

A Brief History of Water Control Operations in South Dade

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Introduction

This document is an attempt to summarize the water control operations in South Dade since 1970 to present. These operations can be divided into four major periods as shown in Figure 1. Each of these periods is described in more detail below but recognizing that the information available at the time of this writing is rather scarce and vague prior to 2002.

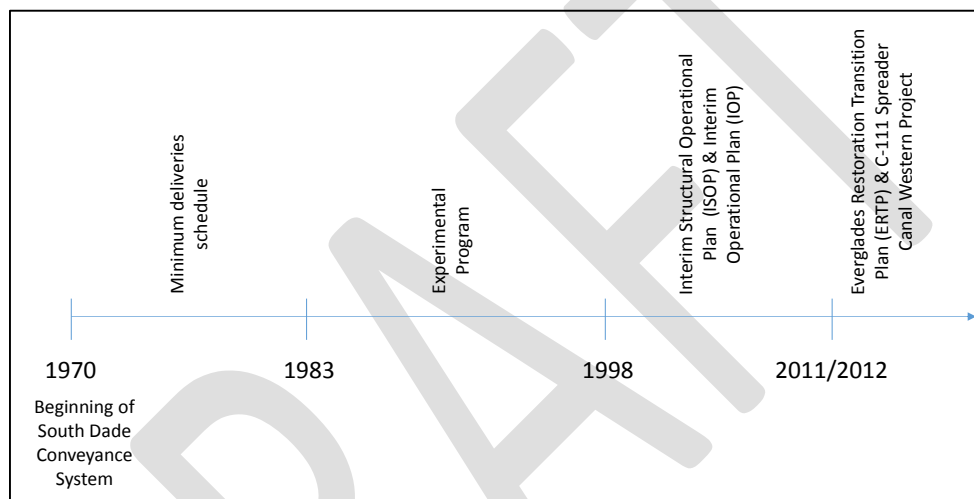


Figure 1. South Dade Water Control Operational Timeline

1970 to 1983 - Minimum Delivery Schedule

"In 1970 the US Congress established legislation (PL 91-282) to guarantee minimum water deliveries to the ENP and to authorize construction of the necessary conveyance facilities. Delivery schedules were established that required minimum monthly water deliveries to three areas of the ENP: (1) to SRS, (2) to Taylor Slough, and (3) to eastern panhandle of ENP. Water deliveries to SRS were made through the S-12 structures."¹ Structure S-333 started operations in 1978 but it was seldom used during this period.

"The water delivery schedule for SRS went into effect in October 1970; whereas the water delivery schedules for Taylor Slough and the eastern panhandle of ENP went into effect in 1983 when the SDCS was completed"^{1,7}

"The minimum [flow] allocations were based on average monthly flow volumes from 1939-1960 that existed prior to the construction of the WCAs. However, these minimum volumes were routinely exceeded due to regulatory discharges designed to ensure that water levels in the upstream reservoirs were maintained within the range necessary to meet water supply and flood control requirements. Large regulatory water releases, in great excess of the prescribed minimum, resulted and caused rapid

changes in hydrologic conditions within the downstream park and disastrous ecological consequences, including the flooding of eggs within alligator nests and the abandonment of nestlings within wading bird colonies.”²

S-12 were operated to provide the minimum monthly delivery schedule according to the table below³.

Table 1: Minimum monthly delivery schedule at the S12s according to Davis and Ogden (1994)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DEC
1000 x ac-ft	22.0	9.0	4.0	1.7	1.7	5.0	7.4	12.2	39.0	67.0	59.0	32.0

The canal control elevations prescribed in USACE Part V Supplement 37 (1963), and Supplement 52 (1973) shed some light on the structure operations between 1970 and 1983 (see appendix A). These control elevations are in agreement with the trigger stages prescribed in the 1983 Base model run which represented at the time what the USACE would revert to should the experimental program be terminated (Appendix B). The only exception is in regards to the operation of S-197 which is documented in the USACE Part V Supplement 37 Addendum 1 Appendix A from 1967.

