapter 373 for water resource functions
- Identification of valued ecosystem components (wetlands and fisheries)
- MFL criteria: 36.5 NGVD for 20+weeks, greater than every 4 years.

B. Questions and Comments:

1. Bottom pg. iii: Assuming the discussion of patterns of drying and flooding is refers to a natural flood pulse? Some additional discussion of the ecological importance of flood pulses here or elsewhere would be useful for the reader.

Exhibit B-2. Review Comments by Dr. D. Aday – Page 4 (Continuation).

2. A detailed definition of NGVD would be useful here for readers unfamiliar with this measurement.
3. Here (and throughout document): when the NGVD is referenced, how is water level measured? I assume this is a mean water level, but it's not clear at this point how and where those water levels are taken.

II. Chapter 1:*A. Background Information:*

- Water management districts annually review priority list schedules and make revisions
- MFLs are not stand-alone tools, but part of larger resource protection responsibilities.
- Outline of specific factors to consider in setting MFL
- Need for establishment of resource functions for protection and identification of baseline conditions.
- Definitions of "harm".
- Water shortages and phases of restrictions (1 & 2 = prevent harm. 3 & 4 require use cutbacks that may cause economic impact).
- Provision for development of a recovery and prevention strategy if MFL is violated.

B. Questions and comments:

1. Middle paragraph on page 3: could this be restructured to make less confusing? There is a reference to minimum flow and then minimum level, but it's not clear how these are related (i.e., if the flow is low is the level also low? Can you have one without the other?).
2. Top of page 4: the phrase "natural seasonal changes in water flows or levels" is used. Does this refer to a natural flood pulse (or something similar) that apparently no longer exists in Lake Istokpoga? If so, is there some desire to restore this (despite the fact that the documentation makes clear that these plans are not designed for restorative purposes)?

III. Chapter 2:*A. Background Information:*

- Provides detailed background information on Lake Istokpoga itself, the water control structures, the climate, the land use and hydrology, the biological resources, water quality issues, water resource issues, and other projects associated with the management of Lake Istokpoga and the surrounding watershed.

B. Questions and comments:

1. Pages 13-14: I'm having a difficult time visualizing the physiography of the region. Is there any way that this could be presented graphically?
2. Figure 9 is poor and difficult to interpret. If this figure is necessary, it should be revised.
3. Top of page 22: The description of the FAS needs to be more clear. Without detailed understanding of the area and of aquifer systems, it is very difficult to follow this description.
4. Bottom of page 24: The relationship between stage and area for the lake is described as "almost linear". My view of this relationship would be that it is asymptotic.
5. Page 25: Elevations are now discussed in terms of sea level rather than NGVD used earlier. More consistency would make the document easier to read and interpret.

Exhibit B-2. Review Comments by Dr. D. Aday – Page 5 (Continuation).

6. Page 28: Describes a 12-year period of record. Should this not be an 11-year period?
7. Page 29: How was evapotranspiration estimated?
8. Page 35: At the bottom, a large-scale vegetation management and treatment project is referred to, but there is no additional supporting information. I would recommend including, at this first mention, a detailed description of the Floridone treatment mentioned later in this chapter (e.g., what is Floridone, how was it applied, what effects might be recognized beyond just aquatic vegetation removal, etc.).
10. Page 38: How were the surveys of fish populations and communities conducted? When? By whom? The same questions apply to the angler surveys. Much more information is needed here (and in other chapters when referring to fisheries data) to gain an accurate understanding of the fisheries-related issues in Lake Istokpoga [see additional comments in upcoming chapters].
11. Page 43: Is there no TDML for Lake Istokpoga? If not, why not? If so, some information should be provided here.
12. Page 52: What is the source of the mercury?
13. Page 56: The description of pools in the Kissimmee River would be easier to follow if there was a map or graphical illustration to reference.
14. Section on Lake Istokpoga Resource Protection Programs: This is valuable information for the reader. It is good to know how the current plan fits with existing management plans and initiatives for the lake and surrounding ecosystems. However, it's not clear from reading this how these all fit together (e.g., what is the level of cooperation and coordination among projects in terms of working towards a common goal? Is there data sharing or leveraging of ideas among projects?...etc.). Would it be possible to provide additional summary information that discusses how these projects all fit together to address watershed issues throughout the region?

IV. Chapter 3:*A. Background information:*

- Water resource functions: supply, flood control, quality, habitat, and recreation.
 - primary goals are flood protection and water supply.
- Water quality issues – better in wetlands, worse in tributaries (especially nutrients).
- Hydrological changes (Alterations of hydro patterns, reduced water tables and wetlands, drainage and diversion, alteration of water courses, construction of ditches and canals, changes to seasonal flood patterns).
- Discussion of considerations (Natural systems, hydrology, water supply, flood protection, water quality, navigation and recreation).
- Discussions of exclusions (no Section 373 exclusions).

B. Questions and comments:

1. Page 59: Water storage is mentioned under “water supply and flood control”. This is very general and vague; some additional discussion (and quantification, if possible) would be useful. For example, how much storage is possible? What parameters are used to determine when water is stored or passed? Are these seasonal or day-to-day decisions?
2. Page 60: Under the “water quality” subsection, the low water quality of tributary inflows is mentioned. Is there any effort to address or remedy this problem (related primarily to agriculture – tillage, tiles, alternate fertilizers, etc.)?

Exhibit B-2. Review Comments by Dr. D. Aday – Page 6 (Continuation).

3. Page 61, top: The way the first paragraph reads implies that the undeveloped creeks and lakes are not important wildlife habitat. It would seem that these areas could be as or more important than the “remaining water bodies and wetlands” described in the following sentence. Should this be revised, or is there some reason that the creeks and lakes are not as valuable as they would seem to be?
4. Page 61: Small semantic issue: the term “fishery” is used. This term implies a human-use component that would not be appropriate when describing a fish communities’ importance to wildlife issues in general. The terms “fishery” and “fisheries” should be reserved for discussions of fish populations or communities subject to harvest by anglers.
5. The “Considerations” section: In my opinion, this section should be modified to include a separate subsection for fish and wildlife issues. Although these are mentioned briefly within the subsection “natural systems”, the current presentation fails to reflect the ways in which fish and wildlife issues are biologically and ecologically connected to each of the other subcategories listed. That is, fish and wildlife issues are influenced by hydrology, water supply, flood protection, water quality, and recreation. Therefore, these seem to warrant a separate subcategory that acknowledges their importance and the necessity of considering their links to each of the other areas of consideration.
6. There is a typographical error on the top of page 64 (second sentence should read “The construction of numerous.....” rather than “The construction of a numerous....”).

V. Chapter 4:*A. Background information:*

- Provides conceptual basis for MFL (minimum flow is only one component, need for best available information, etc.).
- Listing of notable changes to system in previous century (Stabilization of water levels, alteration of seasonal patterns, alteration of flowways, draining of floodplain, nutrient pollution, nonnative plants, organic sediment accumulation).
- Listing of management objectives (provide periodic drawdowns to approximate low water conditions, provide a more natural pattern of seasonal water levels, protect and enhance wetlands, improve water quality).
- Identification of other programs in Florida lakes.
- Identification of historic hydrological conditions.

B. Questions and comments:

1. Page 67: The “adaptive approach” to management mentioned in this section is to be commended, however, additional information would be useful. For example, when are evaluations and changes going to take place? What are the logistics associated with making changes if they are deemed necessary?
2. I am surprised by (and have some concerns regarding) the management objectives for Lake Istokpoga described on page 68. In particular, I’m surprised by objective 1 (“Provide periodic drawdowns...”). Although this seems like an important consideration, the timing and implementation of these drawdowns could have serious impacts on the other important issues mentioned throughout the document (water levels, fish and wildlife habitat, consumptive use, etc.). In particular, I have concerns about drawdowns and their potential impact on fish communities. Spawning and habitat use by important recreational (e.g., largemouth bass, bluegill, and crappie) and non-game species could be

Exhibit B-2. Review Comments by Dr. D. Aday – Page 7 (Continuation).

influenced to a significant degree by the number, timing, and duration of drawdown events. If these were implemented, I would recommend providing far more detail about the logistics of the drawdowns and a careful consideration of the potential impacts on fishery resources. Literature is available, in particular, on the influence of reservoir drawdowns on largemouth bass spawning, movement, and behavior, and this and other similar literature should likely be consulted (e.g., Kohler et al. 1995; DiCenzo et al. 1995; Rogers and Bergersen 1995; Raibley et al. 1997). Although the authors seem to be encouraged by fishery data following the earlier drawdown, I would suggest that it may be too early to determine the actual impact of that drawdown on the ecology of the system and the associated fish populations and communities. In addition, because only limited information is provided on how the fishery surveys were conducted, it is difficult to determine whether the data are a reliable indicator of the actual condition of the fisheries.

2. Page 69: Lake Okeechobee has significant aquatic habitat loss when water level decreases by only 1 foot. Could this present a similar problem in Lake Istokpoga? The reader is left wondering.
3. Page 73: Although the categories defined by the SJRWMD are somewhat semantically confusing, I really like the definition of different stages. This makes good sense ecologically. Was there any effort to develop a similar stage strategy for Lake Istokpoga? Would that approach not be valuable in Lake Istokpoga?
4. Page 74: Indicates that descriptive statistics were used to characterize the three water regime periods. Were those analyses adequate to answer the background questions you asked? Was there any feeling that additional “hard” statistical tests would be useful to actually quantify the differences among periods?
5. Page 76: Describes water supply issues and makes clear that water supply has been and may become a significant problem. If that is the case, why are additional drawdowns being considered? When would these drawdowns occur, and how would they impact the water supply issues addressed in this section? I find it interesting that the following statement is made at the bottom of page 76, “Lake Istokpoga’s water supply function is therefore not considered a constraint in developing MFL criteria at this time”. That seems to be contrary to previous statements that water supply has been and could continue to be a concern.
6. Water quality and lake levels, pages 77-78. I find it difficult to believe that there is a weak relationship between water levels and water quality. Although I agree that the “magnitude of these inputs to the lake is independent of water levels in Lake Istokpoga...”, this assumption fails to recognize that water level and water quality are likely inextricably linked. For example, the influence of nutrient inputs into the lake would presumably be quite different when water levels are low versus high, which would effect, among other things, the presence and persistence of macrophytes and algae (and the dynamics between the two), sunlight penetration and turbidity, and nutrient concentration. This, in turn, would influence the fish and invertebrates present, and could establish a feedback loop through nutrient recycling by certain fish (e.g., nutrient recycling by gizzard shad; Mather et al. 1995; Vanni and Layne 1997). Thus, it would seem that the timing of water-level fluctuations and they way in which they interact with seasonal nutrient fluctuations would have the potential to influence the entire ecosystem. It may be that there is not enough information on water quality to include it in the

Exhibit B-2. Review Comments by Dr. D. Aday – Page 8 (Continuation).

development of the MFL, but I would argue that the scientific assumptions leading to this decision are either incorrect or incomplete. I suggest that a more careful consideration of the potential relationship between water level and water quality be considered and described, even if the ultimate conclusion is that there is insufficient information to include it in the development of the MFL at this time.

7. Page 78: It is interesting that the chemical vegetation control resulted in an increase in chlorophyll *a* but not in algal blooms. Algae presumably increased substantially following the removal of macrophytes, and this would explain the chlorophyll *a* increase. Were these data quantified correctly? Perhaps some additional discussion could be provided here. In addition, the literature on “alternative stable states” (e.g. Janse 1997) and macrophyte-algae dynamics could be consulted and used as context for these considerations if similar future vegetation treatments are planned.
8. Page 79, Fish communities: As stated several times before, I find the information presented on fish communities inadequate to fully evaluate. This section states, “the effects of low water levels on the fishery resource were considered as part of the MFL criteria. Fish survey data, collected before and after the 2001 drawdown, and the impact of low water levels on critical habitats were examined to determine whether impacts occurred that persisted for more than two years.” Much more information is necessary. For example:
 1. What effects were considered?
 2. Which fisheries? Just largemouth bass, crappie, and bluegill? If so, what about important forage fish that influence each of the three sportfish?
 3. How were the data collected?
 4. What impacts were measured and how were they quantified?
 5. What temporal component allowed determination of impacts that persisted for more than two years?

