

February 18, 2004

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
(Prudential Building)
701 San Marco Blvd.
Jacksonville, FL 32207

Mr. Henry Dean
Executive Director
South Florida Water Management District
P.O. Box 24680
West Palm Beach, Florida 33416-4680

Dear Col. Carpenter and Mr. Dean:

In light of several newly released reports, the Charlotte Harbor National Estuary Program (CHNEP) recommends that the U.S. Army Corps of Engineers (COE) and the South Florida Water Management District (SFWMD) modify the regulations affecting flows from Lake Okeechobee to the Caloosahatchee estuary. These regulations include the COE Lake Okeechobee Water Supply/Environmental (WSE) regulations and the SFWMD "WSE Operational Guidelines Decision Tree, Part 2: Define Lake Okeechobee Discharges to Tidewater (Estuaries)."

The CHNEP Comprehensive Conservation and Management Plan (CCMP) objective HA-2 calls for maintaining a more natural seasonal variation for the Caloosahatchee River. The decision tree should be modified to establish targets designed to replicate optimal flows (including maximum flows) to the estuaries whenever possible based on new research from the South Florida Water Management District, Florida Gulf Coast University, Sanibel-Captiva Conservation Foundation, Florida Fish and Wildlife Conservation Commission (FWC), and others. Methods to meet minimum flows at all times should also be incorporated.

Reports that provide information to base amendments to the WSE and Decision Tree include the Caloosahatchee Minimum Flows and Levels Update and the November 2003 FWC report entitled "Management of Lake Okeechobee and Associated Estuaries." In doing so, COE and SFWMD will protect Florida's fish and wildlife resources and provide for a more natural variability in water flows to the estuaries.

If the Charlotte Harbor National Estuary Program can assist you in these tasks in any way, please let me know at lbeever@swfrpc.org.

Sincerely,

Lisa B. Beever, PhD
Director

cc: Mr. Ken Haddad, Executive Director FFWCC 620 South Meridian Street Tallahassee, FL 32399-1600	Honorable Ray Judah, Chairman Lee County BCC P.O. Box 398 Fort Myers, FL 33902-0398	Secretary FDEP 3900 Commonwealth Blvd. Tallahassee, FL 32399-3000
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Management of Lake Okeechobee and Associated Estuaries

Lake Okeechobee and Associated Estuaries Issue Team
Florida Fish and Wildlife Conservation Commission
November 2003

Summary

Current water management practices for Lake Okeechobee are often detrimental to the living resources in the lake itself, as well as in marshes, other lake and river systems, and estuarine systems tied to the lake by both natural and artificial connections. Fundamental problems for fish and wildlife resources are prolonged high water levels, and timing and volume of water releases not consistent with natural hydrological patterns. These problems result in significant negative impacts to emergent and submerged vegetation, invertebrates (crabs, crayfish, oysters), waterfowl, wading birds, Florida snail kites, American alligators, turtles, manatees, and fishes. Lake Okeechobee water levels and discharges are controlled primarily for water supply and flood control by the South Florida Water Management District and the United States Army Corps of Engineers. Discharges from the lake occur through manmade connections to the St. Lucie Estuary, Water Conservation Areas (WCAs), and the Caloosahatchee Estuary. The timing, magnitude, duration, and quality of water in these discharges result in measurable negative effects on plants and animals in the WCAs and both estuaries. Although there appear to be no short-term (operational within 5 years) plans or engineering solutions for changing the schedule of water releases from Lake Okeechobee, long-term solutions rest in future projects for water storage and conveyance, including those in the current Comprehensive Everglades Restoration Plan. These projects will eventually direct more water from the lake into the Greater Everglades, and ultimately northern Florida Bay, rather than through the artificial canal systems connecting to the Atlantic Ocean and Gulf of Mexico estuaries. Until these projects are completed and functional, we suggest short-term management changes to better protect the important living resources. Water levels in Lake Okeechobee should be kept between 12.0 feet and 15.5 feet National Geodetic Vertical Datum, with these low and high water levels being met every 3 years. Annually, water levels within Lake Okeechobee should be dropping from November through June, stable through August, and peaking in October. Discharges to the Caloosahatchee and St. Lucie rivers, and WCAs should be timed to match natural hydrologic cycles as much as possible (i.e., major discharges should occur during annual wet periods). Discharge events to the St. Lucie Estuary greater than 2000 cubic feet per second (cfs) and flows greater than 4500 cfs to the Caloosahatchee Estuary should be avoided to minimize adverse effects on estuarine ecology. In regard to the Caloosahatchee Estuary, minimum fresh water flows of 800 cfs in the spring and 1200 cfs in the fall are needed to maintain optimum salinities for submerged aquatic vegetation.