1983 to 1998 - Experimental Water Deliveries Program

“In 1983 the U.S. Congress passed legislation (PL 98-181) which allowed the District, COE, and ENP to temporarily set aside the Minimum Delivery Schedule and to begin a series of field experiments to test proposed management plans for making water deliveries to SRS.”¹

“The first 5 iterations of the Experimental Program of the Water Deliveries to ENP focused on improving water deliveries to Northeast Shark River Slough. Iterations 6 and 7 have focused on improving water deliveries to Taylor Slough.”⁵

- Flow Through Plan: a two year plan starting in June 1983. S-12s gates were kept open to provide unregulated discharges to SRS. During this test S-333 was mostly used for water supply. However, two smaller scale tests took place within the “Flow Through Plan”: (a) 30-day dry season field test, and (b) 90-day wet season field test. The goal of both of these short-term tests was to send water to the NESRS from S-333 while at the same time monitor the effects on the 8.5 square mile area. South Dade representatives agreed to the 90-day test provided that the stage between S-335 and S-176 would be maintained below 4.5 ft during the test⁷. This stage criterion was later challenged by the ENP as being too low and for overcompensating for the benefits provided by S-333 in NESRS⁸.
- Test 1 - Rainfall Plan: a two year plan starting in July 1985 designed to restore a more natural hydrologic condition to SRS including the NESRS area.

The intent of the Rainfall Plan was to distribute deliveries from WCA 3A between the S-12s (45%) and S-333 (55%). S-333 operation was subject to L-29 stage below 7.5 ft and G-3273 below 6.8 ft for more than 24 hrs.

To compensate for the increased discharges at S-333/S-331, while at the same time maintaining the level of flood protection downstream, the trigger stages at S-176 were modified as follows¹:

S-176 normal operation: open at 4.5 ft and close at 4.1 ft

S-176 water supply operations: HW stage at 4.5 ft

Note: Since the start of the test in 1985 and to this date, the Rainfall Plan has been the basis for determining the target flows and operations at S-12s and S-333.

- Test 2 to Test 5: “[These tests] simply extended the experimental testing program with no significant changes in Test 1 operating criteria for NESRS.”⁷
- Test 6 – Taylor Slough Demonstration Project: This test began in July 1993 and continued through October 1995. The test included the elements contained in the previous 5 tests with the addition of two components: (a) L-31N canal stage at S-176 headwater was raised from 4.5 ft to 5.0 ft during the wet season and (b) the pump capacity at S-332 was increased from 165 cfs to 465 cfs into Taylor Slough. See more detail information regarding Test 6 operation criteria in Table 1 of the Concurrency Agreement for Test 7 located in Appendix C
- Test 7 Phase I: This plan started in October 1995 with objectives consistent with the previous test – to improve the conditions in the ENP (NESRS and Taylor Slough) without compromising flood control. “Test Iteration 7 components include water deliveries into Northeast Shark River Slough, reduction of seepage along L-31N, increased water deliveries to Taylor Slough through increased water levels in L-31W, and minimized utilization of S-197 for flood operations.”⁹ Upon request by the FWS however, in 1998 Test 7 Phase I was terminated (see “Test 7 emergency deviation” below). Specific trigger stages under Test 7 Phase I between 1995 and 1998 are found in Appendix D from Examination of MOD Waters, C-111 Project, and Experimental Water Deliveries (1999)⁶. Additional operational details for Test 7 are found in the interagency Concurrency Agreement for Test 7 (Appendix C) and Table 3 of the Test Iteration 7 Year One Hydrologic Monitoring Report located in Appendix E