In addition, I’m wondering about continued surveys. Will additional data be collected? It may be that effects of the drawdown will be more long-term, and may not show up for many years. This would be particularly true if the drawdown had an effect on forage fish populations, or on life-history characteristics of the sportfish (timing of maturation, age-at-first maturation, mortality schedule). Simple population parameters like measures of recruitment and size structure may not be adequate to determine the future dynamics of these fish populations and communities.

VI. Chapter 5:*A. Background information:*

- Provides historical context for understanding hydrology of Lake Istokpoga.
- Points out ecological value of both high and low water events.
- Provides table (table 14) that summarizes access status at different water levels.
- Summarizes water level requirements for wetlands.
- Summarizes analysis and recommendations

B. Questions and comments:

1. Last two paragraphs on page 89: The 2001 drawdown was only a few years ago. I’m wondering if there has really been time to assess the impact of that drawdown on a swamp community, which contains flora with much longer life spans and generation times. Are there plans for continued monitoring? The same question applies to the

Exhibit B-2. Review Comments by Dr. D. Aday – Page 9 (Continuation).

interpretation of data on the marsh community – is it too soon to say that the drawdown event was actually beneficial?

2. Table 15 – was any literature for systems outside of Florida consulted? Is this a comprehensive enough search to get adequate information for decision-making purposes?
3. Section on water level requirements of fish communities: Similar to comments on previous fishery-related issues, I still feel that more information is needed to adequately assess the influence of water-level management on fish populations and communities. For example:
 - What does “enhancement of fish habitats” mean? Because habitat requirements for different species are so variable, enhancement for one species may be detrimental for others.
 - The text suggests that the water drawdown caused a temporary reduction in numbers of some fish species, but that those quickly rebounded. How were these data quantified? What other factors were considered? My concern is that, just because numbers are returning to pre-drawdown levels doesn’t necessarily mean that the impact on the population(s) is well understood. When population density rapidly declines, it is often the case that fish will reproduce at younger ages and smaller sizes, which will, through time, result in a change in the age and size structure of the population. This is particularly important to consider with predatory fish like largemouth bass and crappie, which undergo ontogenetic diet shifts. The timing of their switch to piscivory can have a marked influence on other fish populations (e.g., bluegill) and can, therefore, really affect the entire aquatic community.
 - I think it’s too soon to say that significant harm was not documented. Again, we need to know what metrics were quantified, and we have to determine how long it might actually take to better understand the influence the drawdown may have had.
 - The text suggests that water-level drawdowns below 36.5 feet may reduce littoral zone habitats. I’m wondering if this is really a concern. It would seem that, in a lake that is only 4 ft deep on average, most of the lake would be littoral zone.
 - Top of page 92 – suggests that the change in water levels could reduce the quality of fish habitats and reduce spawning success. Again, this is difficult to interpret based on what is presented. The dynamics of fish populations are tied to so much more than spawning success that this seems difficult to defend without more detail. In some cases, reduced spawning success can be quite beneficial to fish populations. For example, reductions in spawning might help alleviate density-dependent growth limitations or recruitment bottlenecks. As such, a more detailed discussion of data collection procedures (past and future) is necessary to really understand and assess the influence of water-management initiatives on fish populations and fisheries.

VII. Chapter 6:*A. Background information:*

- Defined significant harm as occurring when water levels fall below 36.5 feet NGVD for 20 weeks or longer, more frequently than every four years.
- Describes rationale for proposed criteria in terms of fisheries resources.
- Goes over monitoring, prevention, and research recommendations.

B. Questions and comments:

1. It’s interesting to me that the rationale for proposed criteria focus almost exclusively on

Exhibit B-2. Review Comments by Dr. D. Aday – Page 10 (Continuation).

fisheries issues. Throughout the document, much more detail was provided on other aspects of Lake Istokpoga (e.g., hydrology, recreation, flood control, water supply, etc.). It's encouraging that fisheries considerations are so important, but I feel that more information is needed in the previous sections to better assess the potential impacts of water-level management on fish populations and communities.

2. Page 100: suggests that the FWC conducts annual fish catch surveys. Are there other data collections on fish populations and communities? Catch data can be notoriously unreliable, and samples only a few members of the fish community (and only a small fraction of the populations actually being harvested). I recommend that, if much of this water-management plan is built with fisheries issues in mind, a more rigorous sampling protocol be developed. Or, if more data have been and will be collected, that should be clearly described in this documentation so that it possible to assess the adequacy of those data collections to meet the needs of management-related goals.
3. On page 101, the 'Research Recommendations' section states that "birds, fish, aquatic and littoral zone communities are being monitored, as well as water quality...". This seems to conflict with the statement on page 100 (which says that no additional biological monitoring of parameters in Lake Istokpoga are proposed). More importantly, I don't think there is enough information to adequately assess the monitoring strategies. For example, how are the fish populations and communities monitored? When? By whom? What data are collected? This continues the theme of 'more information needed' to adequately critique the MFL as it relates to fisheries and fish populations and communities.

VIII. Appendices:

1. *Appendix A*: My only comment on this appendix is that it probably contains more material than is actually necessary. I think the statute information is valuable. I'm not sure that all of the letters and documentation associated with the tribal compacts, etc. are necessary (despite the fact that they are relevant to the MFL document).
2. *Appendix C*: Contains useful information. Figure C-1 is difficult to interpret. Table C-3 may not be necessary.
3. *Appendix D*: Contains useful information. It is a bit difficult to determine how the calculations are influenced by "unknown" or "unmeasured" sources of water input and output, and how much the MFL depends on these calculations. Over long-term averages, however, the data seem fairly reliable and the approach seems scientifically sound based on the data that are available.

Exhibit B-2. Review Comments by Dr. D. Aday – Page 11 (Continuation).**Literature cited:**

- DiCenzo, VJ, MJ Maceina, and WC Reeves. 1995. Factors related to growth and condition of the Alabama subspecies of spotted bass in reservoirs. *North American Journal of Fisheries Management* 15:794-798.
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- Janse, JH 1997. A model of nutrient dynamics in shallow lakes in relation to multiple stable states. *Hydrobiologia*.
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- Rogers, KB and EP Bergersen. 1995. Effects of a fall drawdown on movement of adult northern pike and largemouth bass. *North American Journal of Fisheries Management* 15: 596-600.
- Vanni, MJ and CD Layne. 1997. Nutrient recycling and herbivory as mechanisms in the "top-down" effect of fish on algae in lakes. *Ecology* 78:21-40.

Exhibit B-3. Review Comments by Dr. T. Lodge – Page 1.

MEMORANDUM

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To: John Zahina, SFWMD project manager for Lake Istokpoga MFL
From: Thomas E. Lodge
Date: July 1, 2005
Subject: Review of the first draft Technical Documentation to Support
Development of Minimum Levels for Lake Istokpoga, SFWMD Water Supply
Department, May 2005

Overview

This draft document presents a reasonable approach to the question of minimum level criteria to protect Lake Istokpoga from significant harm. There is a sufficient presentation of the lake's characteristics and uses to give the reader an adequate basis for understanding the potential impact of low levels. The data presented to support the draft MFL varies from very good (e.g. the level chosen roughly follows the lower elevation contour of the lake's existing emergent littoral zone) to weak (e.g. game fishery data used to evaluate the 2001 lake drawdown and a lack of specific data in support of an alleged deleterious succession of the littoral zone if longer or more frequent low levels would occur). However, while there were some shortcomings in the data used to develop the draft MFL criteria, nothing presented would support a contrary conclusion regarding the proposed MFL criteria. It is my opinion that the selected MFL criteria would protect Lake Istokpoga from significant harm.

General review of the entire document

1. *Does the MFL document present a defensible scientific basis for setting initial minimum flows and levels within this water resource? Are the approaches or concepts described in the document scientifically sound based on "best available information"?*

The basis used is scientifically defensible in that the following were considered: water quality; recreation and navigational access; fish and wildlife habitat; gamefish population rebound; and wetland/littoral zone succession and upland encroachment. However, many details were lacking that would improve scientific credibility, including adequate

Exhibit B-3. Review Comments by Dr. T. Lodge – Page 2 (Continuation).

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documentation of wading bird success, specific littoral zone successional expectations, especially involving cypress and the apparent current lack of successful recruitment among the larger, old cypress in the deeper portions of their habitat. While the littoral zone functions and successional processes may be beyond the scope of establishing MFL criteria (i.e. the entire fluctuation schedule as being examined in CERP is involved), there at least needs to be clear justification on why they are beyond the scope. Water quality is only briefly addressed as being beyond possible control by the MFL criteria, but more specific statements could have been made, such as the exterior loadings are not affected by MFL criteria.

2. *Are the proposed criteria logically supported by “best available information” presented in the main body of the document? What specific additions, deletions or changes are recommended by the expert to enhance the validity of the document?*

Much of the science alluded to in establishing the MFL criteria are limited and vague, although logically aimed toward good science. For example, health of the swamp community around Lake Istokpoga addresses only the community above elevation 39.5 ft. NGVD. Our field excursion on June 28, when the lake stage was reportedly at 38.4 ft., evidenced that most if not nearly all of the spectacular, old cypress were standing in water, so that they were probably mostly between 37 and 38 ft. There was no apparent recruitment among them. This very important aesthetic and functional role (e.g. support of huge numbers of osprey nests) that the older cypress play begs more documentation. Cypress recruitment data are available in literature sources.

The single drydown event that serves as the backbone of support for the MFL is too limited. Drydown studies on Florida lakes are abundant, including lakes Toho, Kissimmee, and Okeechobee, and could have been referenced for supporting documentation.

Additional concerns for the selected criteria are what would happen in the event that water levels would drop to very low levels within the allowed duration of 20 weeks. For example, the criteria would allow the lake to go completely dry so long as the excursion below 36.5 ft. was less than 20 weeks. While the probability of such an extreme is remote, possible very low excursions should be addressed in the document. However, it is recognized that the use of the established criteria is in judging the permissibility of a requested consumptive use of water. As such, it is improbable that the impact of very low excursions of water level would be realistic. Such calculated low levels would obviously tend to violate the 20 week recovery time and not be permitted under the draft criteria.

3. *Are there other approaches to setting the criteria that should be considered? Is there available information that has not been considered by the authors? If so, please identify specific alternatives to setting the MFLs and the data available to validate the alternative approach.*

Exhibit B-3. Review Comments by Dr. T. Lodge – Page 3 (Continuation).

Thomas E. Lodge
Lake Istokpoga draft MFL document review

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The approach taken is sound. It merely needs additional supporting documentation as emphasized above.

Specific editorial comments by page numbers

Page iii. Significant harm is referenced in Chapter 373 requirements to include flood control, water quality protection, water supply and storage, fish and wildlife protection, navigation and recreation. However, on page iv, it is stated that significant harm "...for Lake Istokpoga is based primarily on impacts to the lake's biological resources..." The basis of not including the broader suite of categories needs a clearer explanation.

Page 14, second paragraph. The "Paleogene Epoch" should be changed to the "Paleogene epochs" as it represents the combined time of the Paleocene, Eocene, and Oligocene epochs.

Pages 24 (bottom) and 25. The text data do not all agree with the Figure 14. For examples, at 35 ft. the lake volume on Figure 14 is 48,075 ac-ft., not 62,500 ac-ft.; and neither graph extends to 43 ft. as inferred in the text.

Page 39, Table 6. The eastern mosquitofish is *Gambusia holbrooki*; the tadpole "darter" should be the tadpole madtom; and both bullheads listed are now in the genus *Ameiurus*, not *Ictalurus*. Also, a table in a paper by Furse, Champeau, Ford and others dated August 26, 2004 (presented at the Lake Istokpoga performance measures science review panel workshop of that date) included the following additional species, several of which may be important ecologically: blue tilapia (*Oreochromis aurea*), bowfin (*Amia calva*), brown hoplo (*Hoplosternum littorale*), channel catfish (*Ictalurus punctatus*), sailfin molly (*Poecilia latipinna*), walking catfish (*Clarias batrachus*), and white catfish (*Ameiurus catus*). A local resident brought a photograph of a brown hoplo to the MFL workshop and stated his observation of its nesting habit and difficulty in predation by ospreys.