Management of Lake Okeechobee and Associated Estuaries

Taxonomic Considerations, Desired Future Conditions, And Management Recommendations

Lake Okeechobee and Associated Estuaries Issue Team
Florida Fish and Wildlife Conservation Commission
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INTRODUCTION

In its unaltered state, Lake Okeechobee fluctuated within a defined floodplain and had no channelized outflows. Water exited from the southern end of Lake Okeechobee through the Everglades. Water left the Everglades system via evapotranspiration, sheetflow to Whitewater and Florida Bay, and through the transverse drainages along the lower east coast. The River and Harbor Act of July 3, 1930 (Public Law 71-520) provided for improvements to the Caloosahatchee River and Lake Okeechobee Drainage Areas (Senate Document No. 115). The principal features of the project were improvement of the Caloosahatchee River and Canal, St. Lucie Canal and River, construction of a levee and navigation canal following the south shore of Lake Okeechobee, and a levee on the north shore of the lake. After the floods of 1947 a comprehensive improvement plan was developed as House Document No. 643 and was authorized in the Flood Control Act of June 30, 1948 (Public Law 80-858). House Document No. 643 described Lake Okeechobee thusly: "This great reservoir and its controls are the heart of any plan for flood control and water conservation in south Florida". As a result of this legislation, Lake Okeechobee was recognized as the major focus of South Florida's water management system, being the primary flood control and water storage facility for agriculture within the Everglades Agricultural Area (EAA) and providing backup water supplies for east coast municipalities (SFWMD 1989).

The construction of a levee around the perimeter of Lake Okeechobee isolated the system from its historical floodplain. Today, the major lake outflows are through dredged channels that deliver water to the St. Lucie Estuary and Caloosahatchee Estuary, and into the Water Conservation Areas (WCAs). Anthropogenic alteration of water flow direction, timing of releases, and duration of discharges has greatly affected the ecological processes in these ecosystems. Perturbations have occurred at all trophic levels.

The detrimental environmental impacts to Lake Okeechobee and the St. Lucie and Caloosahatchee estuaries increased when water levels in Lake Okeechobee were increased by two feet in 1978 in response to implementation of a 15.5 ft to 17.5 ft National Geodetic Vertical Datum (NGVD) regulation schedule. This change in the target lake depth was "created in an effort to store a greater amount of water, available during wet periods, for use during subsequent extended dry periods" (USACE 1996). The lake levee approximately follows the 15.0 ft NGVD contour. Water levels above this height result in little increase in lake surface area. They add only to water depth and storage capacity. Prior to implementation of this schedule, the lake attained a stage ≥ 15.0 ft NGVD only 16% of the time; however, the two foot schedule increase resulted in a stage ≥ 15.0 ft NGVD 54% of the time (Trimble and Marban 1988). Greater water

depths have devastated woody plants, and submerged and emergent macrophytes, resulting in habitat destruction and alteration of primary production in the Lake Okeechobee ecosystem (LOLZTG 1988; SFWMD 2002).

Higher lake stages also result in heavy discharges that imperil the sensitive estuarine ecosystems of the St. Lucie and Caloosahatchee rivers (US ACE 1999). Managed discharges south to the WCAs also have resulted in undesirable ecological changes. During dry years, water demand from the EAA and developed areas capture water prior to it reaching the northern Everglades. This has resulted in the northern sections of WCA-1, 2, and 3 being dryer than normal, and is manifested by undesirable vegetative changes, soil oxidation, and potentially devastating wildfires. Conversely, large-volume discharges to the WCAs during high-water periods are often combined with discharges from the EAA and urban areas resulting in too much water being delivered to the area. This can negatively impact alligator nesting, wading bird foraging and nesting success, and a variety of natural habitat conditions.

