

TECHNICAL MEMORANDUM 48

**2003 INTERIM ENVIRONMENTAL WATER MANAGEMENT  
PLAN FOR THE UPPER ST. JOHNS RIVER BASIN PROJECT**

By

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## EXECUTIVE SUMMARY

Within one year after completion of the construction of the Upper St. Johns River Basin Project (USJRBP), the U. S. Army Corps of Engineers (USACE) must publish a final water control manual to guide day-to-day operation of the project. The final water control plan will provide structure operation schedules to meet flood control, environmental, and water supply objectives. The USACE has assumed responsibility for developing the operational guidelines to meet the flood control constraints of the project (Zone A management), whereas the St. Johns River Water Management District (SJRWMD) has assumed the responsibility for developing guidelines to meet environmental and water supply goals (Zone B management; USACE 1991).

A preliminary water control manual (COEWCP) specifying flood control regulation schedules for the various project areas, as well as structure operation guidelines for meeting these schedules, was initially published by the USACE in 1991 (USACE 1991). In 1996, the SJRWMD published a Preliminary Environmental Water Management Plan (EWMP) to guide project operation when water levels were below flood control regulation schedules (Miller et al. 1996).

Since 1996, modifications to the original project design and refinement of the hydrologic models used to develop the environmental regulation schedules have necessitated updating the original EWMP. A new hydrologic modeling effort to meet environmental objectives was completed in July 2001. The Interim EWMP presented here is based on this modeling effort.

Since completion of the new environmental hydrologic modeling effort, plans to further modify the USJRBP by constructing an additional water management area adjacent to the St. Johns Water Management Area (SJWMA) have been initiated. Water management within this new reservoir, which is scheduled to be operational in 2005, will greatly impact environmental water management plans implemented prior to this date. Incorporation of this new reservoir into project operational plans to meet environmental objectives will require a completely new hydrologic modeling effort. However, since the design of this new reservoir is only in its preliminary stages, this modeling effort will not be initiated for at least a year. Therefore, this interim EWMP has been created to guide USJRBP structure operation to meet environmental

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goals until new hydrologic modeling has been conducted and the new water management area becomes operational. This Interim Plan will be in effect until the Final EWMP is developed.

One pathway to achieving the environmental goals of the USJRBP is to restore, to the greatest extent possible, the natural hydrologic regime that shaped and maintained the historic basin ecosystem. By creating a hydrologic regime that mimics natural cycles, we believe optimum soil and vegetation characteristics will be maintained. A number of hydrologic characteristics have been identified as being ecologically significant (Miller et al. 1996). These include: mean depth, frequency of inundation, maximum depth, range of annual fluctuation, timing of fluctuation, and water level recession rates. Numerical environmental hydrologic criteria describing each of these characteristics have been developed for each project area. These criteria comprise a series of hydrologic statistics (or constraints) that form the boundaries of an acceptable environmental hydrologic regime for that area (Miller et al 1996).

USJRBP structure operation guidelines presented in this Interim Plan were developed using simulated hydrologic stage data derived from the Upper Basin Hydrologic Model. Simulated daily stages were calculated by the model from historic daily rainfall data measured over a 57-year period of record (1942 -1998). Through an iterative process, a number of discharge scenarios were modeled for each project area to derive a discharge schedule under which simulated stage data most closely met the all the environmental hydrologic criteria simultaneously. Those operational schedules were subsequently accepted for inclusion in this interim plan although all environmental hydrologic criteria were not necessarily met.

#### **Interim EWMP Discharge Schedules Presented by Project Area:**

##### **Fort Drum Marsh Conservation Area (FDMCA)**

Structure S-252D is the only FDMCA structure that will be operated under Zone B regulation.

Under both Zone A and Zone B regulation S-252D will remain fully open to discharge water into the C-52 Canal. S-252D may be temporarily closed during the wet season if the St. Johns Water Control District indicates that discharge through S-252D is

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impeding their ability to make flood control discharges from their reservoir into the C-52 canal. In addition, S-252D may also be closed temporarily if conditions exist for backflow to occur through the structure.

Generally, backflow conditions are indicated whenever stages in the C-52 Canal are at least 0.2 ft higher than water levels in the FDMCA.

### **Blue Cypress Marsh Conservation Area (BCMCA)**

Structure S-96C is the main discharge structure for the BCMCA.

When water levels in the BCMCA are in Zone B, S-96C will be operated to maintain a continuous 75 cubic feet per second (cfs) discharge. S-96C may be closed temporarily to prevent backflow if tail water conditions are high due to flood control discharges through S-96B.

### **Blue Cypress Water Management Area (BCWMA)**

Structure S-96D is the primary structure regulating water levels in the BCWMA. To meet environmental hydrologic conditions specified in the Biological Opinion rendered by the U. S. Fish and Wildlife Service (USFWS) for protection of the endangered snail kite, the following Zone B discharge schedule for S-96D has been developed:

When water levels in the SJWMA fall to 21.0 ft NGVD or below and water levels in the BCWMA exceed 23.2 ft NGVD, 300 cfs will be discharged from the BCWMA into the SJWMA through S-96D. This 300 cfs discharge will continue until water levels in the SJWMA rise to 22.0 ft NGVD or, water levels in the BCWMA fall to 23.2 ft NGVD. When either of these conditions occurs, S-96D will be closed. If after S-96D is closed, water levels in the BCWMA continue to decline and subsequently fall below 22.9 ft NGVD, and water levels in the SJWMA fall to 21.0 ft NGVD or lower, then S-96D will be reopened to discharge 300 cfs for an additional 30 days.