Page 42, Plants and Animals of Special Concern. There is no mention of the snail kite – it should be included.

Page 52, first paragraph. I found no citations for the burhead sedge (*Osyrcaryum cubense*) until I discovered it as a synonym for the current name, Cuban bulrush (*Scirpus cubensis*). I suggest the latter names be used or referenced as synonyms.

Page 54, first paragraph last line. The proper name for the referenced aquifer is "Floridan" aquifer.

Page 83, second paragraph. I disagree that addressing environmental impacts from water level stabilization is beyond the project's scope. *Significant harm* of low water is relative to level fluctuations, and therefore tied to the history of fluctuation stabilization. Setting the level at the low elevation of the existing emergent littoral zone addresses the

Exhibit B-3. Review Comments by Dr. T. Lodge – Page 4 (Continuation).

Thomas E. Lodge
Lake Istokpoga draft MFL document review

Page 4 of 4

situation, so I think that the document and selected MFL are still valid, but the wording should reflect that setting a low level is relative to fluctuations that are ongoing and have caused harm by being too restrictive – thus the importance of the MFL being set below the existing control schedule.

Page 98, bottom paragraph. "...the annual average hydroperiod for lake wetlands may be reduced below the typical range for these community types." This statement is so vague and general that its value is limited. There is much more specific information available from other lake drawdowns that could be cited. I suggest this statement be reworded to reflect fishery recovery time and perhaps excessive interference with navigation and recreation, unless specific deleterious effects on littoral zone communities can be documented/referenced.

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 1.**Review and Response to Questions
Prepared by Joel Trexler**

Goals: limit at which further withdrawals would be *significantly harmful* to water resources or ecology of the areas

Significant harm: temporary loss of water resource functions... that take longer than two years to recover

Lake Istokpoga is a natural lake that provides important ecological services including (see list page 4):

- Fisheries (both recreational and commercial);
- Wildlife (e.g., large osprey populations, bald eagles, etc);
- Home to distinctive, if not unique, fringing cypress swamp (certainly a beautiful location).

Ecological harm would include, but possibly not be limited to:

- Loss of fishery characteristics;
- Change in trophic status of lake leading to low DO, continued accumulation of organic matter;
- Loss of bird populations;
- Loss of habitat character (fringing cypress swamp).

Key point: Three dimensions to MFL regulation for this lake are minimum depth, max length at depth, return time

1. a. Does the MFL document present a defensible scientific basis for setting initial flows and levels within this water resource?

The primary basis for the Minimum water level of 36.5 ft seems to be bathymetry of the lake and associated vegetation. Literature is reported indicating minimum hydroperiods needed to maintain the various vegetation types at key elevations. The duration of such low-water events appears to derive from experience obtain in the 2001 drought and draw-down event. That event lasted 19 weeks and may have provided benefits to fisheries, at least over a several year time interval. The return time for the minimum levels seems to be derived primarily from fisheries concerns and recruitment dynamics, though the connection is verbal.

Tugend and Allen (2004) provides a basis for using drawdown and herbiciding as a management tool for a similar lake in the same drainage

2001 was only one event... not replicated, endpoints could be different due to details of when in year and rate of water decline

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 2 (Continuation).

1. b. Are the approaches described scientifically sound based on ‘best available information’?

Sticking to my own area of expertise, aquatic ecology and fishes, I found the fisheries material presented to be lacking. A report from the FWC is cited, but the tabular and graphical materials reproduced were not cogent to the arguments made. It is not clear to me if the necessary information is actually present in the reports, but statements made regarding the impact of the 2001 management actions or other periods must be taken on face value. That written, I found the conclusions drawn consistent with my expectations and suspect that they are correct, for whatever that’s worth. Results are consistent with recommendations for Florida fisheries management in Aumen and Gray (1995), Moyer et al. (1995), Allen et al. (2002), and Bonvechio and Allen (2003). Note that Aumen and Gray (1995) provide a basis to use historical ecological variation as a management target (rather than single-species goals that often yields conflicting recommendations across taxa).

My own work in the Everglades supports the idea that the longer the minimum level is retained, the more severe the mortality incurred by fish populations and the longer time required for recovery post-disturbance (Trexler et al. 2005). However, the population-level impact may be a minor component of the long-term population dynamics of fishes in a lake where large areas of aquatic habitat will be retained in low-water years and no aquatic taxa are actually at risk to be driven extinct. The return time of minimum levels (proposed to exceed four years) could also have major implications for population and community dynamics. The proposed minimum return time of four years is not well justified in the current document. However, four years seems reasonable in permitting recovery of aquatic communities from drought, and the generation time and age of first reproduction of the longest-lived fishes in the system. It would be nice to have a time series of population data from key fisheries taxa to exam this expectation. Bonvechio and Allen (2003) elaborate on these issues in the context of setting MFL for rivers and lakes in Florida. Again *for what its worth*, our data from the Everglades (parts of WCA-3A have some similarities to this lake), suggest that four years between droughts is a minimum to recover long-lived fish species and their communities both in terms of relative abundance of ‘desirable’ species like bass and their consumptive impact on prey species (Chick et al. 2004; Trexler et al. 2005). Data from Lake Istokpoga are sorely needed in this report.

One aspect of the impact of a low-water event is its timing with regard to fish recruitment. I know that M.S. Allen (UF) has worked on the relationship of largemouth bass recruitment in Lake Istokpoga and hydrology, but none of his work is mentioned here. Perhaps this is reviewed in the FWC’s report? The current plan assumes that the 2001 timing is consistent with any future drying event... is that reasonable?

Pages 52-53 mention mercury consumption advisory that is in effect. There was little concern about this in our visit to the lake. Was there any effect of the 2001 management action on mercury levels in fish?

2. Are the proposed criteria logically supported and what additions, deletions, or changes are recommended?

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 3 (Continuation).

The report is impressive in the breadth of material considered. Presumably the ecological data available for such an analysis are limited and concepts must be drawn from nearby systems where information is available. Ideally, there would be more quantitative data on ecological relationships of aquatic communities to water levels, water-level fluctuation, and drought return times. For me, a telling comment in the document was that cypress and mixed hardwood communities that historically fringed the lake are no longer producing recruits because of hydrological stabilization. Some quantitative data on this would be useful. However, since this criterion does not address operation schedules per se, this clear ‘harm’ of ecological function is not explicitly addressed. Clearly, periodic excursions to the minimum level proscribed here may actually be *mandatory* to avoid ‘harm’ to ecological structure of the remaining habitat of the lake.

3. Are there other approaches to setting the criteria that should be considered?

I found the review of approaches used by St Johns WMD and Southwest Florida WMD useful in setting a context for this analysis. I do not have suggestions for alternative approaches at this time. However, a stronger case could have been made through the use of simulation models to justify the choice of return time for the minimum level. I’m surprised that some general analysis of this type that identifies key parameters to be tracked for specific lakes has not been developed by the FWC. The use of GIS and bathymetry for proposing the level was convincing, when linked to the practical issues of navigation, etc. It would seem that the FWC would actually have fisheries monitoring data that would permit development of a statistical relationship of fish population dynamics and length of dry-down. Further, I know that the seasonal timing of the dry-down has a huge impact on nesting and recruitment success. This is not addressed in the current report... this is more relevant to regulatory schedule.

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 4 (Continuation).

I have noted a few problems in reporting references in the notes below. Notes made while reading the text:

Page 21: What is the composition of the materials in Undifferentiated clastic deposits and Tamiami Formation and the Hawthorn Group geological units? The lower deposits are all limestone. I wondered about this because of the implications of these materials on nutrient dynamics on the surface water and then became frustrated by the lack of consistency in reporting in this table.

Page 37: Cypress swamp mixed veg is not reproducing because of water level stabilization. This seems important and warrants elaboration and DATA presentation

Page 38: References hard to follow: FWC 2003... no such reference; Champeau 2003 is listed as 2004 in the literature cited section

Page 39: Several errors in taxonomy need correcting... I caught these (the correct names listed below, should be easy to link to errors on the page):

Gambusia holbrooki

Notropis emiliae

Ameiurus natalis

Tadpole madtom

Pages 40-41: Conclusions about recruitment and age classes, etc, cannot be inferred from figures 20 and 21. There is no evidence to support the statements listed and the figures are useless. Need to insert graph showing length by age or otherwise indicate cohorts on the length-frequency histograms to make this useful.

Page 52: FWC 2002 reports that fish surveys indicated an increase in fish species richness and abundance following 2001 drought/drawdown/vegetation control; No data are presented to support this contention... are such data in the FWC report?

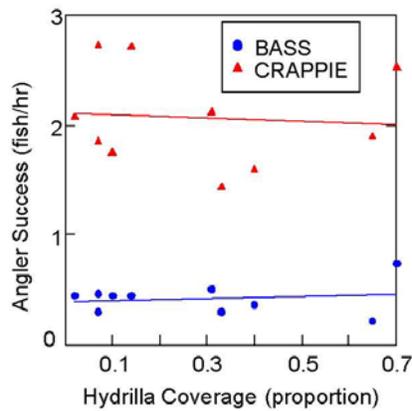
Page 53: Lake has mercury alert for fish consumption; what is status in years since 2001? Is there any evidence that drawdown had an impact (positive, negative, none) on mercury levels in key taxa?

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 5 (Continuation).

Page 54, Table 10: No measure of repeatability on these numbers... 2000-2001 data are clearly skewed by low water/concentration event. This table tells us nothing about fisheries; pre-drawdown data are lower and higher for all taxa. Sunfish reporting is particularly useless with a change in reporting in mid-project. Are the two species summed comparable to the data from 1991 – 1995? No explanation or quantitative linkage was made between *Hydrilla* data and fisheries (see Allen et al. 2003, who also found no relationship in these variables). Since these data don't show a relationship, why are they reported... what's the point?

Table 1. Pearson correlations of data from FWC (2003).
None are significant.

	HYDRILLA	BASS	CRAPPIE
HYDRILLA	1		
BASS	0.16	1	
CRAPPIE	-0.079	0.593	1



P70: need to report the 'significantly altered' term per SWFWMD for clarity

Page 71: need definition of 'significantly altered' or note that none is available.

Page 78: Vegetation management effects and low water on nutrient releases not established well enough to include in this analysis.

Page 91: Concludes that 2001 drawdown event caused only short-term negative impact on some fish communities; can't evaluate that from data presented.

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 6 (Continuation).

Page 94, bottom: periodic short-duration low-water events don't create harm... could mention benefits here. Recruitment of cypress requires dry periods in fringing swamp habitat?

Page 98: Criterion relies on 2001 experience where drawdown below 36.5ft for 19 weeks did not lead to "harm"

Page 100: Monitoring strategy DO? Should provide a table of monitoring provided by Florida Lakewatch and those parameters deemed critical for monitoring MFL... can't assume Lakewatch continues to provide quality data on this system for enforcement into indefinite future. More data on fisheries monitoring is needed... what is actually being done and what is critical to evaluate MFL? Also, need monitoring of vegetation independent of enhancement projects. This should include cypress swamp vegetation, with ability to track recruitment.

Literature cited or that should be considered for citation in this report:

Allen, M. S., K. I. Tugend, and M. J. Mann. 2004. Largemouth bass abundance and angler catch rates following a habitat enhancement project at Lake Kissimmee, Florida. *North American Journal of Fisheries Management* 23:845-855

Allen, Micheal S. and Kimberly Tugend. 2002. Effects of a large-scale habitat enhancement project on habitat quality for age-0 largemouth bass at Lake Kissimmee, Florida. *Proceedings of the International Black Bass Symposium 2000*, American Fisheries Society, Bethesda, Maryland.