DESIRED FUTURE CONDITIONS FOR FISH AND WILDLIFE RESOURCES

In Lake Okeechobee, water level management that mimics natural conditions will have the greatest benefits to plant communities. Enhancement of primary production will have cumulative positive effects as increased available energy moves through the various trophic levels. Expansion of desirable plant communities will provide increased habitat for fish and wildlife species.

More robust and diverse plant communities should result in increased relative abundance of epiphytic and benthic macroinvertebrates. Macroinvertebrates are important food items to the American Alligator (*Alligator mississippiensis*), juvenile and adult fishes, turtles, wading and shorebirds, and waterfowl. Florida applesnail (*Pomacea paludosa*) production and availability is critical to the Florida snail kite (*Rostrhamus sociabilis plumbeus*). Desired future conditions would include an increase in the relative abundance of midges (*Chironomidae*), scuds (*Amphipoda*), and other desirable species with a concomitant relative abundance decline in segmented worms (*Oligochaeta*) to < 50%. There should be no documented declines in macroinvertebrate species diversity.

Periodic dewatering of the shallow marsh (lake level :S 13.0 ft NGVD) will permit increased germination and expanded coverage by moist soil annual seed producers such as smartweed (*Polygonum hydropiperoides*), water grasses (millets; *Echinochloa* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp. and *Cyperus* spp.), and when coupled with gradual inundation to approximately 14.5 ft NGVD during the fall and winter, will provide enhanced waterfowl feeding opportunities. Another important shallow marsh plant community that would benefit from a similar regime is spikerush (*Eleocharis cellulosa*). Spikerush seeds germinate only under moist soil conditions and thrive under shallow inundation. Spikerush is important fish spawning and nursery habitat, and is important to wading birds, waterfowl, and the Florida snail kite as foraging habitat. Spikerush marshes are deemed critical habitat for the Florida snail kite due to the abundance and accessibility there of Florida applesnails. The desired area of coverage of spikerush in Lake Okeechobee is at least a minimum of 17,600 acres, based on 1973 estimates (Milleson 1987).

Dewatering of the shallow marsh zone will also provide opportunity for torpedo grass (*Panicum repens*) control activities. Torpedo grass is an invasive exotic that has out competed much of the spikerush community and has little fish and wildlife value. A desirable goal is to reduce the acreage of torpedo grass to no more than 520 acres (Schardt and Nall 1982).

A decline in willow tree (*Salix caroliniana*) communities has resulted in a decrease in available nesting sites for colonial-nesting birds and Florida snail kites. Several active wading bird rookeries have been lost since the higher water level schedule was implemented in 1978. An increase in willow abundance will provide wading birds and Florida snail kites with stable nesting habitat. When coupled with lake levels of 13.0 ft to 15.5 ft NGVD, increased willow habitat should result in increased nesting success and fledgling numbers due to increased availability of foraging habitat and access to flooded, woody nesting vegetation. The desired areal coverage of willow is a minimum of 10,000 acres, based on the 1973 estimate (Milleson 1987).

A water level regime that maximizes the extent and natural diversity of the emergent marsh will be beneficial to the American Alligator. A fluctuating lake level that mimics the natural hydroperiod is desirable. A relatively stable lake level from June through August would probably increase nesting success.

To enhance nesting and hatchling survival of other herpetofauna, primarily freshwater turtles, in Lake Okeechobee, a lake level that follows the pre-1978 historical fluctuations from April through early-September would be optimal.