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Hydrologic modeling indicates this supplemental 30-day discharge is needed to ensure water levels in the BCWMA fall below 22.5 ft NGVD for 30 continuous days at least once every 10 years.

The BCWMA is divided into two areas, BCWMA-East and BCWMA-West. BCWMA-East is not contained within the Federal Project, however; water levels in the area are controlled by project structure S-251. S-251 will also be operated to prevent reverse flows from BCWMA-West to BCWMA-East. To prevent reverse flows, S-251 will be closed whenever water levels in BCWMA-West are more than 0.05 ft higher than levels in BCWMA-East.

### **St Johns Water Management Area (SJWMA)**

Structure S-96B, which is the primary structure regulating water levels in the SJWMA, will be operated only to follow the COEWCP flood control schedule. There are no environmental hydrologic criteria developed for the SJWMA at this time. However, S-96B needs to be closed incrementally after making flood control discharges to attempt to prevent downstream fish kills.

If S-96B is to be closed after making flood control discharges, the structure should not be shut immediately after the flood control schedule in the SJWMA is reached but rather, discharge should be reduced to maintain a rate of 75 to 100 cfs. This 75 to 100 cfs discharge through S-96B should continue until S-96C has been re-opened to discharge its base flow of 75 cfs, which should occur immediately after tail water conditions become appropriate. If S-96B is to be closed and S-96C is to be opened to make flood control discharges, then S-96B can be closed immediately without a staging down period as long as S-96C is opened immediately.

### **St. Johns Marsh Conservation Area (SJMCA)**

There is currently only one water control structure in the SJMCA, which is a culvert structure in Canal Plug E-7.

The culvert structure in Canal Plug E-7 will be fully opened annually during the months of April, May and June and then closed throughout the rest of the year.

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**Three Forks Marsh Conservation Area (TFMCA ) This project area is currently under construction.**

Water levels in the TFMCA will be regulated by an overflow weir and by culvert Structure S-257.

When water levels in the TFMCA exceed 20.0 ft, unregulated discharges will occur over the overflow weir. Culvert Structure S-257 will remain fully open when water levels in the TFMCA exceed 19.0 ft. After water levels reach 19.0 ft, discharges through S-257 will be reduced 20% per day for 5 days until the structure is closed. To provide low flow augmentation for Lake Washington, when water levels stages in the TFMCA exceed 14.0 ft, and the water level in Lake Washington is below 12.0 ft NGVD, a supplemental discharge of 30 cfs will be released through S-257.

**Sawgrass Lakes Water Management Area (SLWMA) This project area is currently under construction.**

Water levels in the SLWMA will be regulated by Structure S-262.

During normal operation, discharge through culvert Structure S-262 will be regulated to match pump inflow to the area. If water levels in Cell 3 of the SLWMA are unable to be maintained above 16.75 ft, Structure S-262 will be closed.

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## INTRODUCTION

The purpose of the Environmental Water Management Plan (EWMP) is to provide water level regulation schedules that maximize environmental benefits of the USJRBP. Eventually this plan will be included as a part of the overall Army Corps of Engineers Upper St. Johns River Basin Water Control Plan (COEWCP) and will be used to direct the operation of project water control structures when water levels are below flood control regulation schedules.

The primary purpose of the Upper St. Johns River Basin Project (USJRBP) is flood protection. Secondary project goals are to provide environmental, water supply, and recreational benefits. Regulation schedules outlined in the COEWCP have been designed to provide flood protection by increasing available storm water storage capacity during the rainy season (June-August) and to allow extra water to be stored during the dry season (November-April). Figure 1 shows the regulation schedule for the Blue Cypress Marsh Conservation Area (BCMCA). Regulation schedules for the other project areas are similar. When water levels are in Zone A, maximum discharges will occur. When water levels are in Zone B, discharges will be made following the operational schedules detailed in the EWMP.

Four marsh conservation areas and three water management areas comprise the major components within the USJRBP (Miller et al. 1996). The marsh conservation areas are designed to temporarily retain floodwater, provide for long-term water storage, and preserve floodplain wetlands. The water management areas are designed to provide for flood protection and to serve as treatment areas to improve the quality of agricultural and urban surface water runoff before it is discharged into the St. Johns River. Water management areas may also provide water for irrigation where feasible.

Within the USJRBP, over 40,000 acres of land previously drained for agriculture are being restored to wetlands. In addition, more natural hydrologic regimes are being implemented on greater than 70,000 acres of existing freshwater marsh. Ultimately, these measures will increase and enhance habitat for fish and wildlife as well as improve water quality. Another