Aumen, N. G., and S. Gray. 1995. Research synthesis and management recommendations from a five-year ecosystem-level study of Lake Okeechobee, Florida (USA). *Archiv fur Hydrobiologie* 45:343-356

Bonvechio, T. F., and M. S. Allen. 2005. Relations between hydrologic variables and year class strength of sportfish in eight Florida waterbodies. *Hydrobiologia* 532:193-207

Chick, J. H., C. R. Ruetz III, and J. C. Trexler. 2004. Spatial scale and abundance patterns of large fish communities in freshwater marshes of the Florida Everglades. *Wetlands* 24:652-664

Moyer, E. J., M. W. Hulon, J. J. Sweatman, R. S. Butler, and V. P. Williams. 1995. Fishery responses to habitat restoration in Lake Tohopekaliga, Florida. *North American Journal of Fisheries Management* 15:591-595

Trexler, J. C., W. F. Loftus, and S. Perry. 2005. Disturbance frequency and community structure in a twenty-five year intervention study. *Oecologia*, in press (proof is attached)

Tugend K.I. and M. S. Allen. 2004. Changes in the plant and fish communities in enhanced littoral areas of Lake Kissimmee, Florida, following a habitat enhancement. *Lake and Reservoir Management* 20:54-64

Exhibit B-4. Review Comments by Dr. J. Trexler – Page 7 (Continuation).

Walker, W. W. and K. E. Havens. 2003. Development and application of a phosphorus balance model for Lake Istokpoga, Florida. *Lake and Reservoir Management* 19:79-91

Exhibit B-5. Review Comments from the Office of Water Policy, Florida Department of Environmental Protection – Page 1.



Jeb Bush
Governor

Department of Environmental Protection

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Colleen M. Castille
Secretary

September 6, 2005

John Zahina
South Florida Water Management District
P.O. Box 24680
West Palm Beach, FL 33416-4680

Re: Lake Istokpoga MFL

John
Dear Mr. Zahina,

The Department appreciates the opportunity to review the technical document for establishing the minimum flow and level (MFL) for Lake Istokpoga. The report clearly describes the natural features of the lake and explains the District's methodology for determining the MFL. The Department would like offer the following comments as you finalize the document and prepare to adopt the MFL by rule. Most of these, we discussed on the phone a few weeks ago.

Expression of the MFL

As we discussed on the phone, the current language could be interpreted several different ways that may allow the lake levels to fall below an elevation of 36.5' for extended periods that may result in significant harm. We suggest that the language be revised to reflect the District's intent that the lake elevation not to fall below 36.5' for any more than 20 weeks within a 365 day period and that event should not occur more often than once every 4 years. Additionally, the 20 week duration should be considered cumulatively over the 365 day period.

Multiple Levels

As MFLs have been developed throughout the state, the need to establish multiple flows or levels to adequately capture the natural variability of the system has become apparent. New amendments to Section 62-40.473 (2), F.A.C. state the following:

(2) Water bodies experience variations in water flows and levels that often contribute to significant functions of the system, such as those described in section 62-40.473(1), F.A.C. Minimum flows and levels should be expressed as multiple flows or levels defining a minimum hydrologic regime to the extent practical and necessary to establish the limit beyond which further withdrawals would be significantly harmful to the water resources or the ecology of the area as provided in Section 373.042(1), F.S. However, a

"More Protection, Less Process"

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Exhibit B-5. Review Comments from the Office of Water Policy, Florida Department of Environmental Protection – Page 2 (Continuation).

Lake Istokpoga MFL
Page 2

minimum flow or level need not be expressed as multiple flows or levels if other resource protection tools, such as reservations implemented to protect fish and wildlife or public health and safety, that provide equivalent or greater protection of the hydrologic regime of the water body, are developed and adopted in coordination with the minimum flow or level.

The report indicates that there is a significant community of cypress trees fringing a portion of the lake. It is not clear how the proposed MFL will ensure protection of this cypress community and it seems that multiple levels might be necessary to protect all of the lake's resources. Based upon our discussion on the phone, you indicated that there were some structural considerations that prevented the establishment of multiple levels and that one problem was that water levels were too high within the cypress community. It would be helpful if the technical document had a more thorough discussion of the existing levels that occur in the cypress community and the constraints that surrounding development might place on establishing multiple levels to protect this community.

Relationship Between Lake Drawdown and MFLs

Page 100 of the report indicates that there may be circumstances to “conduct controlled drawdowns in magnitudes or frequencies that exceed the proposed MFL criteria...” The report further notes that the proposed MFL criteria do not restrict the ability to conduct controlled drawdowns. The peer review also noted that there were problems with basing recommendations on the frequency and duration of drawdowns on the short term results from one recent event. Please note that if drawdowns occurred more frequently and for a longer duration than allowed under the MFL, that could be considered an exceedance of the MFL criteria. The District should revise this section of the report to indicate that further research is needed regarding the appropriate frequency and duration of drawdowns and that drawdowns will not be conducted in a manner that will exceed the MFL criteria.

Additionally, Section 40E-8.421(9) of the draft rule states that extreme drawdowns will be avoided “to the greatest extent possible”. This language seems to be inconsistent with the MFL criteria and should be revised as follows:

The District, in coordination with other appropriate agencies, should also plan and operate extreme Lake drawdowns for environmental purposes in a manner that, ~~to the greatest extent possible,~~ avoids a MFL violation.

Peer Review and Water Quality

The peer review suggested that the District provide additional information related to certain areas of the report especially with respect to water quality. I understand the District is going to revise this section of the report. Please note that Lake Istokpoga is identified as an impaired water body in the Department's *Draft Verified List of Impaired Waters for the Group 4 Basins* (July 7, 2005) and is tentatively scheduled to have a TMDL developed by 2010. For more information regarding the development of this TMDL, you may contact Dr. T. S. Wu at 850-245-8457. The

Exhibit B-5. Review Comments from the Office of Water Policy, Florida Department of Environmental Protection – Page 3 (Continuation).

Lake Istokpoga MFL
Page 3

Department would also like to know of any additional changes that the District makes in response to the concerns identified by the peer review.

In summary, it appears that the proposed analysis adequately considers the resources of Lake Istokpoga and that they will be protected from significant harm. It would be helpful if the District modified or expanded some sections of the report to address the items identified in this letter and by the peer review. The monitoring and research proposed to be conducted will help the District determine whether additional modification may be necessary.

Please feel free to contact me at 850-245-8681 (suncom 205-8681) or by email at kathleen.greenwood@dep.state.fl.us if you have any questions.

Sincerely,



Kathleen P. Greenwood
Office of Water Policy

cc: Janet G. Llewellyn
Tom Swihart
Dr. T.S. Wu

APPENDIX C
**GIS Analysis of Pre-Development Landscape
Features around Lake Istokpoga**

INTRODUCTION

An analysis was conducted to examine pre-development hydrogeographic patterns and landscape features of the Lake Istokpoga area. Information on pre-development conditions was obtained from the public land survey maps and field notes and from soil survey information. This information was used to compile a comprehensive pre-development map of the Lake Istokpoga watershed. The results of this analysis provided clues to important landscape level characteristics of the original lake system and insights into the ways in which subsequent changes may have impacted the resource.

METHODS

General Land Office Survey Map of Pre-Development Conditions

A map of major landscape features was obtained from the 1870 General Land Office (GLO) survey field notes. These maps were acquired for 16 Township/Range blocks (**Table C-1**) and were joined into a single map. Features along map borders were edge-matched and the comprehensive map was geo-rectified in ArcInfo and converted to a Geographic Information System (GIS) coverage. Field notes from the GLO survey for the Lake Istokpoga area were acquired from the Florida Department of Environmental Protection's Land Boundary Information System (LABINS) website <http://www.labins.org/glo>.

Pre-Development Vegetation Community Map from County Soil Survey Database

Soil taxonomic characteristics can be used to infer long-term hydrological conditions at a site. Using a relationship between vegetation community type and average hydrological conditions for a soil taxon, a map of the extent of pre-development vegetation communities was developed (Zahina *et al.* 2001) and was verified by GLO survey field note information. A table of GLO vegetation types along section lines was used to compare data from soil surveys in four Township/Range blocks around Lake Istokpoga (**Table C-2**).

Table C-1. Township/Range Blocks Used to Construct a Map of Lake Istokpoga Watershed Features

Township	Range
34 South	29 East
34 South	30 East
34 South	31 East
34 South	32 East
35 South	29 East
35 South	30 East
35 South	31 East
35 South	32 East
36 South	29 East
36 South	30 East
36 South	31 East
36 South	32 East
37 South	29 East
37 South	30 East
37 South	31 East
37 South	32 East

Table C-2. Section Transects Examined for Descriptions of Vegetation in the Lake Istokpoga Area.

Township	Range
35 South	31 East
35 South	30 East
36 South	30 East
36 South	31 East

RESULTS OF ANALYSIS

Major Pre-Development Landscape Features of the Lake Istokpoga Area

The comprehensive map of the Lake Istokpoga watershed generated from the original land survey maps provides insight into the characteristics of the pre-drainage landscape (**Figure C-1**). Among the most notable features are the extensive unsurveyed perennial wetlands to the immediate southeast of the lake and the system of smaller lakes on the southwest side, including Lake Cram, which no longer exist. The map also identifies the historic meander of the four major tributaries included in the analysis (Arbuckle Creek, Josephine Creek, Istokpoga Creek and the unnamed stream on the SW side of the lake).

Field notes and maps from the GLO were examined to determine the different vegetation community types described by the surveyors. In some cases, the distinction between some community types was not clearly defined, as the GLO notes were intended to provide general descriptions of the landscape with respect to usability of the land for settlement, agriculture and resources. For instance, the term “prairie” indicated a treeless plain usually dominated by grasslike plants. Modern definitions of community types in Florida define different types of prairie, namely “wet prairie” (seasonally inundated) or “dry prairie” (associated with flatwoods and not wetlands). Examination of the field notes, maps and context of the observations usually provided clues as to which type of prairie was implied.

These vegetation community types along section transects in the Lake Istokpoga area were compared with vegetation types as inferred from soils (**Table C-3**). Of the 165 section lines studied, 34 (21 percent) had insufficient data to make a comparison between sources. Of the remaining 131 section transects, 123 (94 percent) had a complete or partial match of information between the two sources and eight (6 percent) had disagreement. A complete match occurred when both data sets provided the same information to the same level of detail. A partial match of information occurred when more detail (i.e., more community types) was given in one data set than another.

Table C-3. Comparison of Field Observations of Historic Vegetation with Soil-Inferred Vegetation Communities

Township/Range/ Section	1870 GLO Field Survey ¹	Soil-Inferred Pre- Drainage Vegetation ²	Agreement ³
35S/31E/1-2	Cane grass; 3rd rate pine	Wetlands, Flatwoods	A
35S/31E/2-11	3RD rate (dry) prairie	Flatwoods	A
35S/31E/2-3	3RD rate (dry) prairie	Flatwoods	A
35S/31E/3-10	No data	Flatwoods	I
35S/31E/3-4	3RD rate (dry) prairie	Flatwoods	A
35S/31E/4-9	3RD rate (dry) prairie	Flatwoods	A
35S/31E/4-5	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/5-8	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/5-6	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/6-7	Prairie (wet), 3rd rate sand	Wet prairie	A
35S/31E/7-8	Prairie, 3rd rate sand	Flatwoods, wet prairie	A
35S/31E/8-9	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/8-17	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/9-10	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/9-16	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/10-11	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/10-15	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/11-12	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/11-14	Prairie (dry) , 3rd rate sand	Flatwoods, Wetlands	A
35S/31E/12-13	Prairie (dry) , 3rd rate sand	Flatwoods, Wetlands	A
35S/31E/13-24	Prairie (dry) , 3rd rate sand	Flatwoods, Wetlands	A
35S/31E/13-14	Prairie (dry) , 3rd rate sand	Flatwoods, Wetlands	A
35S/31E/14-23	Prairie (dry) , 3rd rate sand	Flatwoods, Wetlands	A
35S/31E/14-15	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/15-22	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/15-16	Prairie (dry) , 3rd rate sand	Flatwoods, wet prairie	A
35S/31E/16-21	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/16-17	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/17-20	Prairie (dry), sand, (cypress), lake	Flatwoods, wetlands	A
35S/31E/17-18	Lake, (cypress), wetland	Flatwoods, water	A
35S/31E/20-21	Prairie (dry), scrubby, 3rd rate sand	Flatwoods	A
35S/31E/20-29	Prairie (dry), scrub, 3rd rate sand, lake	Flatwoods	P
35S/31E/21-22	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/21-28	Prairie, 3rd rate sand	Wetlands, wet prairie	A
35S/31E/22-23	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/22-27	Prairie (dry) , 3rd rate sand, Istokpoga Creek with assoc wetlands	Flatwoods	P
35S/31E/23-24	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/23-26	Istokpoga Creek with assoc wetlands	Flatwoods, Wetlands	A
35S/31E/24-25	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/31E/26-27	Unsurveyed, lake area	Flatwoods	I

Table C-3. Comparison of Field Observations of Historic Vegetation with Soil-Inferred Vegetation Communities (Continuation).