1984 to 1985 – ENP-SFWMD-Farmers Agreement

According to the Center of Natural Resources, in 1984 an agreement between the farmers, the ENP, and the SFWMD was reached for a “1-year test in which S-175 and S-177 headwaters were lowered to 3.5 ft by October 15, S-175 stage [was] held there for the entire growing season, and S-177 held at 3.7 ft after planting was complete”⁵. These triggers seem to be consistent with historical observations. According to Van Lent et al. (1999), the 1-year test results showed an undesirable water table drawdown in the ENP wetlands. This finding lead the ENP to oppose to future drawdowns. More details regarding the Frog Pond Drawdown 1984 agreement are found in Appendix F

1987 to 1988 – SFWMD - Farmers Agreement:

After the first 1-year drawdown agreement, Van Lent et al. (1999) claims that drawdowns continued through the 1985-86, 1986-87 and 1987-88 growing seasons without the ENP consent based on separate agreements between the Farmers and the SFWMD. One of this agreements was signed in 1987 which included the following key points: (1) water control level in the L-31N canal north of S-331 would vary

depending on the water stage measured at angel's well for the protection of the 8.5 square mile area, (2) water control level in the L-31N canal north of S-176 would have two setting depending on the growing season and, (3) flows at S-333 would be limited based on the stage at S-176. (See Appendix G for more details)

1989 – East Everglades Expansion Act:

In December 1989 public law 101-229 was signed to authorize the expansion of the ENP and include the north east shark river slough with an area of approximately 107,600 acres.

1995 Frog Pond land Purchase:

In February 1995 the SFWMD purchased approximately 5,250 acres in the Frog Pond area (L-31N Project). The goal was to use this land to restore a more natural flow of water to Taylor Slough.

1998 to 2000 – Test 7 Phase I Emergency Deviation

In December 1997, due to El Nino conditions, large regulatory releases were made at the S12s structures. These releases coupled with above average precipitation created flooding of the sparrow's western habitat (subpopulation A). In December 1997, the FWS requested the USACE to immediately terminate Test 7 and proposed a series of operating rules that were partially implemented during this period. The overall intent of the proposal was to limit the discharges at S-343 A/B, S-344 and S12 A/B/C by diverting more water through S-333. In February 1999 the FWS issued a final Biological Opinion that lead to the termination of the experimental program. Some of the "Reasonable and Prudent alternatives" proposed in the FWS BO are found in Appendix H but it is unclear to what extent these alternatives were implemented. As described in USACE March 1999 Memorandum of Record, in January 1999 regulatory releases from Lake Okeechobee to the WCAs were restricted, regulatory releases from WCA 1 and WCA 2A to tide were maximized, and S-12A and S-12B releases were shifted to S-333 as maximum as practical. The L-29 stage constraint was raised to 8.0 ft NGVD and a modified WCA 3A schedule was proposed.

2000 to 2001 - Interim Structural Operational Plan (ISOP)

This plan was developed by the USACE in response to the Fish and Wildlife Service (FWS) Biological Opinion of February 1999. As a result, the experimental program was officially terminated for the protection of the Cape Sable Seaside Sparrow (CSSS). Closing periods for the S12s structures were implemented to avoid flooding of the CSSS during the breeding season. "To compensate for the closures and prevent excessively high stages in WCA 3A, operational changes were made to allow conveyance of some of the water through the S-333 structure into the L-29 canal and thence down the L-31 North (L-31N) canal and into the new impoundment [at S-332D], from which it could overflow or seep into ENP lands near eastern CSSS populations."⁴

Also, pre-storm water control operations for named storms were added in order to improve flood protection capability in the South Dade.

During this period the system was operated under two very similar operating set of guidelines (Refer to: ISOP 2000 and ISOP 2001 in Appendix I).

July 2002 to 2012 - Interim Operation Plan (IOP 2002 Alt 7R)

The main objective of this plan was to “to create favorable hydroperiods in [the] sparrow habitat in ENP while providing flood protection capability for developed lands east of the L-31N Canal”.

Also, pre-storm water control operations for named and no named storms were added in order to improve flood protection capability in the South Dade.