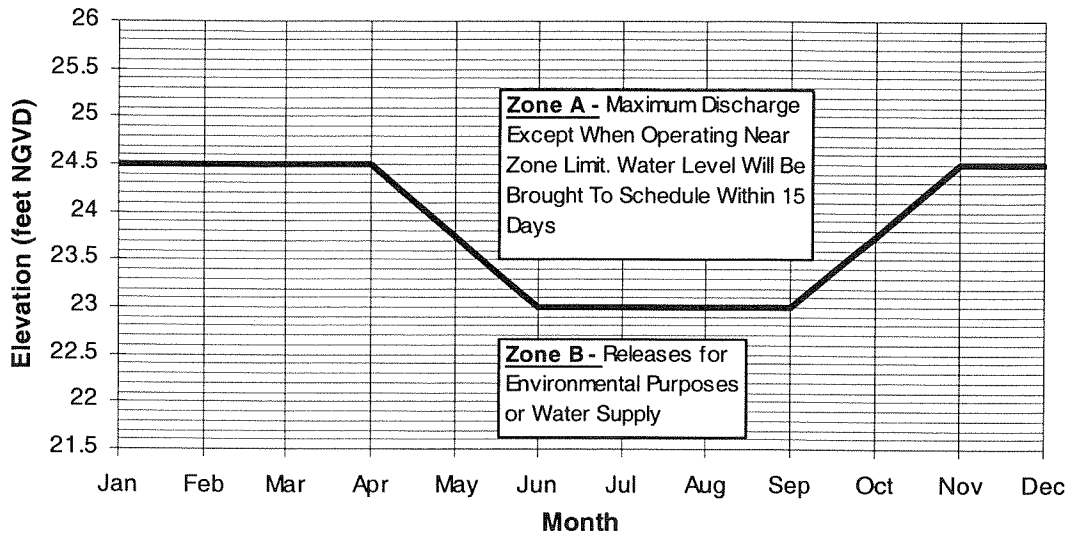


Figure 1. Flood control regulation schedule for the Blue Cypress Marsh Conservation Area.

benefit of the project is a decrease in the amount of stormwater that has been historically diverted to the Indian River Lagoon.

Miller et al. (1996) presented the initial plan for managing water in the USJRBP to meet environmental objectives. However, acquisition of new properties and the refinement of the hydrologic model used to create the original plan necessitated the environmental water control schedules be updated. New USJRBP structure operation schedules were developed in 2001 using simulated hydrologic stage data derived from the updated hydrologic model. Simulated daily stages were calculated by the model from historic daily rainfall data measured over a 57-year period of record (1942 -1998). Through an iterative process, a number of discharge scenarios were modeled for each project area to derive that discharge schedule under which simulated stage data most closely met the environmental hydrologic criteria. Those discharge schedules were subsequently accepted for inclusion in this interim plan although all

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environmental hydrologic criteria were not necessarily met. Simulated stages are also provided here for project areas that are currently under construction.

After the 2001 modeling effort was complete, plans were initiated to construct a new additional water management area adjacent to the St Johns Water Management Area (SJWMA). Still in the preliminary planning stage, this new water management area, known as the Fellsmere Water Management Area (FWMA), will be not completed for several years. Incorporation of this new reservoir into project operational plans to meet environmental objectives will require a completely new hydrologic modeling effort. However, since the design of this new reservoir is only in its early stages, this modeling effort will not be initiated for at least a year. Therefore, this interim EWMP has been created to guide USJRBP structure operation to meet environmental goals until the new water management area becomes operational. Because this is an interim plan, an extensive project description including all flood control regulation schedules and a detailed description of the environmental hydrologic criteria are not presented but will be included in a final EWMP to be published after construction of the USJRBP is complete. This information can presently be found in the Preliminary COEWCP (ACOE 1991) and in the 1996 EWMP (Miller et al. 1996).

## **INTERIM ZONE B OPERATION SCHEDULES**

### **Fort Drum Marsh Conservation Area (FDMCA)**

The FDMCA is located in southwestern Indian River County, between the Florida Turnpike and State Road 60. The FDMCA is approximately 20,588 acres in size and is a diverse area containing unimproved pasture, pine flatwoods, live oak hammock, cabbage palm hammock, mixed hardwood swamp, cypress swamp, dry prairie, and freshwater marsh.

The northern, eastern, and southern sides of the FDMCA are bounded by levees L-78 and L-79. Inflow occurs from the west via Fort Drum Creek, drainage from adjacent pastureland, and via two structures located at the northwestern corner of the property. Water levels in the FDMCA are regulated by structures S-252A, S-252B and S-252C, which discharge north into

the Blue Cypress Marsh Conservation Area (BCMCA) and by structure S-252D, which discharges east into the C-52 canal just upstream of the Blue Cypress Water Management Area (BCWMA). Structures S-252A, S-252B, and S-252C are continuously open to allow water to flow from the FDMCA to the BCMCA whereas S-252D, is a gated culvert.

The environmental hydrologic criteria for the FDMCA (Miller et al. 1996) were best met by allowing continuous discharge to occur through S-252D into the C-52 canal (Table 1). However, there are two issues regarding the operation of S-252D that will affect our ability to make continuous discharges through S-252D. Occasionally water levels in the C-52 canal may exceed water levels in the FDMCA causing back-flow through the structure. Generally backflow conditions are indicated whenever stages in the C-52 canal are at least 0.2 ft higher than water levels in the FDMCA. During these periods, S-252D should be closed to prevent adverse water quality impacts. Conversely, during periods of high water, discharge through S-252D may increase water levels in the C-52 canal to levels that may hinder the ability of the St. Johns

Table 1. Environmental hydrologic criteria-related performance summary for the FDMCA.