Township/Range/ Section	1870 GLO Field Survey ¹	Soil-Inferred Pre- Drainage Vegetation ²	Agreement ³
35S/31E/27-34	Unsurveyed, lake area	Wet prairie, wetlands	I
35S/31E/27-28	Unsurveyed, lake area	Wetlands	I
35S/31E/28-33	Unsurveyed, lake area	Flatwoods, wetlands	I
35S/31E/28-29	Swamp, wet prairie, lake (fringe)	Wetlands, flatwoods	P
35S/31E/29-32	Unsurveyed, lake area	Wetlands, flatwoods	I
35S/31E/32-33	Unsurveyed, lake area	Water	I
35S/31E/33-34	Unsurveyed	Flatwoods	I
35S/31E/34-35	Unsurveyed	Flatwoods, wetlands	I
35S/30E/1-2	Prairie (dry) , 3rd rate sand	Flatwoods	A
35S/30E/2-11	Prairie (dry) , 3rd rate sand, Arbuckle Creek wetlands	Flatwoods	P
35S/30E/2-3	Water (lake fringe)	Wetlands	P
35S/30E/3-16	Willow, sawgrass, boggy, inundated	Wetlands	A
35S/30E/3-4	Low muddy dark rich soil	Flatwoods, Wetlands (Arbuckle Creek floodplain)	A
35S/30E/4-5	Unsurveyed	Flatwoods, Wet Prairie	I
35S/30E/5-8	Pine, prairie, 3rd rate sand	Scrub, Flatwoods	A
35S/30E/5-6	Boggy swamp, 3rd rate pineland	Wetlands	P
35S/30E/6-7	Bay swamp	Wetlands	A
35S/30E/7-8	Prairie, pine island	Flatwoods	A
35S/30E/7-18	Prairie, boggy pine, swamp	Flatwoods, Wetlands	A
35S/30E/8-9	Prairie, 3rd rate sand	Flatwoods	A
35S/30E/8-17	Prairie, 3rd rate sand	Flatwoods	A
35S/30E/9-10	Sawgrass, lake	Flatwoods	D
35S/30E/9-16	Prairie, 3rd rate sand	Flatwoods	A
35S/30E/10-11	Arbuckle Creek, wetlands	Wetlands	A
35S/30E/11-12	Prairie, 3rd rate sand	Flatwoods, wetlands	A
35S/30E/12-13	Unsurveyed lake	Wetlands	I
35S/30E/13-14	Unsurveyed lake	Flatwoods, wetlands	I
35S/30E/14-23	Unsurveyed lake	Wetlands, wet prairie	I
35S/30E/14-15	Unsurveyed lake	Uplands	I
35S/30E/15-22	Unsurveyed lake	Flatwoods, no data	I
35S/30E/15-16	Sawgrass	Wetlands, no data	I
35S/30E/16-21	Sawgrass, boggy & impassible wetland	Wet prairie, wetlands	A
35S/30E/16-17	Prairie, pine island, 3rd rate sand	Flatwoods, no data	I
35S/30E/17-20	Prairie, 3rd rate sand	Flatwoods, wet prairie	A
35S/30E/17-18	Prairie, 3rd rate sand	Flatwoods, uplands	A
35S/30E/18-19	Prairie, 3rd rate sand, pinelands	Flatwoods, uplands	A
35S/30E/19-20	Prairie, 3rd rate sand	Flatwoods	A
35S/30E/19-30	Prairie & pine of 3rd rate	Flatwoods, uplands	A
35S/30E/20-21	Pine & prairie, 3rd rate sand, edge of swamp (maple)	Flatwoods, wet prairie	A

Table C-3. Comparison of Field Observations of Historic Vegetation with Soil-Inferred Vegetation Communities (Continuation).

Township/Range/ Section	1870 GLO Field Survey ¹	Soil-Inferred Pre- Drainage Vegetation ²	Agreement ³
35S/30E/20-29	Prairie	Wet prairie	A
35S/30E/21-22	No survey	Wet prairie	I
35S/30E/21-28	No survey	Wet prairie, water	I
35S/30E/22-23	No survey	Water (lake)	I
35S/30E/28-29	No survey	Wet prairie, water	I
35S/30E/29-32	Swamp, lake edge	Wet prairie	P
35S/30E/29-30	Prairie of 3rd rate, pineland	Upland, wet prairie	A
35S/30E/30-31	Leslie Creek, swamp	Wetlands	A
35S/30E/31-32	Swamp, Leslie Creek	Wet prairie	P
35S/30E/31 & 36S/30E/6	No data	Highlands	I
35S/30E/32 & 36S/30E/5	No data	Wetlands	I
36S/30E/3-4	Lake, fringing swamp	Wet prairie	P
36S/30E/4-9	No data	Highlands, uplands	I
36S/30E/4-5	Bay swamp	Flatwoods	D
36S/30E/5-8	Sand ridges	Flatwoods, wet prairie	A
36S/30E/5-6	Bay swamp	Highlands	D
36S/30E/7-8	Bay swamp, sand, pine	Highlands	P
36S/30E/7-18	Sand ridge, low scrub	Highlands, wetlands	A
36S/30E/8-9	Low sand ridges	Flatwoods	A
36S/30E/8-17	Pines, swampy creek bed	Flatwoods, uplands	P
36S/30E/9-10	Creek bed	Wet prairie	P
36S/30E/9-16	Level sand with scrub	Uplands, wetlands	A
36S/30E/10-15	Sand and low scrub	Water, wetlands	D
36S/30E/15-16	Bay swamp	Wetlands, wet prairie	A
36S/30E/16-21	Sand ridges to lake shore (L. Cram)	Wet prairie, uplands	A
36S/30E/16-17	Saw palmetto	Wetlands, wet prairie	P
36S/30E/17-20	High sand ridges, scrub, L. Apthorp, saw palmetto	Uplands, flatwoods	A
36S/30E/17-18	Lake (Apthorp)	Wet prairie, wetlands	P
36S/30E/18-19	Saw palmetto	Highlands	A
36S/30E/19-20	Sand ridges, low scrub	Flatwoods	P
36S/30E/19-30	Scrub, sand	Flatwoods, uplands	A
36S/30E/20-21	Low sand ridges	Flatwoods	A
36S/30E/20-29	Lake edge	Wet prairie	P
36S/30E/21-22	Low sand hills	Wet prairie	D
36S/30E/21-28	Creek bed, lake (Cram), low scrub	Uplands, wetlands	A
36S/30E/22-23	Low sand hills, palmetto prairie	Highlands	A
36S/30E/22-27	Creek bed, low palmetto prairie	Wet prairie, water	A
36S/30E/25-36	No data	Water, wetlands	I
36S/30E/26-27	Saw palmetto	Water	D

Table C-3. Comparison of Field Observations of Historic Vegetation with Soil-Inferred Vegetation Communities (Continuation).

Township/Range/ Section	1870 GLO Field Survey¹	Soil-Inferred Pre- Drainage Vegetation²	Agreement³
36S/30E/27-34	Saw palmetto low prairie	Wet prairie	A
36S/30E/27-28	Sand ridge, palmettos, lakes	Wet prairie	P
36S/30E/28-33	Low sand ridge	Highlands	A
36S/30E/28-29	Lake Clay, boggy prairie	Highlands, wet prairie	P
36S/30E/29-32	Lake Clay, low scrub	Water	P
36S/30E/29-30	Scrub	Wet prairie	D
36S/30E/30-31	Sand ridge, low scrub	N/A	I
36S/30E/31-32	Scrub	Highlands	A
36S/30E/32-33	Pine, boggy prairie	Highlands	P
36S/30E/32 & 37S/30E/5	Level scrub, low prairie	Highlands, wetlands, water	P
36S/30E/33-34	Sand ridge	Highlands	A
36S/30E/33 & 37S/30E/4	Pine, scrub, low palmetto	Highlands	A
36S/30E/34-35	Low pinelands	Water, wetlands	A
36S/30E/34 & 37S/30E/3	Bay swamp, scrub	Wetlands, Highlands	A
36S/30E/35-36	Bay swamp, impassible swamp	Water, wetlands	A
36S/30E/35 & 37S/30E/2	Bay swamp, impassible swamp	Water, wetlands	A
36S/30E/36	No survey	Wetlands	I
36S/31E/1 & 36S/32E/6	No survey	Flatwoods	I
36S/31E/1-12	Sawgrass, 2nd rate prairie	Flatwoods, wet prairie	A
36S/31E/1-2	Inundated	Wetlands	A
36S/31E/2-11	Sawgrass, water	Wetlands	A
36S/31E/2-3	No data	Flatwoods, wetlands	I
36S/31E/3-10	No data	Wetlands	I
36S/31E/10-11	Sawgrass, water	Wet prairie	P
36S/31E/11-12	Sawgrass, water	Wetlands	A
36S/31E/11-14	Sawgrass, water	Wetlands	A
36S/31E/12 & 36S/32E/7	Sawgrass, water	Flatwoods	D
36S/31E/12-13	Sawgrass, water	Wet prairie	P
36S/31E/13- & 36S/32E/18	No data	Wetlands, wet prairie	I
36S/31E/13-24	Inundated	Flatwoods, wet prairie, wetlands	P
36S/31E/13-14	Inundated	Wet prairie, flatwoods	P
36S/31E/14-22	Sawgrass, water	Wetlands, wet prairie, flatwoods	P
36S/31E/14-15	Inundated	Wetlands	A
36S/31E/22-23	Inundated	Wetlands	A
36S/31E/23-24	Inundated	Wetlands, wet prairie	A

Table C-3. Comparison of Field Observations of Historic Vegetation with Soil-Inferred Vegetation Communities (Continuation).

Township/Range/ Section	1870 GLO Field Survey ¹	Soil-Inferred Pre- Drainage Vegetation ²	Agreement ³
36S/31E/23-26	Low lands	Wetlands, wet prairie	A
36S/31E/24 & 36S/32E/19	Sawgrass, low prairie, ponds	Wetlands, wet prairie, flatwoods	A
36S/31E/24-25	Sawgrass, low prairie, ponds	Wetlands	A
36S/31E/25 & 36S/32E/30	Ponds, prairie, marsh	Wet prairie, flatwoods	A
36S/31E/25-36	2nd rate prairie	Flatwoods, wetlands	A
36S/31E/25-26	Ponds, prairie, marsh	Wetlands, wet prairie, flatwoods	A
36S/31E/26-35	2nd rate prairie, cabbage palm	Flatwoods	A
36S/31E/26-27	Marsh, 2nd rate prairie, cabbage palm	Wetlands, wet prairie	A
36S/31E/34-35	2nd rate prairie, cabbage palm	Wet Prairie	A
36S/31E/35-36	No data	Flatwoods	I
36S/31E/35 & 37S/31E/2	No data	Wetlands, wet prairie	I
36S/31E/36 & 36S/32E/31	No data	Wetlands, flatwoods	I

1. General Land Office Field Notes, 1870.
2. From Zahina *et al.*, 2001.
3. A=agreement, D=disagreement, P=partial, I=insufficient data to determine.

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APPENDIX D

A Water Budget for Lake Istokpoga

INTRODUCTION

The purpose of this report is to provide a general water budget for Lake Istokpoga. The relative contributions of tributaries and rainfall were quantified and compared with water releases through the S-68 Structure and evapotranspiration losses. The amount of water released through the S-68 to the Indian Prairie Basin is compared with consumptive use permit allocations in the basin.