A comprehensive table for IOP 2002 operating criteria can be found in Table 2.11 (Alt 7R) of the IOP WCP 2002. (See Appendix J)

2012 to present - Everglades Restoration Transition Plan (ERTP 2012) – C-111 Spreader Canal Western Project – G-3273 Relaxation and S-356 Pump Station Field Test, Increment 1

The main objective of this plan was to improve the conditions in WCA 3A for the protection of endangered species by mainly lowering the regulation schedule in WCA 3A.

A comprehensive table for ERTP 2012 operating criteria can be found in Table 7-5 of the ERTP 2012 (Appendix K).

The C-111 Spreader Canal Western Project was originally part of the Comprehensive Everglades Restoration Plan (CERP). The goal of the C-111 Spreader Canal Project was the ecological restoration of the Southern Glades and Model Lands by improving timing, distribution, quality and quantity of water deliveries. S-199 and S-200 pump stations and the frog pond detention area were built as part of the C-111 Spreader Canal Western Project. Tables 1 and 2 in the 2011 Expedited C-111 Spreader Canal Western Project (Appendix L) describe in detail the preliminary operational criteria for these two pump stations. Since then, and based on experience, actual operations have evolved to archive the original intent of the project – maximize the pumping to the park before the gate at S-177 is opened. The current pump on/off criteria is now based on S-177_H and in general trigger stages are 0.1 ft lower than those prescribed in the preliminary operating manual.

The G-3273 relaxation and S-356 pump station field test is an attempt to increase discharges from WCA 3A to the NESRS via S-333, and to reduce ENP seepage losses to the L-31N canal via S-356. In addition, recognizing that not all seepage control features are built as yet, Increment 1 field test included some modifications to the operation of S-197 based on S-178_T and the average stage in WCA 3A. See more details about this additional criteria in the history of operations for S-197 in the next section.

Structure S-197 – Water Control Operation History

Construction & Structure modifications

- 1969 : construction completed – 3 x 84in CMP culverts and a plug
- ~1989: 10 additional barrels replaced the plug for a total of 13 x 84in CMP
- 2012: structure rebuilt. Four (4) cast-in-place rectangular culverts (11x10 ft²) with manually operated vertical slide gates. (same design capacity ~ 2,400 cfs)

Operation

1969: 3-barrel culvert and a plug in the C-111 canal

If S-18C_T > 1.9 ft-NGVD open gates

If S-18C_T < 1.6 ft-NGVD close gates

If S-18C_T > 2.1 ft-NGVD open plug

Source: USACE Part V Supplement 37 - Appendix A to Addendum 1 (1967)

1984: Interim Operating Procedure for S-197

In response to a request from the SFWMD, the USACE and the ENP approved the addition of S-177_H as open/close criteria. It is not clear if the S-18C_T criteria remained.

If S-177_H > 4.3 (6 hours after S-18C and S-177 have been fully opened), open 3 culverts at S-197 and remove the plug.

~1989: 10 additional barrels were added for a total of 13 barrels due to environmental concerns associated to plug operation

If S-177 is open and S-177_H > 4.1 ft-NGVD or S-18C_H > 2.8 ft-NGVD open 3 gates total

If S-177_H > 4.2 ft-NGVD (USACE 1989 Permit indicates 4.15 ft-NGVD) or S-18C_H > 3.1 ft-NGVD open 7 gates total

If S-177_H > 4.3 ft-NGVD or S-18C_H > 3.3 ft-NGVD open 13 gates total

Close when all following conditions are met:

1) S-176_H < 5.2 ft-NGVD and S-177_H < 4.2 ft-NGVD

2) Storm moved away from basin, and

3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176.

All 13 culverts closed if S-177_H < 4.1 ft-NGVD after all conditions satisfied.