Submerged plants including hydrilla (*Hydrilla verticillata*), Illinois pondweed (*Potamogeton illinoensis*), and eelgrass (*Vallisneria americana*) provide food to waterfowl and manatees (*Trichechus manatus*), and influence fish species diversity and recruitment by providing spawning substrate and cover for adults, and foraging areas and protective habitat for larval and sub-adult fish. Also, these plants have a structural complexity that influences fish biomass, distribution, and predator-prey interactions. Submerged plant communities in Lake Okeechobee would benefit from a lake regulation schedule that fluctuates between 12.0 ft to 15.5 ft NGVD. Higher lake stages allow wave energy to uproot submerged plants, and produce higher turbidity that prevents adequate sunlight from penetrating the entire water column, thus reducing photosynthesis and seed germination. Desired acreage for pondweed and eelgrass, based on 1982 estimates, is approximately 4,800 acres and 2,900 acres, respectively (Schardt and Nall 1982). Hydrilla is an exotic plant that has demonstrated invasive characteristics in numerous aquatic systems; however, the hydrologic conditions, morphometry and weather conditions in Lake Okeechobee preclude a system-wide takeover by hydrilla. The fish and wildlife values of hydrilla should be recognized, and eradication should not be the management goal for this plant in the Lake Okeechobee ecosystem.

Reduction of submerged plants in Lake Okeechobee reduces manatee food resources in the lake, and may directly impact manatee survival by forcing manatees to roam in search of food. Lake Okeechobee habitats are important to manatees, especially in summer months and allow gene flow dispersal between west and east coast populations. High water-level differentials between the lake and surrounding canals prevent manatees from re-entering the lake through structures

and result in entrapment, and ultimately death, due to cold stress in winter months. Manatee protection devices should be incorporated into any new structure design. Current structures and structure operations and any future changes in these structures or operations should be designed to prevent manatee mortality or entrapment.

Bulrush (*Scirpus californicus* & *S. valid us*), a native emergent plant, supports high abundance and biomass of important recreational fish species such as largemouth bass (*Micropterus salmoides floridanus*), bluegill (*Lepomis macrochirus*), and redear sunfish (*Lepomis microlophus*). The bulrush community is most prevalent along the interface of the littoral zone and open water. High lake stages (> 15.5 ft NGVD) permit high-energy waves to move into the bulrush community, uprooting the plants and destroying the community. Bulrush communities function as breakwaters, dissipating waves before they reach the more fragile submerged plants such as pondweed, eelgrass, and hydrilla; however once the bulrush community in an area is eliminated, the submerged plants receive the full brunt of wave energy and are rapidly radicated. Also, by slowing water movement, bulrush benefits submerged plants by reducing turbidity, allowing increased sunlight penetration into the water column. The desired Lake Okeechobee bulrush coverage should be no less than 8,800 acres (Schardt and NaII 1982).

Prolonged discharges of large volumes of water to the St. Lucie and Caloosahatchee estuaries should be minimized. To lessen fish health concerns in the St. Lucie Estuary, maximum discharge volumes should not exceed 2000 cubic-feet-per-second (cfs) at S-80 (St. Lucie Lock and Dam), or result in prolonged salinity levels below 12 parts-per-thousand (ppt) in the middle St. Lucie Estuary. Sustained discharges should be minimized to lessen impacts to shellfish populations within the vicinity of these estuaries. A reduction in sustained flows also may result in an increase in sea turtle nesting in beach areas near the St. Lucie Inlet. Large volume water discharges to the Caloosahatchee Estuary can result in the loss of submerged aquatic vegetation. Of particular concern is the submerged aquatic vegetation near manatee thermal refuges. In addition to the direct loss of food resources, increased movement as the manatees search for food increases the potential for mortality associated with boat collisions and water control structure operations. To lessen fish health concerns, maximum discharge volumes should not exceed 4500 cfs at S-79 (W.P. Franklin Lock and Darn), or result in prolonged salinity levels below 12 ppt in the middle Caloosahatchee River.