CALCULATION OF A LAKE ISTOKPOGA WATER BUDGET

The Hydrologic Equation

A simplified water budget for Lake Istokpoga was calculated with the following equation using existing data sets from the South Florida Water Management District's corporate environmental database, DBHYDRO:

$$(\text{Inputs}) - (\text{Outputs}) = (\text{Change in Lake Volume})$$

Inputs

Inputs are calculated as (Rainfall on Lake Surface + Inflow from Arbuckle Creek + Inflow from Josephine Creek). Some other sources have not been included in this analysis as either they are insignificant relative to the total input volume or insufficient measured data on them exist; these unincluded sources include groundwater (which may be flowing into the lake at some times of the year and flowing out of the lake at other times) and miscellaneous surface water inflows such as those from local drainage ditches and recreational access canals.

Outputs

Outputs are calculated as (Outflows through the S-68 Structure + Evapotranspiration). Evapotranspiration (ET) is the combined loss of water vapor through direct evaporation of water from the lake surface and by transpiration of water vapor through the leaves of plants. Evapotranspiration is generally expressed as inches of water per year, and for application in this water budget, it is translated into volume (ac-ft) of water per year for the average lake surface area. Evapotranspiration is generally regarded as one of the main hydrologic variables in south Florida, second only to rainfall (Irizarry-Ortiz *et al.* 2003). Several studies have been conducted to characterize evapotranspiration rates in south Florida, including Visher and Hughes 1969, Abtew 1996, Reardon and Abtew 2002, and Irizarry-Ortiz *et al.* 2003. An average annual value of 50 inches of ET was used in these calculations, following Visher and Hughes (1969).

Some other output sources have not been included in this analysis as either they are insignificant relative to the total output volume or insufficient measured data on them exist; these unincluded output sources include groundwater (which may be flowing into the lake at some times of the year and flowing out of the lake at other times) and outflow through the Istokpoga Canal. Water flow through the Istokpoga Canal is generally negligible. A review of flow measurements at the G-85 Structure (in the Istokpoga Canal) from October 1983 through November 1988 indicates that no water flow was measured during this period; therefore, the volume of water flowing from Lake Istokpoga through the Istokpoga Canal is not a significant portion of the total water budget and for this reason has not been included.

Water Budget Calculations

The results from the water budget calculations for the period of record 1990–2000 are shown in **Tables D-1** through **D-4**. These results indicate that generally a surplus of water exists in the wet season and a deficit of water during the dry season. The amount of unaccounted-for water in the average annual budget during the period of record is small (1 percent or less). Annual and seasonal variations in unaccounted-for water may reflect a carryover effect from a previous period, an effect that commonly occurs when imposing a calendar date cutoff to a variable data time series.

The volume of water unaccounted for in this water budget can range from relatively small (1,807 ac-ft) to significant (104,790 ac-ft) between water years. These variations may be the result of interannual differences in ET, groundwater influence or ungauged flows or they may be an artifact from the analytic method that imposes a calendar date cutoff onto a variable data time series. Although there is variation from year to year, the decade average is approximately 1 percent or less of the water budget (7,149 ac-ft for calendar years, 9,434 ac-ft for water years). Walker and Havens (2003) estimate that ungauged inflows to the lake may be as much as 17 percent of the total gauged inflow.

Table D-1. Calendar Year* Water Budget for Lake Istokpoga (acre-ft).

Year	Water Inputs to Lake			Water Outputs from Lake		Difference between Inputs and Outputs	Change in Lake Volume for Year	Unaccounted Water Volume
	Rainfall	Arbuckle Creek	Josephine Creek	S-68	Estimated ET			
1990	91,275	146,347	34,894	197,266	118,405	-43,154	17,836	-25,318
1991	148,264	202,911	39,081	237,750	118,405	34,101	5,675	39,776
1992	138,689	170,733	36,150	58,895	118,405	168,273	-2,027	166,246
1993	115,412	111,488	33,738	140,232	118,405	2,001	-16,620	-14,619
1994	128,283	212,241	42,241	298,508	118,405	-34,148	-3,648	-37,796
1995	120,715	256,395	62,229	453,440	118,405	-132,505	6,486	-126,019
1996	83,649	120,835	26,557	148,291	118,405	-35,654	37,698	2,044
1997	143,735	224,230	29,905	262,657	118,405	16,808	-32,023	-15,216
1998	177,934	453,119	88,224	562,972	118,405	37,900	-5,675	32,225
1999	106,411	198,968	41,286	298,472	118,405	-70,212	-2,027	-72,238
2000	67,883	51,319	10,248	32,235	118,405	-21,190	72,965	51,775
Mean	120,205	195,326	40,414	244,611	118,405	-7,071	7,149	-78

*January 1 through December 31.

Table D-2. Water Year* Water Budget for Lake Istokpoga (acre-ft).

Year	Water Inputs to Lake			Water Outputs from Lake		Difference between Inputs and Outputs	Change in Lake Volume for Year	Unaccounted Water Volume
	Rainfall	Arbuckle Creek	Josephine Creek	S-68	Estimated ET			
1990	117,677	141,354	36,158	156,296	118,405	20,487	-22,295	-1,807
1991	144,193	191,130	36,208	215,392	118,405	37,734	12,972	50,706
1992	102,569	73,608	23,948	71,581	118,405	10,139	-1,621	8,518
1993	102,569	73,608	23,948	71,581	118,405	10,139	1,216	11,355
1994	126,449	255,554	44,277	371,030	118,405	-63,155	-4,864	-68,019
1995	114,265	235,028	63,851	401,150	118,405	-106,411	1,621	-104,790
1996	85,857	98,756	18,107	94,740	118,405	-10,425	31,618	21,193
1997	186,849	516,211	84,564	639,071	118,405	30,149	-36,482	-6,333
1998	120,687	165,458	37,047	229,094	118,405	-24,306	58,372	34,065
1999	109,793	199,274	40,742	277,808	118,405	-46,403	-30,402	-76,805
2000	68,198	35,838	6,865	32,746	118,405	-40,250	93,638	53,388
Mean	116,282	180,529	37,792	232,772	118,405	-16,573	9,434	-7,139

*May 1 through April 30.

Table D-3. Wet-Season* Water Budget for Lake Istokpoga (acre-ft).

Year	Water Inputs to Lake			Water Outputs from Lake		Difference between Inputs and Outputs	Change in Lake Volume for Year	Unaccounted Water Volume
	Rainfall	Arbuckle Creek	Josephine Creek	S-68	Estimated ET			
1990	77,056	107,347	27,037	121,481	70,332	19,626	-31,618	-11,992
1991	105,493	167,404	29,576	198,209	70,332	33,931	-10,539	23,392
1992	99,359	146,681	27,048	48,767	70,332	153,988	-18,241	135,746
1993	72,154	47,494	13,556	26,845	70,332	36,027	-32,023	4,003
1994	87,519	155,804	29,419	203,775	70,332	-1,365	-29,997	-31,361
1995	91,991	165,887	43,899	308,000	70,332	-76,555	-18,241	-94,796
1996	58,394	70,792	15,798	94,133	70,332	-19,482	18,241	-1,241
1997	96,521	91,081	18,253	115,243	70,332	20,280	-40,536	-20,256
1998	98,011	118,757	25,220	147,018	70,332	24,637	-4,054	20,584
1999	93,654	146,143	30,923	220,833	70,332	-20,446	-64,858	-85,304
2000	56,072	26,507	5,363	9,459	70,332	8,151	16,214	24,366
Mean	85,111	113,082	24,190	135,797	70,332	16,254	-19,605	-3,351

*May 1 through October 31.

Table D-4. Dry-Season* Water Budget for Lake Istokpoga (acre-ft).

Year	Water Inputs to Lake			Water Outputs from Lake		Difference between Inputs and Outputs	Change in Lake Volume for Year	Unaccounted Water Volume
	Rainfall	Arbuckle Creek	Josephine Creek	S-68	Estimated ET			
1990	40,621	34,007	9,121	34,815	48,309	625	9,323	9,948
1991	38,700	23,726	6,632	17,183	48,309	3,566	23,511	27,077
1992	45,408	67,531	21,046	109,172	48,309	-23,496	16,620	-6,876
1993	30,415	26,114	10,392	44,736	48,309	-26,124	32,429	6,305
1994	38,929	99,749	14,858	167,255	48,309	-62,027	25,132	-36,895
1995	22,274	69,140	19,951	93,150	48,309	-30,093	20,268	-9,825
1996	27,463	27,964	2,309	607	48,309	8,820	13,377	22,196
1997	90,329	425,130	66,311	523,828	48,309	9,632	4,054	13,686
1998	22,675	46,701	11,827	82,075	48,309	-49,181	60,804	11,623
1999	16,139	53,132	9,819	56,975	48,309	-26,194	32,429	6,235
2000	12,126	9,331	1,501	23,287	48,309	-48,638	77,018	28,381
Mean	35,007	80,230	15,797	104,826	48,309	-22,101	28,633	6,532

*November 1 through April 30.

Consumptive Use Withdrawals and Lake Istokpoga

All of the consumptive use permits in the Indian Prairie Basin are for agricultural uses (**Table D-5**), which include sod, sugarcane, citrus, pasture and livestock. A comparison of the actual amount of water use reported for users (**Table D-6**) with maximum annual allocations (**Table D-5**) indicates that typically, less than one-third of the permitted water is used. A comparison of the maximum annual allocation for all permits (**Table D-5**) with the volume of water discharged to Indian Prairie through the S-68 (**Table D-1**) indicates that there is typically enough water in most years to meet maximum demands. But in below-average rainfall years (e.g., calendar years 1992 and 2000), there may not be enough water discharged from the S-68 to meet maximum demands. The current regulation schedule prevents water from being discharged from Lake Istokpoga for water supply use when water levels fall below Zone B (**Figure D-1**).

Table D-5. Consumptive Use Permits in the Indian Prairie Basin (acre-ft).

Permit Number	Maximum Monthly Allocation	Maximum Annual Allocation	Permit Type
22-00003-W	954	5,084	AG-sugarcane
22-00019-W	8,165	49,625	AG-pasture
22-00021-W	2,102	12,661	AG-no longer in use
22-00032-W	567	3,288	AG-pasture
22-00046-W	312	1,808	AG-pasture
22-00049-W	1,566	5,665	AG-pasture
22-00052-W	1,377	6,937	AG-citrus/pasture/livestock
22-00056-W	616	3,717	AG-sugarcane/pasture/citrus
22-00064-W	443	2,202	AG-citrus
22-00117-W	334	1,707	AG-citrus
22-00140-W	57	155	AG-citrus
28-00023-W	2,082	3,684	AG-pasture
28-00081-W	560	3,041	AG-pasture
28-00120-W	834	5,331	AG-sod
28-00123-W	908	5,140	AG-citrus
28-00129-W	1,180	5,988	AG-sod
28-00133-W	454	2,694	AG-citrus
28-00256-W	700	3,801	AG-pasture
28-00440-W	597	4,299	AG-citrus/sod
Total	23,807	126,380	

Table D-6. Annual Pumpages Reported for Indian Prairie Users (1998–2003)
(acre-ft).