Sources: (1) SFWMD 83base (1999); (2) USACE Concurrency Agreement for Test 7 (1995); (3) USACE Test Iteration 7 - Year One Monitoring Report –Draft (1997)

2002: IOP

The criteria of the level 2 opening (open 7 gates total) was changed to:

If S-177_H > 4.2 ft-NGVD **for 24 hours** or S-18C_H > 3.1, open 7 gates total

Source: USACE Interim Operational Plan (2002)

2012: E RTP

Some clarification notes were added to the closing criteria:

If S-177_H > 4.1 ft-NGVD (after all gates at S-177 are open) or S-18C_H > 2.8 ft-NGVD, open 3 culverts

If S-177_H > 4.2 ft-NGVD for 24 hrs or S-18C_H > 3.1, open 7 culverts

If S-177_H > 4.3 ft-NGVD or S-18C_H > 3.3, open 13 culverts

Culverts at S-197 will remain closed until S-177 has been completely open.

Close gates when all the following conditions are met:

1. S-176_H < 5.2 ft-NGVD and S-177_H < 4.2 ft-NGVD
2. Storm has moved away from the basin
3. Once conditions 1 and 2 above have been met, only the number of S-197 culverts required to match the residual discharge volume flowing through S-176 will be open. This will prevent unnecessary over-drainage of the panhandle region by restricting the amount discharged through S-197 to equal the amount of inflow from the upper basin. All culverts will be closed once S-177 headwater stage declined below 4.1 ft-NGVD, and the above conditions are satisfied

Water supply level at S-197_H = 1.0 ft-NGVD

Source: USACE Everglades Restoration Transition Plan (2012)

2012: The structure was rebuilt as four cast-in-place rectangular culverts with manually operated vertical slide gates. The same criteria remains but the following equivalent gate openings apply:

If S-177_H > 4.1 ft-NGVD (after all gates at S-177 are open) or S-18C_H > 2.8 ft-NGVD open 2 gates by 3.7 ft (remaining gates closed). If possible, the gates opened should result in symmetrical flow through the structure

If S-177_H > 4.2 ft-NGVD for 24 hrs or S-18C_H > 3.1 open 4 gates by 4.3 ft

If S-177_H > 4.3 ft-NGVD or S-18C_H > 3.3 open 4 gates by 10.0 ft

2015: S-356 Field Test - Increment 1

The following opening criteria based on at S-178_T was added. It applies only when: (a) WCA 3A is above the Increment 1 Action Line, (b) S-18C gates are out of the water, and (c) S-18C_T > 2.4 ft-NGVD. (The "Increment 1 Action Line" is a line located 0.25 to 0.50 ft above the top of the WCA 3A schedule.)

S-178 TW [ft-NGVD]	S-197 Target Flow [cfs]
2.5 to 2.6	50 to 100
2.61 to 2.7	100 to 150
2.71 to 2.9	150 to 200
Greater than 2.9	500

Source: USACE Increment 1 Appendix A Operational Strategy (2015)

Structure S-18C – Water Control Operation History

Construction completed in 1965

1970: If S-18C_H > 2.4 ft-NGVD open gates
If S-18C < 1.6 ft-NGVD close gates
Optimum water level 2.0 ft-NGVD

Minimum deliveries schedule to ENP through C-111 gaps:

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DEC
1000 x ac-ft	1.5	0.6	0.3	0.1	0.1	0.3	0.5	0.9	2.7	4.6	4.1	2.2

Note that the minimum deliveries schedule at S-18C became viable only after the construction of new features like S-331 pump station.

Sources: (1) SFWMD 83base (1999); (2) USACE Part V Supplement 37 (1963); (3) USACE Part V Supplement 52 (1973)

1993: Test 6 of the Experimental Program

Low operation: If S-18C_H > 2.0 ft-NGVD open gates; If S-18C < 1.6 ft-NGVD close gates
High operation: If S-18C_H > 2.6 ft-NGVD open gates; If S-18C < 2.0 ft-NGVD close gates

Source: USACE Concurrency Agreement for Test 7 (1995)

1995 Test 7 of the Experimental Program

If S-18C > 2.6 ft-NGVD open gates; If S-18C < 2.3 ft-NGVD close gates
The monthly minimum delivery schedule to the Eastern Panhandle remains.