Criteria	Constraint Level	Simulated From 1942-1998 Data	Criteria Met?
Mean Water Level	>24.0 ft	25.2 ft.	Yes
Freq. of Inundation	24.0 ft > 60%	86%	Yes
Maximum Water Elevations	More Than 1 in 10 years not to exceed:	Occurred:	
14 day	27.0 ft	Once every 14.0 years	Yes
30 day	26.5 ft	Once every 3.7 years	No
60 day	25.5 ft	Once every 1.2 years	No
Minimum Range of Yearly Fluctuation	Continuous 30 day levels Hi = 25.0 Lo = 23.0	Occurred in:	
High	High in >25% of Years	91% of years	Yes
Low	Low in 20%-30% of Years	14% of years	No
		<i>Note- 23.75 reached for 30 days in 32% of yrs</i>	
Timing of Fluctuation	Should occur > 50% of years between	Occurred in:	
Minimum Levels	Apr 1 - Jun 30	61% of Years	Yes
Maximum Levels	Sep 1 - Nov 31	55% of Years	Yes
	More than 1 in 30 years should not occur between:	Occurred:	
Minimum Levels	Sep 1 - Oct 31	1 in 23 yrs	No
Maximum Levels	Apr 1 - May 31	1 in 14 yrs	No
Recession Rates	When water levels < 26 ft	Met greater than:	
7 day	< 0.5 ft	98% of time	Yes
30 day	<1.2 ft	98% of time	Yes

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Water Control District (SJWCD) to discharge floodwaters from their reservoir. During these periods S-252D may also be closed until appropriate tail water conditions in the C-52 canal are reached.

The modeling effort used to generate the hydrologic statistics evaluated in Table 1 was not able to consider the short-term structure closings mentioned above. Even under continuous flow, all environmental hydrologic criteria were not met. Maximum water elevations and durations were exceeded and low levels did not occur with adequate frequency or duration. While this appears to suggest that additional surface water may be available in the FDMCA for irrigation during the dry season, available quantities are unknown and it is doubtful that during low-water conditions sheet flow would occur at a rate sufficient to support continued pump withdrawals.

### **Blue Cypress Marsh Conservation Area (BCMCA)**

The BCMCA encompasses approximately 29,500 acres and is bounded by State Road 60 to the south and Levee L74W to the north. The area includes 6,500-acre Blue Cypress Lake. The BCMCA is the most extensive natural marsh in the project area and is probably the least impacted by human activities. The northwestern corner of the BCMCA was previously farmed. Due to subsidence of the organic soils, this part of BCMCA is now open water and known as Kenansville Lake. Although currently connected to the BCMCA, plans are underway to isolate Kenansville Lake from the BCMCA as part of a project to enhance drainage along the western boundary of the USJRBP. Except for part of the western boundary, most of the BCMCA is surrounded by project and private levees. Inflows to BCMCA primarily occur via Padgett Branch and Blue Cypress Creek from the west and FDMCA structures S-252A, S-252B and S-252C from the south.

Water flows northward from the BCMCA into the St. Johns Marsh Conservation Area (SJMCA) through structure S-96C and structures S-250, S-250B, S-250C, and S-250D. S-96C is a large gated structure that has a discharge capacity of 1,500 cfs. Under the COEWCP design conditions, maximum required discharges from S-96C occur when water levels equal or exceed

24.5 ft NGVD during the dry season (November- April), and 23.0 ft NGVD during the wet season (June - September).

Environmental hydrologic criteria for the BCMCA were best met by allowing for a continuous 75 cfs discharge to occur through S-96C when water levels in the BCMCA were below the flood control regulation schedule (Table 2). All the environmental hydrologic criteria were met except for the 30-day continuous low (reached in 18% of the years instead of the target of at least 20%), the range of annual fluctuation, and the one-in-30-year minimum water level. In future modeling efforts we will investigate the impact of increasing the 75 cfs discharge.

Table 2. Environmental hydrologic criteria-related performance summary for the BCMCA.

Criteria	Constraint Level	Simulated From 1942-1998 Data	Criteria Met?
Mean Water Level	23.0 ft	23.37	Yes
Freq. of Inundation	23.0 ft = 60%	68.3%	Yes
Maximum Water Elevations	More than 1 in 10 Years Not To Exceed:	<u>Occurred:</u> Never	Yes
14 day	26.0 ft	Never	Yes
30 day	25.5 ft	Once Every 19 years	Yes
60 day	24.5 ft		
Minimum Range of Yearly Fluctuation	Continuous 30 day at Hi=24.0; Low=22.0 At Least 25% of yrs. 20% - 30% of Years. 3.0 ft	<u>Occurred in:</u> 63% of years 18% of years 2.3 ft	Yes No No
Timing of Fluctuation	Should occur > 50% of Years Between: Apr. 1 - June 30 Sept. 1 - Nov. 31	<u>Occurred in:</u> 65% of years 61% of years	Yes Yes
One-Day Yearly Min. One-Day Yearly Max.	More than 1 in 30 Years Should not occur between: Apr. 1 - May 31 Sept.1 - Nov. 31	<u>Occurred :</u> Once every 57 years Once every 19 years	Yes No
Recession Rates	> Than 95% of Time	<u>Met greater than:</u> 99% of time 99% of time	Yes Yes
7 day 30 day	< 0.5 ft <1.2 ft		
Minimum Water Levels for Blue Cypress Lake	Water Level Should Not Fall Below	<u>1-day low during period = 19.7 ft</u>	
1 out of 5 year	20.0 ft	1 out of 56 years	Yes
1 out of 50 year	18.2 ft	0 out of 56 years	Yes
1 out of 100 year	17.7 ft	0 out of 56 years	Yes

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## **Blue Cypress Water Management Area (BCWMA)**

The BCWMA is located north of State Road 60 and east of the BCMCA. State Road 512 bisects this management area into BCWMA-East and BCWMA-West. BCWMA-East consists of approximately 4,900 acres of freshwater marsh with no project levee improvements. The BCWMA-West is approximately 5,200 acres of freshwater marsh and open-water habitat enclosed by a project perimeter levee.