The WCAs were part of the natural outflow conduit for Lake Okeechobee water, and water from the lake is essential to the health of the WCA ecosystem. Currently, flow patterns out of Lake Okeechobee have shifted from natural wet season flows in response to rainfall, to dry season flows in response to urban and agricultural demands. Impacts to the WCAs from lake flows are dependant on existing hydrological conditions in the WCAs, which are heavily influenced by additional factors (i.e. ability to discharge to Everglades National Park (ENP), inflows from the EAA and urban areas, etc.). Therefore, the timing and duration of lake discharges are very important. Discharges should not occur when water levels are above the WCA regulation schedule, as determined by SFWMD. Discharges to the WCAs during the dry season (November-April) should not be large enough to cause a reversal in marsh drying patterns, which is necessary for wading bird nesting success. High phosphorus loadings resulting from man-induced hydrologic and land use modifications have degraded the water quality of Lake Okeechobee (FDEP 2001). An additional concern is that the high nutrient load in water flowing

from Lake Okeechobee and the EAA has been deemed to be detrimental to the WCAs and Everglades National Park (Davis 1994; SFWMD 1992).

Boating access to Lake Okeechobee is best when water levels are between 12.0 ft to 15.5 ft NGVD. Boat ramps and access are more directly affected by low water; however, high water conditions result in boat ramps being clogged with floating vegetation, and may make floating courtesy docks at boat ramps inoperable.

MANAGEMENT RECOMMENDATIONS

The desired future conditions in Lake Okeechobee, the St. Lucie and Caloosahatchee estuaries, and the WCAs, should mimic historical natural conditions and cycles. Our desired regulation schedule and water management strategy for Lake Okeechobee is one that mimics pre-1978 inundation characteristics. Lake Okeechobee water levels should fluctuate between 12.0 ft NGVD and 15.5 ft NGVD. The lake should experience both minimum and maximum stage frequencies within the specified range with a 3-year return frequency. On an annual cycle, water levels within Lake Okeechobee should be declining November through June, stable through August, and peaking in October. Sustained discharge flows greater than 2000 cfs to the St. Lucie Estuary should not occur. Water releases to the estuaries and the WCAs should be graded pulses that mimic the natural dry and wet periods in the region. In regard to the Caloosahatchee Estuary, minimum fresh water flows of 800 cfs in the spring and 1200 cfs in the fall are needed to maintain optimum salinities for submerged aquatic vegetation growth. High, sustained discharge flows (greater than 4500 cfs) to the Caloosahatchee Estuary should not occur. It is desirable to reduce the nutrient load of Lake Okeechobee water such that lake outflow can be routed to the WCAs, ENP, and Florida Bay without negative impacts. Timing and duration of discharges to the WCAs should be coordinated with existing hydrological conditions.

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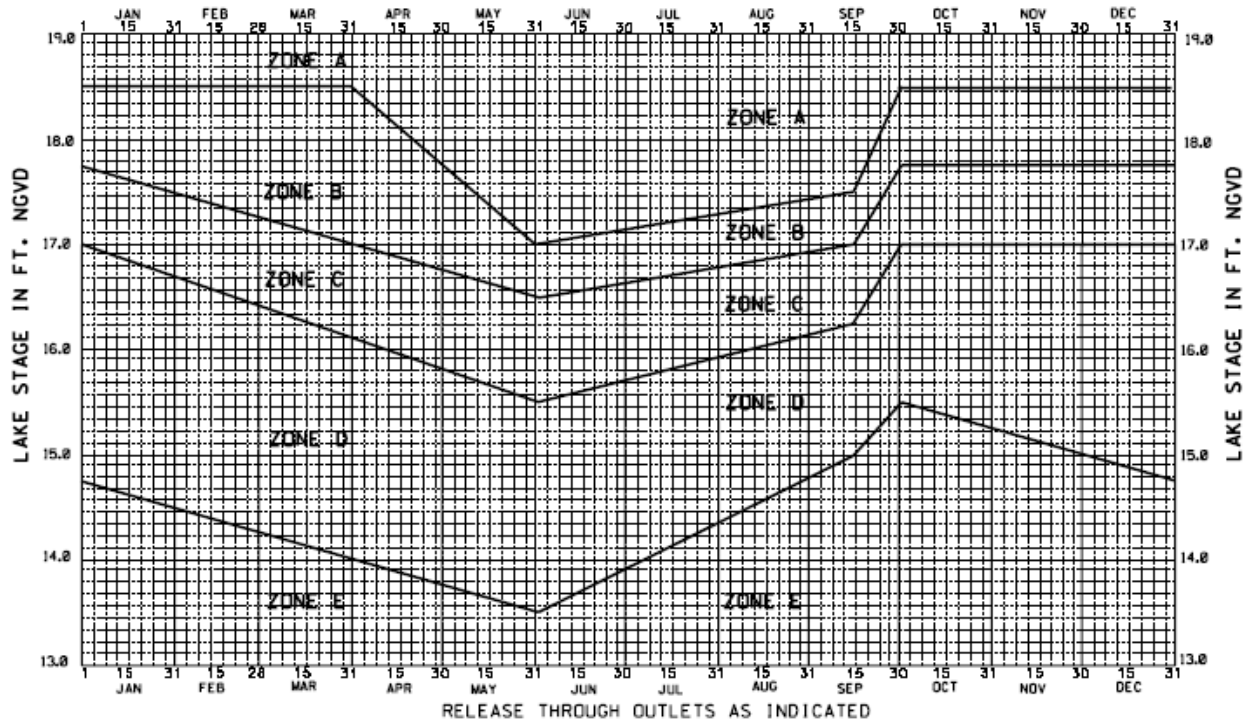
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US Army Corps of Engineers
Water Supply/Environmental Regulations
Dated: November 5, 1999