Source: USACE Concurrency Agreement for Test 7 (1995)

2000: ISOP 2000

If S-18C_H > 2.25 ft-NGVD open gates; If S-18C_H < 2.00 ft-NGVD close gates

2001: ISOP 2001

No change

2002: IOP

If S-18C_H > 2.60 ft-NGVD open gates; If S-18C_H < 2.25 ft-NGVD close gates
The monthly minimum delivery schedule to the Eastern Panhandle remains.
Pre-storm drawdown target and water supply level established at S-18C_H = 2.0 ft-NGVD

Source: USACE Interim Operational Plan (2002)

2012 E RTP

Column 1: If S-18C_H > 2.6 ft-NGVD open gates; If S-18C_H < 2.3 ft-NGVD close gates
Column 2: If S-18C_H > 2.25 ft-NGVD open gates; If S-18C_H < 2.0 ft-NGVD close gates
The monthly minimum delivery schedule to the Eastern Panhandle remains.

Pre-storm drawdown target and water supply level established at S-18C_H = 2.0 ft-NGVD

Source: USACE Everglades Restoration Transition Plan (2012)

DRAFT

Structure S-177 – Water Control Operation History

Construction completed in 1967

1970: Water Control Elevation = 4.5 ft-NGVD; 83Base assumes an opening stage of 5.2 ft-NGVD and a closing stage of 4.3 ft-NGVD. Note that the USACE Operations and Maintenance Manual (1967) suggests a closing stage of 4.1 ft-NGVD

Sources: (1) SFWMD 83base (1999); (2) USACE Part V Supplement 52 (1973)

1984: ENP-SFWMD-FARMERS 1-year agreement

During the planting season (starting ~October 15th) S-177_H should not exceed 3.5 ft-NGVD

After the planting season and until harvest is finished (~ April 30th) S-177 should not exceed 3.7 ft-NGVD

1987: SFWMD-FARMERS 1-year agreement

No change

1993: Test 6 of the Experimental Program

If S-177_H > 4.2 ft-NGVD open gates; If S-177 < 3.6 ft-NGVD close gates

Source: USACE Concurrency Agreement for Test 7 (1995)

1995 Test 7 of the Experimental Program

No change

2002: IOP

Pre storm drawdown target and water supply levels added:

S-177_H = 3.0 ft-NGVD

Source: USACE Interim Operational Plan (2002)

2012 ERTTP and Spreader Canal Western Project

ERTTP suggests no changes to S-177 operations, however the 2011 preliminary project operating manual increases the trigger level for the opening of the gate at S-177 under normal to dry conditions from 4.2 to 4.3 ft-NGVD provided both S-200 and S-199 are pumping.

Source: (1) USACE Everglades Restoration Transition Plan (2012), and (2) Expedited C-111 Spreader Canal Western Project – Preliminary Operating Manual (2011)

Structure S-176 – Water Control Operation History

Construction completed in 1967

1970: Water Control Elevation = 5.5 ft-NGVD; 83Base assumes an opening stage of 5.7 ft-NGVD and a closing stage of 5.3 ft-NGVD. Note that the USACE Operations and Maintenance Manual (1968) indicates an opening stage of 6.0 ft-NGVD

Sources: (1) SFWMD 83base (1999); (2) USACE Part V Supplement 52 (1973)

1987: SFWMD-FARMERS 1-year agreement

Between November 1st and May 31st → if S-176_H > 5.0 ft-NGVD open gate; If S-176_H < 4.6 ft-NGVD close gates

Between June 1st and October 31st → S-176_H > 4.5 ft-NGVD open gate; If S-176_H < 4.1 ft-NGVD close gates