The BCWMA is an important habitat for the federally endangered snail kite (*Rostrhamus sociabilis plumbeus*), therefore, water regulation in BCWMA must be sensitive to the needs of this species. In 1997 the U.S. Fish and Wildlife Service (USFWS) and the Army Corps of Engineers completed formal consultation under Section 7 of the Endangered Species Act with regards to proposed water management activities in the BCWMA. Consultation was initiated, in part, as a way to protect the Army Corps and the District legally in the event that the District's management activities in the BCWMA resulted in, or contributed to, any snail kite nest failures. To be protected by this legal shield, the District is required to comply with all of the Reasonable and Prudent Measures specified in the Biological Opinion. The environmental hydrologic criteria evaluated here are directly specified in the Biological Opinion.

During normal conditions, water from the BCWMA is discharged into the SJWMA via the C-65 flow-way and structure S-96D. Under the COEWCP design conditions, maximum required discharges from S-96D occur when water levels in the BCWMA equal or exceed 25.5 ft NGVD during the dry season, and 24.5 ft NGVD during the wet season.

To meet environmental hydrologic conditions specified in the Biological Opinion rendered by the USFWS for the protection of the endangered snail kite, the following Zone B discharge schedule has been developed. When water levels in the SJWMA fall to 21.0 ft NGVD or below and water levels in the BCWMA exceed 23.2 ft NGVD, 300 cfs will be discharged from the BCWMA into the SJWMA through S-96D. This 300 cfs discharge will continue until water levels in the SJWMA rise to 22.0 ft NGVD, or water levels in the BCWMA fall to 23.2 ft NGVD. When

either of these conditions occurs, S-96D will be closed. If after S-96D is closed water levels in the BCWMA continue to decline and eventually fall below 22.9 ft NGVD, and water levels in the SJWMA fall to 21.0 ft NGVD or lower, then S-96D will be reopened to discharge 300 cfs for an additional 30 days. Hydrologic modeling indicates this supplemental 30-day discharge is needed to ensure water levels in the BCWMA fall below 22.5 ft NGVD for 30 continuous days at least once every 10 years.

Under the discharge schedule specified above, hydrologic modeling indicates that nearly all the environmental hydrologic criteria for the BCWMA would be met (Table 3). The only criterion that would not be met was the 30-day continuous low down to 22.0 ft NGVD that should occur at least once every 15 years. Modeling indicated this level would be reached once every 19 years (Table 3).

Table 3. Environmental hydrologic criteria-related performance summary for the BCWMA.

Criteria	Constraint Level	Simulated From 1942-1998 Data	Criteria Met?
Mean Water Level	24.0 ft	24.62	Yes
Freq. of Inundation	24.0 ft = 75%	81.3%	Yes
Maximum Water Elevation 30 day	More than 1 in 10 Years Not To Exceed: 26.0 ft	Occurred: 1/56 years	Yes
Range of Annual Drydowns		<u>Occurred :</u>	
1 day	Down to 23.0 ft Once Every 2.5 to 4.5 Years.	Once every 4 years	Yes
30 day (continuous)	Down to 23.0 ft Once Every 5 to 7 Years.	Once every 6.2 years	Yes
30 day (continuous)	Down to 22.5 ft At Least Once Every 10 Years.	Once every 9.3 years	Yes
30 day (continuous)	Down to 22.0 ft At Least Once Every 15 Years.	Once every 19 years	No
60 day (ontinuous)	<u>Should Not Go Down To 22.5 More Frequently Than Once Every 10 Years.</u>	Once every 14 years	Yes
Timing of Fluctuation	Should Occur > 50% of Years Between: Apr. 1 - June 30 Sept. 1 - Nov. 31	<u>Occurred in:</u> 63% of years 53% of years	Yes Yes
Recession Rates	> Than 95% of Time	<u>Met Greater than:</u>	
7 day	< 0.5 ft	97% of time	Yes
30 day	<1.2 ft	98% of time	Yes



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BCWMA-East and West are connected by Structure S-251, which flows under State Road 512. S-251 will be operated to prevent backflow from BCWMA-West to BCWMA-East. S-251 consists of four 72-inch culverts. During the majority of time, three of the culverts will remain closed and one will remain open. If water levels in BCWMA-East are more than 0.1 ft higher than water levels in BCWMA-West, all culverts will be opened. Once water levels in BCWMA-East equalize with water levels in BCWMA-West (<0.1 ft difference), three of the S-251 culverts will be closed. To prevent reverse flows, all S-251 culverts will be closed whenever water levels in BCWMA-West are more than 0.05 ft higher than levels in BCWMA-East.

### **St. Johns Water Management Area (SJWMA)**

The SJWMA is located northeast of the BCMCA. Much of this 6,280-acre management area was drained and farmed prior to project construction. Because of soil subsidence, this area is now an open, deep-water environment and supports a high quality sport-fishery.

The SJWMA receives water from the BCWMA through structure S-96D as well as permitted discharge from agricultural lands to the east. Water is discharged through Structure S-96B into the SJMCA. When the USJRBP is complete, SJWMA water will be discharged into the Three Forks Marsh Conservation Area (TFMCA). Under COEWCP design conditions, maximum discharges through S-96B occur when water levels in the SJWMA exceed 23.0 ft NGVD during the dry season and 22.0 ft NGVD during the wet season.