Permit	Annual Permitted	Average Actual Pumpage	Percentage Used
19-W	49,625	15,021	30
332-W	3,288	682	21
49-W	5,670	1,765	31
117-W	1,707	278	16
23-W	3,684	980	27
120-W	5,331	273	5
129-W	5,988	1,140	19

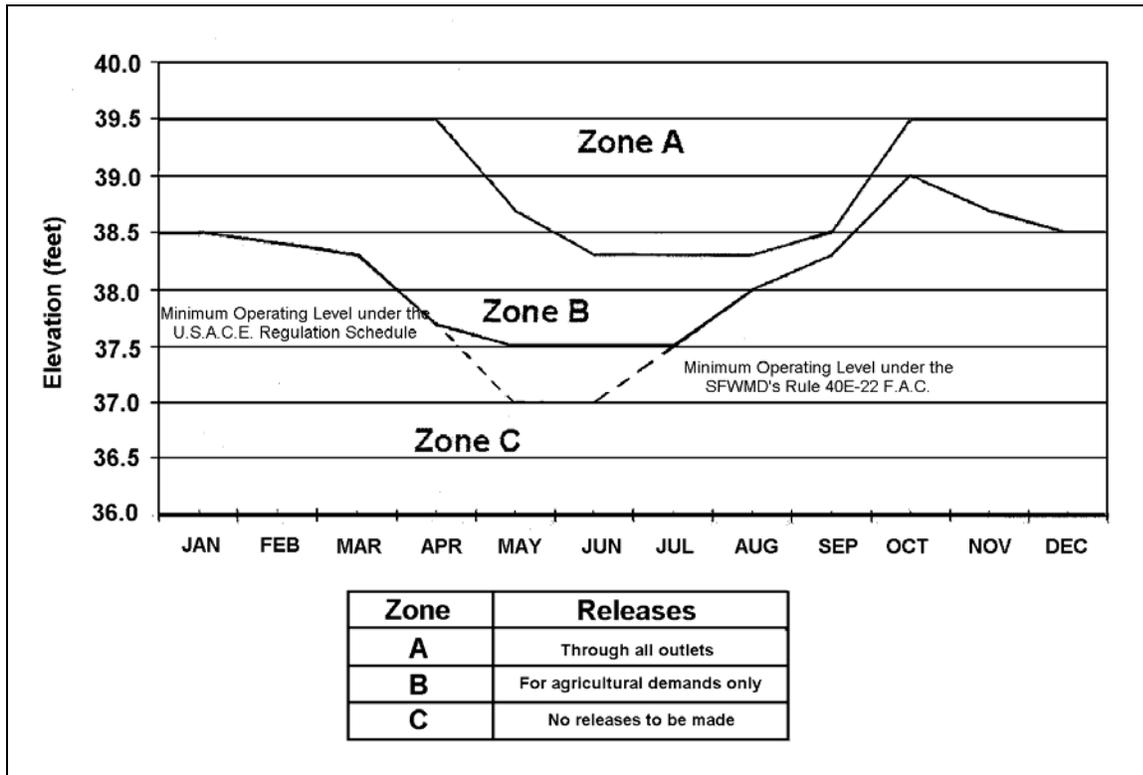


Figure D-1. Regulation Schedule for Lake Istokpoga.

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APPENDIX E
**Bird Species and Associated Habitats in the
Lake Istokpoga Area**

INTRODUCTION

Many species of birds depend on different habitats for different purposes, such as feeding or nesting. For instance, wading birds typically forage for food in marshes or in shallow open-water areas but roost and nest in trees. A habitat disturbance in nesting, roosting and foraging areas may affect bird population distribution and reproductive success.

For most species, studies are lacking that directly relate severity of low water events to avian community impacts or to reduced avian utilization of lake resources. These types of studies are difficult to conduct as many birds are capable of searching for resources across a sizable geographical area. In addition, short-term and long-term effects on avian populations may be quite different. For instance, extended periods of low lake levels may have short-term benefits to many species of wading birds that feed on mud flats and exploit trapped prey in shallow pools (Kushlan 1976, 1986, 1989). But frequently recurring or extreme low water events that cause a decline in prey species' reproduction, growth or habitat may also reduce prey numbers or size distributions, which could impact bird species that depend on only a limited prey diet (e.g. the Everglades Snail Kite, which feeds almost exclusively on apple snails). A reduction of wetland area could also impact bird species that use these habitats for nesting and roosting.

The purpose of the present analysis is to identify bird species and these species' associated habitats within the Lake Istokpoga area. Extreme low water levels that degrade Lake Istokpoga habitats may potentially affect the bird species that utilize those habitats. The analysis proceeded according to the following steps: 1) the bird species found within the Lake Istokpoga area were identified, 2) the respective habitats used by those species for feeding, roosting and nesting were noted and described and 3) the habitat types associated with Lake Istokpoga and affected by lake levels were identified. Low water levels' potential impact on habitats important to avian species was a factor considered in development of the proposed technical criteria for the Lake Istokpoga Minimum Level.

BIRD SPECIES IN THE LAKE ISTOKPOGA AREA

A comprehensive list of bird species believed to be breeding in Highlands County was obtained from the Florida Fish and Wildlife Conservation Commission (Kale *et al.* 1992, Rodgers *et al.* 1996, Pranty 2002, FWC 2003) (**Table E-1**). This list does not include migratory species that pass through the Lake Istokpoga area while traveling between winter and summer ranges; if these transient species were included, the total count would probably increase substantially.

Table E-1. Breeding Bird Species found in Highlands County (Source: Kale 1992, Rogers *et al.* 1996, Pranty 2002, FWC 2003).

Species (Common Name-Scientific Name)	Breeding Status
American Crow (<i>Corvus brachyrhynchos</i>)	Confirmed Breeding
American Kestrel (<i>Falco sparverius</i>)	Probable Breeding
Bachman's Sparrow (<i>Aimophila aestivalis</i>)	Possible Breeding
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Confirmed Breeding
Barred Owl (<i>Strix varia</i>)	Confirmed Breeding
Black-Necked Stilt (<i>Himantopus mexicanus</i>)	Confirmed Breeding
Black Vulture (<i>Coragyps atratus</i>)	Confirmed Breeding
Blue-Gray Gnatcatcher (<i>Poliophtila caerulea</i>)	Probable Breeding
Blue Grosbeak (<i>Guiraca caerulea</i>)	Probable Breeding
Blue Jay (<i>Cyanocitta cristata</i>)	Confirmed Breeding
Boat-Tailed Grackle (<i>Quiscalus major</i>)	Confirmed Breeding
Brown Thrasher (<i>Toxostoma rufum</i>)	Confirmed Breeding
Carolina Wren (<i>Thryothorus ludovicianus</i>)	Confirmed Breeding
Cattle Egret (<i>Bubulcus ibis</i>)	Confirmed Breeding
Chimney Swift (<i>Chaetura pelagica</i>)	Confirmed Breeding
Chuck-Will's-Widow (<i>Caprimulgus carolinensis</i>)	Confirmed Breeding
Common Grackle (<i>Quiscalus quiscula</i>)	Confirmed Breeding
Common Ground Dove (<i>Columbina passerina</i>)	Confirmed Breeding
Common Moorhen (<i>Gallinula chloropus</i>)	Confirmed Breeding
Common Nighthawk (<i>Chordeiles minor</i>)	Probable Breeding
Common Yellowthroat (<i>Geothlypis trichas</i>)	Confirmed Breeding
Cooper's Hawk (<i>Accipiter cooperii</i>)	Probable Breeding
Downy Woodpecker (<i>Picoides pubescens</i>)	Confirmed Breeding
Eastern Meadowlark (<i>Sturnella magna</i>)	Confirmed Breeding
Eastern Screech-Owl (<i>Otus asio</i>)	Confirmed Breeding
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	Confirmed Breeding
Eurasian Collared-Dove (<i>Streptopelia decaocto</i>)	Confirmed Breeding
European Starling (<i>Sturnus vulgaris</i>)	Confirmed Breeding
Everglades Snail Kite (<i>Rostrhamus sociabilis</i>)	Possible Breeding
Fish Crow (<i>Corvus ossifragus</i>)	Confirmed Breeding
Florida Scrub Jay (<i>Aphelocoma coerulescens</i>)	Confirmed Breeding
Fulvous Whistling-Duck (<i>Dendrocygna bicolor</i>)	Confirmed Breeding
Great Blue Heron (<i>Ardea herodias</i>)	Confirmed Breeding
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)	Confirmed Breeding
Great Egret (<i>Ardea alba</i>)	Confirmed Breeding
Green Heron (<i>Butorides virescens</i>)	Confirmed Breeding
Great Horned Owl (<i>Bubo virginianus</i>)	Confirmed Breeding
Hairy Woodpecker (<i>Picoides villosus</i>)	Possible Breeding

Table E-1. Breeding Bird Species found in Highlands County (Continuation).

Species (Common Name-Scientific Name)	Breeding Status
Killdeer (<i>Charadrius vociferous</i>)	Confirmed Breeding
Limpkin (<i>Aramus guarauna</i>)	Confirmed Breeding
Loggerhead Shrike (<i>Lanius ludovicianus</i>)	Confirmed Breeding
Mallard (<i>Anas platyrhynchos</i>)	Confirmed Breeding
Mottled Duck (<i>Anas fulvigula</i>)	Confirmed Breeding
Mourning Dove (<i>Zenaida macroura</i>)	Confirmed Breeding
Muscovy Duck (<i>Cairina moschata</i>)	Confirmed Breeding
Northern Bobwhite (<i>Colinus virginianus</i>)	Confirmed Breeding
Northern Cardinal (<i>Cardinalis cardinalis</i>)	Confirmed Breeding
Northern Flicker (<i>Colaptes auratus</i>)	Confirmed Breeding
Northern Harrier (<i>Circus cyaneus</i>)	Probable Breeding
Northern Mockingbird (<i>Mimus polyglottos</i>)	Confirmed Breeding
Northern Parula (<i>Parula americana</i>)	Possible Breeding
Osprey (<i>Pandion haliaetus</i>)	Confirmed Breeding
Pied-Billed Grebe (<i>Podilymbus podiceps</i>)	Probable Breeding
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	Confirmed Breeding
Pine Warbler (<i>Dendroica pinus</i>)	Probable Breeding
Purple Gallinule (<i>Porphyryla martinica</i>)	Confirmed Breeding
Purple Martin (<i>Progne subis</i>)	Confirmed Breeding
Red-Bellied Woodpecker (<i>Melanerpes carolinus</i>)	Confirmed Breeding
Red-Eyed Vireo (<i>Vireo olivaceus</i>)	Possible Breeding
Red-Headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	Confirmed Breeding
Red-Shouldered Hawk (<i>Buteo lineatus</i>)	Confirmed Breeding
Red-Tailed Hawk (<i>Buteo jamaicensis</i>)	Probable Breeding
Red-Winged Blackbird (<i>Agelaius phoeniceus</i>)	Confirmed Breeding
Rock Dove (<i>Columba livia</i>)	Probable Breeding
Ruby-Throated Hummingbird (<i>Archilochus colubris</i>)	Probable Breeding
Sandhill Crane (<i>Grus Canadensis</i>)	Confirmed Breeding
Short-Tailed Hawk (<i>Buteo brachyurus</i>)	Probable Breeding
Swallow-Tailed Kite (<i>Elanoides forficatus</i>)	Possible Breeding
Tricolored Heron (<i>Egretta tricolor</i>)	Confirmed Breeding
Tufted Titmouse (<i>Parus bicolor</i>)	Confirmed Breeding
Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>)	Possible Breeding
Yellow-Throated Warbler (<i>Dendroica dominica</i>)	Possible Breeding
White-Eyed Vireo (<i>Vireo griseus</i>)	Confirmed Breeding
White-Winged Dove (<i>Zenaida asiatica</i>)	Confirmed Breeding
Wood Duck (<i>Aix sponsa</i>)	Confirmed Breeding

HABITAT REQUIREMENTS OF BIRDS IN THE LAKE ISTOKPOGA AREA

Bird reference guides and other resources were consulted to determine the general habitats used by the species listed in **Table E-1**. A summary of this information is presented in **Table E-2** and **Table E-3**, which describe the preferred food, feeding habitats, nesting season and nesting habitats. Lake Istokpoga contains three primary types of habitats important for bird species: 1) aquatic, 2) littoral zone marsh and 3) swamp. **Figure E-1** shows the distribution of these habitat types around Lake Istokpoga, and **Table E-4** displays the aerial extent of each.

Aquatic habitats are open-water areas that may contain submerged vegetation. A wide variety of fish is found in the water column, and numerous species of invertebrates and other small animals live within the vegetation beds. Examples of bird species that use this habitat are the bald eagle, black-necked stilt, common moorhen, osprey, egrets, herons and some ducks. Low water events that cause drying of aquatic vegetation beds or that negatively affect native aquatic vegetation can potentially affect the fish and invertebrate populations that are important food sources for some bird species. Active management of aquatic habitats and control of weedy and invasive species are necessary in order to maintain healthy aquatic communities in Lake Istokpoga.