RELEASE THROUGH OUTLETS AS INDICATED

ZONE	AGRICULTURAL CANALS TO WCAs (1,2)	CALOOSAHATCHEE RIVER AT S-77 (1,2,4)	ST. LUCIE CANAL AT S-80 (1,2,4)
A	PUMP MAXIMUM PRACTICABLE	UP TO MAXIMUM CAPACITY	UP TO MAXIMUM CAPACITY
B (3)	MAXIMUM PRACTICABLE RELEASES	RELEASES PER DECISION TREE (THESE CAN RANGE FROM MAXIMUM PULSE RELEASE UP TO MAXIMUM CAPACITY)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM MAXIMUM PULSE RELEASE UP TO MAXIMUM CAPACITY)
C (3)	MAXIMUM PRACTICABLE RELEASES	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 6500 CFS)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 3500 CFS)
D (3,5)	AS NEEDED TO MINIMIZE ADVERSE IMPACTS TO THE LITTORAL ZONE WHILE NOT ADVERSELY IMPACTING THE EVERGLADES. (SEE NOTE 5.)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 4500 CFS)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 2500 CFS)
E	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE

- NOTES: (1) SUBJECT TO FIRST REMOVAL OF RUNOFF FROM DOWNSTREAM BASINS
(2) GUIDELINES FOR WET, DRY AND NORMAL CONDITIONS ARE BASED ON: 1) SELECTED CLIMATIC INDICES AND TROPICAL FORECASTS AND 2) PROJECTED INFLOW CONDITIONS. RELEASES ARE SUBJECT TO THE GUIDELINES IN THE WSE OPERATIONAL DECISION TREE, PARTS 1 AND 2.
(3) RELEASES THROUGH VARIOUS OUTLETS MAY BE MODIFIED TO MINIMIZE DAMAGES OR OBTAIN ADDITIONAL BENEFITS. CONSULTATION WITH EVERGLADES AND ESTUARINE BIOLOGISTS IS ENCOURAGED TO MINIMIZE ADVERSE EFFECTS TO DOWNSTREAM ECOSYSTEMS.
(4) PULSE RELEASES ARE MADE TO MINIMIZE ADVERSE IMPACTS TO THE ESTUARIES
(5) ONLY WHEN THE WCAs ARE BELOW THEIR RESPECTIVE SCHEDULES

CENTRAL AND SOUTHERN FLORIDA
INTERIM REGULATION SCHEDULE
LAKE OKEECHOBEE
DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA
DATED: 5 NOVEMBER 1999

WSE (WITH CLIMATE OUTLOOK)

WSE Operational Guidelines Decision Tree

Part 2: Define Lake Okeechobee Discharges to Tidewater (Estuaries)