Environmental hydrologic criteria have not been developed for the SJWMA because its principal purposes are water quality treatment and water supply. However, minimum recommended water levels to protect the sport-fishery have been developed. These levels are not viewed as targets, but as metrics to evaluate the environmental impacts of the various discharge scenarios. Obviously it would be undesirable to implement a water management plan that results in frequent fish kills in the SJWMA. A hydrologic evaluation of water levels in the SJWMA related to these minimum levels is presented in Table 4.

Another issue of concern has been the occurrence of fish kills downstream of Structure S-96B. These kills usually occur in association with the rapid closing of the structure after making flood control discharges. To mitigate the adverse environmental impacts associated with the rapid closing of this structure, a scheduled stage-down was developed. In addition, closing of S-96B will be integrated with the operation of S-96C to ensure a constant base flow condition of at least 75 cfs is maintained below these structures at all times.

Structure S-96B will be operated only to follow the COEWCP flood control schedule and there is no Zone B discharge schedule. After the flood control regulation schedule in the SJWMA has been reached by discharging through S-96B, and, if S-96C is closed, then S-96B will not be shut immediately after the flood control schedule in the SJWMA is reached but rather, discharge should be reduced to maintain a rate of 75 to 100 cfs. This 75 to 100 cfs discharge through S-96B will continue until after S-96C is re-opened to discharge its base flow of 75 cfs. If S-96B is to be closed and, S-96C is to be opened to make flood control discharges, then S-96B can be closed immediately without staging down period as long as S-96C is opened immediately.

Table 4. Environmental hydrologic performance summary for the SJWMA.

Proposed Constraints	Constraint Level	Simulated From 1942-1989 Data	Targets Met?
Mean Water Level	20.5 ft	22.2	Yes
Freq. of Inundation	20.5 ft = 60%	97.3%	Yes
Minimum Water Levels	Water Level Should Not Fall Below	1-day low during period = 16.9 ft	
1 out of 5 Year	19.5 ft	1 out of 28 years	Yes
1 out of 10 Year	19.0 ft	1 out of 28 years	Yes
1 out of 100 Year	18.5 ft	1 out of 28 years	No

### St. Johns Marsh Conservation Area (SJMCA)

The SJMCA consists of approximately 34,300 acres of freshwater marsh, pasture, forested wetlands, and shallow lakes, and lies between Levee L74W (formerly the Fellsmere Grade) and US 192. Downstream discharge from the SJMCA is not controlled, but the western, southern, and eastern sides are bounded by levees. Both the TFMCA and the Sawgrass Lakes Water Management Area (SLWMA) border the SJMCA to the east. The principal habitats of St. Johns

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MCA are freshwater marsh dominated by sawgrass, maidencane, cattail, willow, smartweed and duck potato.

Primary inflows to the SJMCA occur from the BCMCA through structures S-96C and S-250A-D, and from the SJWMA through Structure S-96B. Other inflows to the SJMCA that drain from the west include Sixmile, Wolf, Tenmile and Jane Green Creeks. When the USJRBP is complete the SJMCA will no longer receive inflow through Structure S-96B but will receive inflow from the TFMCA near river mile 273. Discharges through structures S-96B and S-96C currently flow north in the SJMCA through the C-40 canal. To prevent overdrainage of the SJMCA during periods when neither structure is discharging, canal plug E-7 was constructed in the C-40 canal. This canal plug has an operable culvert structure capable of discharging up to 100 cfs.

Environmental hydrologic criteria have been established for three cross-sections within the SJMCA. Each is associated with a water level gauging station (USACE 2002). Evaluations of how well modeling predicted the environmental hydrologic criteria at each cross-section would be met are presented in Tables 5-7. For modeling we assumed culvert structure E-7 was fully opened annually during the months of April, May and June and then closed throughout the rest of the year. For the most part all environmental hydrologic criteria were met at the Six-Mile site except for occasional rapid water level recession rates (Table 5). All the criteria were met at Mulberry Mound except the 30-day continuous-low criterion (Table 6). Model results indicate that Big Bend may be flooded a little too deeply (Table 7). All model results assume the TFMCA is fully operational, therefore these results should be viewed cautiously.

### **Three Forks Marsh Conservation Area (TFMCA)**

The TFMCA is located north of Levee L74W at the Indian River County/Brevard County line and east of the SJMCA. This project area is currently under construction. When completed the TFMCA will be create nearly 14,000 acres of open-water, slough and emergent marsh habitat. A more thorough and complete description of the TFMCA and its project features can be found in the recently completed Draft Supplementary Environmental Impact Statement (EIS) for project features north of the Fellsmere Grade (USACE 2002).

Table 5. Environmental hydrologic criteria-related performance summary for the Six-Mile Transect in the SJMCA.