Littoral zone marshes are found on the broad flats that surround the lake. Marsh vegetation provides shelter and food for a variety of organisms that are important prey for some bird species. In addition, tall wetland plants provide nesting sites and cover for a number of birds. Birds that utilize the littoral marsh for feeding or nesting include a variety of wading birds, ducks and gallinules. Although occasional drawdowns of surface water in marsh habitats is a natural occurrence, extreme or prolonged low water events that cause a loss of marsh vegetation or promote dense growths of weedy or invasive vegetation (e.g. torpedo grass) can reduce habitat quality. Vegetation management programs have focused on maintaining and enhancing the lake's marsh habitats.

Forested wetlands, also called swamps, are found mostly along the southern shoreline (**Figure E-1**). These forests are located behind the littoral zone and are important roosting and nesting sites for wading birds and many raptors (McNair *et al.* 2001, Stewart 2001). Examples of bird species that utilize this habitat include the American kestrel, bald eagle, barred owl, osprey, hawks, herons and kites. Generally, this habitat type is less sensitive to low water events than are the aquatic beds and marsh, and most swamp tree species can tolerate prolonged periods of low water levels. Even so, there are concerns that sufficient flooding of these habitats does not occur, and it has been noted that the bald cypress and mixed hardwood forests along Lake Istokpoga are not successfully reproducing. Although this condition may not be a direct result of prolonged low water levels, the hydropattern characteristics that support reproduction of this important habitat type have implications for the local avian populations.

Table E-2. Food Resource Habitats for Breeding Bird Species in the Lake Istokpoga Area.

Species	Preferred Food ¹	Primary Feeding Habitat ¹
American Kestrel	Large insects, small vertebrates	Littoral, swamp
Bald Eagle	Fish, small birds, small animals, carrion	Aquatic ² , littoral, swamp
Barred Owl	Various small vertebrates and invertebrates	Littoral, swamp
Black-Necked Stilt	Fish, aquatic organisms	Aquatic, littoral
Common Moorhen	Aquatic vegetation, seeds, fruit, insects, small invertebrates, small frogs	Aquatic, littoral
Cooper's Hawk	Small birds	(Littoral, swamp) ³
Fulvous Whistling Duck	Aquatic vegetation	Aquatic, littoral
Great Blue Heron	Fish, insects, crustaceans, amphibians, snakes, young birds, rodents	Aquatic, littoral, swamp
Great Egret	Fish, aquatic organisms	Aquatic, littoral, swamp
Green Heron	Insects, spiders, snails, crustaceans, frogs, fish	Aquatic, littoral, swamp
Limpkin	Mollusks, especially apple snails	Littoral
Mallard	Aquatic vegetation	Aquatic, littoral
Mottled Duck	Insects, snails, mollusks, crayfish, small fish, seeds, stems, roots	Aquatic, littoral
Northern Harrier	Rodents, small birds, snakes, frogs, large insects	Aquatic, littoral, swamp
Osprey	Primarily fish; also some crustaceans, frogs, turtles, birds, rodents	Aquatic, swamp
Pied-Billed Grebe	Diving feeder; insects, crayfish, fish	Aquatic
Purple Gallinule	Aquatic vegetation, insects, small invertebrates, small frogs	Aquatic, littoral
Red-Shouldered Hawk	Sluggish animals (e.g. frogs, toads, snakes, rodents, nestlings)	Littoral, swamp
Red-Tailed Hawk	Small mammals	Littoral, swamp
Red-Winged Blackbird	Seeds, insects and other invertebrates	Littoral
Sandhill Crane	Insects, earthworms, small vertebrates and assorted vegetation	Littoral
Short-Tailed Hawk	Small birds	(Littoral, swamp) ²
Snail Kite (Everglades Snail Kite)	Apple snails	Littoral
Swallow-Tailed Kite	Insects, anoles, frogs, snakes, nestling songbirds and small mammals	Littoral, swamp
Tricolored Heron	Small fish	Aquatic, littoral
Wood Duck	Vegetation, plant material, invertebrates	Aquatic, littoral

1. Source: National Geographic Society 1987, Ehrlich *et al.* 1988, Poole *et al.* 1992, Bird 1999.
2. Indicates habitats that have very long hydroperiods, such as aquatic beds and mud flats that may occasionally be exposed during drought conditions.
3. Indicates an indirect association.

Table E-3. Typical Nesting Habitats and Seasons for Breeding Bird Species in the Lake Istokpoga Area.

Species (Common Name)	Typical Nesting Season¹	Primary Nesting Habitat¹
American Kestrel	March through June	Cavity nests in swamp trees
Bald Eagle	September through May	High nest on swamp trees
Barred Owl	December through April	Cavity nests in swamp trees
Black-Necked Stilt	April through June	Littoral vegetation
Common Moorhen	March through September	Littoral vegetation
Cooper's Hawk	April through July	Swamp trees
Fulvous Whistling Duck	March through August	Littoral vegetation
Great Blue Heron	Extended through much of the year	Swamp trees
Great Egret	Year-round	Swamp trees
Green Heron	March through July	Swamp trees or shrubs
Limpkin	February through June	Littoral vegetation
Mallard		Littoral vegetation
Mottled Duck	February through September	Littoral vegetation
Northern Harrier	February through September*	
Osprey	Year-round	High nest on swamp tree
Pied-Billed Grebe	Year-round	Littoral vegetation
Purple Gallinule	March through September	Littoral vegetation
Red-Shouldered Hawk	January through May	Swamp trees
Red-Tailed Hawk	January through June	Nest in mature tree-swamp
Pied-Billed Grebe	March through July	Littoral vegetation
Sandhill Crane	December through June	Often nests in wet areas-littoral
Short-Tailed Hawk	February through May	Swamp tree
Snail Kite (Everglades Snail Kite)	Year-round	Swamp or littoral vegetation
Swallow-Tailed Kite	April	Tall cypress tree-swamp
Tricolored Heron	February through August	Swamp trees or shrubs
Wood Duck	January through June	Cavity nests

1. Source: National Geographic Society 1987, Ehrlich *et al.* 1988, Poole *et al.* 1992, Bird 1999.

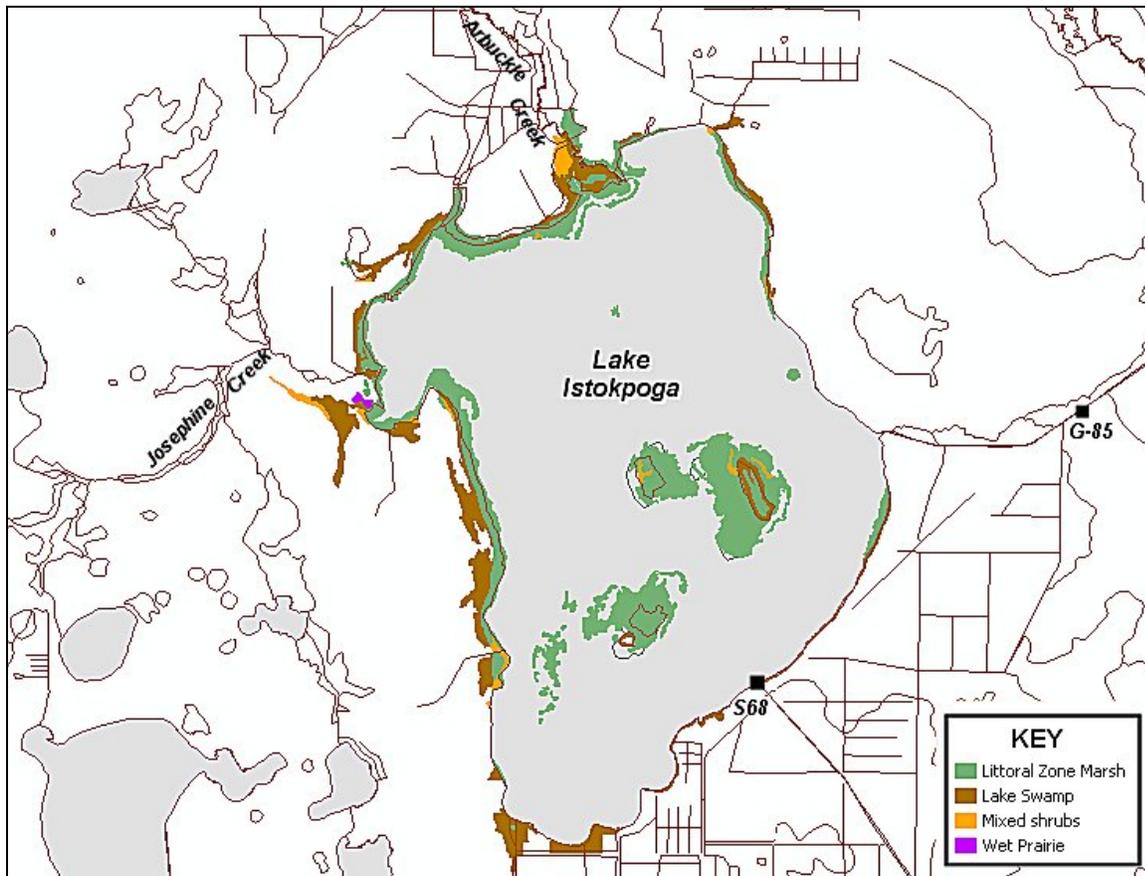


Figure E-1. Lake Istokpoga Wetlands (Source data: 1995 FLUCCS).

Table E-4. Aerial Extent of Lake Istokpoga Habitats Important to Bird Species (Source data: FDOT 1995).

Habitat Type	Area (acres)	Area (hectares)
<i>Littoral Zone Marsh</i> All non-forested wetlands including emergent marsh, sloughs and cattails.	3,480	1,411
<i>Lake Swamp</i> All forested wetlands including cypress, mixed and hardwood-dominated swamps.	1,700	686
<i>Mixed Shrubs and Wet Prairie</i> Seasonally inundated wetlands dominated by shrubby vegetation or grasses.	280	113
<i>Aquatic/Open Water</i> Open water habitat, including submerged aquatic vegetation beds and non-vegetated lake bottom.	Varies with lake stage	Varies with lake stage

LAKE HABITAT UTILIZATION BY BIRDS

During the life cycle of a bird, typically more than one habitat type is exploited; sometimes one habitat is used for feeding and another for nesting and rearing of chicks. A review of information in **Table E-3** indicates that most breeding bird species in the Lake Istokpoga area nest in a single habitat type, with swamp trees often being the preferred site (see **Table E-5** and **Table E-6**). This specificity of nesting requirements is an important consideration in natural resource management and protection of existing resources. Hydrologic conditions that lead to a reduction in swamp or marsh quality or extent could also reduce breeding success of some bird species. For instance, ospreys nest in the swamp adjacent to the lake and feed from the lake's aquatic habitat (Stewart 2001). Of the 26 bird species identified in **Table E-2**, some 21 utilize more than one habitat type.

Table E-5. Potential Habitat Use by Bird Species within Lake Istokpoga.

Habitat Use	Habitat Type		
	Aquatic	Marsh	Swamp
Used as a Feeding Habitat by Breeding Species (Number of Species)	15	24	13
Used as a Nesting Habitat by Breeding Species (Number of Species)	0	11	15
Used as a Feeding and Nesting Habitat by Breeding Species (Number of Species)	0	10	12

Table E-6. Summary of Habitat Specificity of Birds in the Lake Istokpoga Area.

Breeding Species	Number of Species	Percentage of Species	Examples
Typically Use One Feeding Habitat Type*	5	19	Limpkin, Pied-Billed Grebe, Pied-Billed Grebe, Sandhill Crane, Everglades Snail Kite
Typically Use Two Feeding Habitat Types*	16	62	American Kestrel, Barred Owl, Black-Necked Stilt, Common Moorhen, Cooper's Hawk
Typically Use Three Feeding Habitat Types*	5	19	Bald Eagle, Great Blue Heron, Great Egret, Green Heron, Northern Harrier

*i.e. Lake Istokpoga habitats.

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