Criteria	Constraint Level	Simulated From 1942-1989 Data	Criteria Met?
Mean Water Level	21.0 ft	21.19	Yes
Freq. Of Inundation	21.0 ft = 60%	72%	Yes
Maximum Water Elevation	More than 1 in 10 years Not To Exceed:		
14 day	24.5 ft	Never occurred	Yes
30 day	24.0 ft	Never occurred	Yes
60 day	23.5 ft	Never occurred	Yes
Minimum Range of Yearly Fluctuation	Continuous 30 Day Levels Hi= 21.5 Low=20.5	<u>Occurred In :</u>	
High	Hi in $\geq$ 25% of years	71% of years	Yes
Low	Low in $>$ 20% of years	63% of years	Yes
Timing of Fluctuation	Should occur $>$ 50% of Years Between:	<u>Occurred in:</u>	
Minimum levels	Apr. 1 - June 30	100% of years	Yes
Maximum levels	Sept. 1 - Nov. 31	50% of years	Yes
One-day yearly min.	More than 1 in 30 Years should not occur between	<u>Occurred:</u>	
One-day yearly max.	Sep1 - Oct 31	0/56 years	Yes
	Apr 1 - May 31	2/56 years	Yes
Recession Rates	$>$ Than 95% Years (22.5)	<u>Met:</u>	
7 day	$<$ 0.5 ft	92% of time	No
30 day	$<$ 1.2 ft	94% of time	No

Table 6. Environmental hydrologic criteria-related performance summary for the Mulberry Mound Transect in the SJMCA.

Criteria	Constraint Level	Simulated From 1942-1989 Data	Criteria Met?
Mean Water Level	18.1 ft	19.07	Yes
Freq. Of Inundation	18.1 ft = 60%	85%	Yes
Maximum Water Elevation	More than 1 in 10 years Not To Exceed:	<u>Occurred :</u>	
14 day	21.5 ft	Once Every 28 years	Yes
30 day	21.0 ft	Once Every 56 years	Yes
60 day	20.5 ft	Never occurred	Yes
Minimum Range of Yearly Fluctuation	Continuous 30 Day Levels Hi= 18.6 Low=17.5	<u>Occurred :</u>	
High	Hi in 25% of years	100% of years	Yes
Low	Low in 20--30% of years	11% of years	No
Timing of Fluctuation	During $>$ 50% of Years Occurs Between	<u>Occurred in:</u>	
Minimum levels	Apr. 1 - June 30	91% of years	Yes
Maximum levels	Sept. 1 - Nov. 31	53% of years	Yes
One-day yearly min.	More than 1 in 30 Years should not occur between:	<u>Occurred</u>	
One-day yearly max.	Sep1 - Oct 31	0/56 years	Yes
	Apr 1 - May 31	1/56 years	Yes
Recession Rates	$>$ Than 95% of Time (19.6)	<u>Met:</u>	
7 day	$<$ 0.5 ft	97% of time	Yes
30 day	$<$ 1.2 ft	98% of time	Yes

Table 7. Environmental hydrologic criteria-related performance summary for the Big Bend Transect in the SJMCA.

Criteria	Constraint Level	Simulated From 1942-1989 Data	Criteria Met?
Mean Water Level	17.0 ft	175 ft	Yes
Freq. Of Inundation	17.0 ft = 60%	76%	Yes
Maximum Water Elevation 14 day 30 day 60 day	More than 1 in 10 Years Not To Exceed: 20.2 ft 19.7 ft 19.2 ft	<u>Occurred :</u>  Once every 5.6 years Once every 8.0 years Once every 8.0 years	No No No
Minimum Range of Yearly Fluctuation High Low	Continuous 30 Day Levels Hi= 17.8 Low=16.2 Hi in 25% of years Low in 20—30% of years	<u>Occurred :</u> 77% of years 48% of years	Yes Yes
Timing of Fluctuation Minimum levels Maximum levels  One-day yearly min. One-day yearly max.	During > 50% of Years Occurs Between Apr. 1 - June 30 Sept. 1 - Nov. 31 More than 1 in 30 Years should not Occur Between Sep1 - Oct 31 Apr 1 - May 31	<u>Occurred in:</u> 39% of years 58% of years  <u>Occurred</u> 0/56 years 1/56 years	No Yes  Yes Yes
Recession Rates 7 day 30 day	> Than 95% of Time (18.8) < 0.5 ft <1.2 ft	<u>Met</u> 96% of time 96% of time	Yes Yes

Inflows to the TFMCA will occur primarily through Structure S-96B and from the C-54 Retention Area via a pump station. Culvert structures S-255 and S-256 allow drainage into the TFMCA from agricultural lands to the east and from the Deer Run subdivision. A high water overflow weir (20-ft crest elevation) and a culvert structure (S-257) will connect the TFMCA to the SJMCA near river mile 280.

Hydrologic modeling indicated the environmental hydrologic criteria for the TFMCA were best met by the following Zone B discharge schedules. When water levels in the TFMCA exceed 20.0 ft, unregulated discharges will occur over the overflow weir. Structure S-257 will remain fully open when water levels in the TFMCA exceed 19.0 ft. After water levels in the TFMCA reach 19.0 f discharges through S-257 will be reduced 20% per day for 5 days until the structure is closed. To provide low flow augmentation for Lake Washington, when water levels stages in the TFMCA exceed 14.0 ft, and water levels in lake Washington are less than 12.0 ft NGVD, a discharge of 30 cfs will be released through S-257. Essentially all of the environmental hydrologic criteria were met by this discharge scenario except for some criteria related to the timing of high-water events (Table 8).

Table 8. Environmental hydrologic criteria-related performance summary for the TFMCA.

Criteria	Constraint Level	Simulated Data	Criteria Met?
Mean Water Level	>18.0 ft.	19.1 ft.	Yes
Freq. Of Inundation	18.0 ft. > 60%	84.9%	Yes
Minimum Water Elevation	16.5 ft. ≥ 95%	96.5%	Yes
One Day Minimum	< 16.0 ft. should not occur in more than 1 in 4 years	1 in 9.3 yrs	Yes
Minimum Drying Level 30-day	Continuous 30 Day Levels Low=17.5 ft. every 2 to 5 years	<u>Occurred in:</u> Every 3.5 years	Yes
60-day	Continuous 60 Day Levels Low= 17.0 ft. every 5 to 10 years	Every 5.6 years	Yes
Timing of Fluctuation	During > 50% of Years Occurs Between Apr. 1 - June 30 Sept. 1 - Nov. 31 More than 1 in 30 years should not occur between:	<u>Occurred In:</u> 47% of years 56% of years	No Yes
Minimum levels		<u>Occurred:</u> 1 in 53 years	Yes
Maximum levels		1 in 19 years	No
One-day yearly min.	Sep 1 - Oct 31		
One-day yearly max.	Apr 1 - May 31		
Recession Rates	> Than 95% of Time	<u>Met:</u>	
7 day	< 0.5 ft.	>99% of time	Yes
30 day	<1.2 ft.	>99% of time	Yes

### Sawgrass Lake Water Management Area (SLWMA)

The SLWMA is located to the east of the SJMCA near Sawgrass Lake and is directly north of the TFMCA. This water management area, which is currently under construction, will serve as a treatment wetland for storm water runoff from the City of Palm Bay. Under the current design water will be discharged from the SLWMA into the SJMCA through culvert Structure S-262.

Pump stations with a maximum capacity of 380 cfs will be the primary source of inflow to the SLWMA. The average discharge from the SLWMA to the SJMCA is estimated to be 40-50 cfs. During normal operation discharge through S-262 will be regulated to match the pump inflow to the area. When water levels in Cell 3 of the SLWMA are unable to be maintained above 16.75 ft, Structure S-262 will be closed. Because this is a water management area, specific environmental hydrologic criteria have not been developed.

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## **MODIFICATIONS TO ZONE B WATER MANAGEMENT**

It is probable that some environmental needs for water management will not be met by the long-term environmental criteria. At times, water levels may need to be manipulated within Zone B to manage short-term unanticipated problems. Two decision frameworks have been developed which anticipate the general types of problems that may arise, identify priorities, and provide appropriate methods of response. The principal agencies involved in these decisions are the St. Johns River Water Management District, the U.S. Army Corps of Engineers, the Florida Fish and Wildlife Commission, and the U.S. Fish and Wildlife Service. Other agencies will be consulted as appropriate.

### **Emergency Events**

Decisions in the case of emergency events, such as a chemical spills, fish or bird kills of any type, or sudden threat to an endangered species, will be handled as described below:

- 1). The event must be verified by state or federal agency personnel. Networking with key agencies should begin upon notification, regardless of whether or not the event is verified. The notified agency should network with other key agencies to coordinate field verification and an initial assessment. Key agencies are those that need to be initially involved. For example, a fish kill in the SJWMA would directly involve the District and the Florida Fish and Wildlife Commission, but not necessarily the U.S. Fish and Wildlife Service.
- 2). Once an event has been verified, an analysis of the event will be conducted to determine if emergency alterations in the regulation schedule can remedy or mitigate the impacts. Suggested alterations in the regulation schedules will be reviewed with all agencies. An attempt will be made to reach consensus with all agencies on the appropriate plan of action.
- 3). Once a plan of action is selected, the District will determine the technical feasibility of implementing the change with regard to hydrology and engineering constraints.

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4). If the change is technically feasible and will not violate flood control constraints, the District will examine potential impacts of the change with regard to water supply, environment, and water quality. All positive or negative impacts of the proposed change will be evaluated against the potential consequences of taking no action.

5). If the proposed schedule change is technically feasible and environmentally sound, and appropriate agencies have agreed with the change, official notifications will be made and the change implemented.

### **Non-Emergency Actions**

Decisions concerning water level management actions that are not an emergency will be made using the following:

1). The agency proposing a Zone B schedule change will present to all involved agencies information which illustrates the need for the requested action. Information will also be presented which shows how the proposed change will accomplish stated goals.

2). If there is agreement as to the proposed schedule change, the District will determine the technical feasibility of implementing the change. The District retains the authority to reject proposed changes if they are not logistically or technically feasible.

3). If a regulation schedule change is technically feasible, will not violate flood control constraints, and is generally agreed upon by all the agencies consulted, the District will examine potential impacts of the change with regard to water supply, environment, and water quality. Positive or negative impacts of the proposed change will be evaluated against the potential consequences of taking no action.

4). If the proposed schedule change is found to technically feasible and biologically sound and agencies are in agreement of the benefits of the change, official notifications will be made and



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the change implemented. If inter-agency agreement cannot be reached, the District will retain the authority to implement or not implement the regulation change.

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## LITERATURE CITED

- Miller, S. J., A. K. Borah, M. A. Lee, E. F. Lowe, and D. V. Rao. 1996. Environmental /Water Management Plan for the Upper St. Johns River Basin Project. Technical Report. St. Johns River Water Management District, Department of Water Resources, Palatka, Florida. 54 pp.
- U. S. Army Corps of Engineers. 1991. Preliminary Water Control Manual Central and Southern Florida Project for Flood Control and Other Purposes Upper St. Johns River Basin. Department of the Army Corps of Engineers, Jacksonville District, Jacksonville, Florida.
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