1993: Test 6 of the Experimental Program

Low operation: If S-176_H > 5.0 ft-NGVD open gates; If S-176_H < 4.75 ft-NGVD close gates

High operation: If S-176_H > 5.0 ft-NGVD open gates; If S-176_H < 4.6 ft-NGVD close gates

Source: USACE Concurrency Agreement for Test 7 (1995)

1995 Test 7 of the Experimental Program

If S-176_H > 5.0 ft-NGVD open gates; If S-176_H < 4.75 ft-NGVD close gates

Under flood conditions, if S-176_H < 4.6 ft-NGVD close gates

Source: USACE Concurrency Agreement for Test 7 (1995)

2000: ISOP 2000

If S-176_H > 4.7 ft-NGVD open gates; If S-176_H < 4.5 ft-NGVD close gates

2001: ISOP 2001

No change

2002: IOP

If WCA 3A is not making regulatory releases to the SDCS or SRS:

If S-176_H > 5.0 ft-NGVD open gates; If S-176_H < 4.75 ft-NGVD close gates

If WCA 3A is making regulatory releases to SDCS:

If S-176_H > 4.9 ft-NGVD open gates; If S-176_H < 4.7 ft-NGVD close gates

Pre-storm drawdown target and water supply level established at S-176_H = 4.0 ft-NGVD

Source: USACE Interim Operational Plan (2002)

2012 E RTP

Column 1: If S-176_H > 5.0 ft-NGVD open gates; If S-176_H < 4.75 ft-NGVD close gates

Column 2: If S-176_H > 4.9 ft-NGVD open gates; If S-176_H < 4.7 ft-NGVD close gates

Pre-storm drawdown target and water supply level established at S-176_H = 4.0 ft-NGVD

Source: USACE Everglades Restoration Transition Plan (2012)

DRAFT

Structure S-173/S-331 – Water Control Operation History

S-173 construction completed in 1967; S-331 construction completed in 1983

1970: Water Control Elevation at S-173_H = 5.0 ft-NGVD

Sources: (1) SFWMD 83base (1999); (2) USACE Part V Supplement 37 (1963); (3) USACE Part V Supplement 52 (1973)

1987: SFWMD-FARMERS 1-year agreement

If angel's well < 5.5 ft-NGVD, only canal design limits apply at S-331_H

If angel's well > 5.5 ft-NGVD, S-331_H daily average maintained at or below 5.0 ft-NGVD

If angel's well > 6.0 ft-NGVD, S-331_H daily average maintained at or below 4.5 ft-NGVD until angel's well is below 5.7 ft-NGVD

1993: Test 6 of the Experimental Program

If angel's well < 5.5 ft-NGVD, only canal design limits apply at S-331_H

If angel's well > 5.5 ft-NGVD, S-331_H range of operation between 4.5 and 5.0 ft-NGVD

If angel's well > 6.0 ft-NGVD, S-331_H range of operation between 4.0 and 4.5 ft-NGVD

Terminate the pumping if S-176_H > 5.5 or S-331_T > 6.0 ft-NGVD; resume pumping only once S-176_H < 5.0 ft

Terminate pumping if S-176_H > 5.0 ft-NGVD and heavy rainfall is forecasted

Source: USACE Concurrency Agreement for Test 7 (1995)

1995 Test 7 of the Experimental Program

No change

Source: USACE Concurrency Agreement for Test 7 (1995)

2002: IOP

If angel's well < 5.5 ft-NGVD, only canal design limits apply at S-331_H

If angel's well > 5.5 ft-NGVD, S-331_H daily average maintained at or below 5.0 ft-NGVD

If angel's well > 6.0 ft-NGVD, S-331_H daily average maintained at or below 4.5 ft-NGVD until angel's well is below 5.7 ft-NGVD

Terminate pumping if S-176_H > 5.5 or S-331_T > 6.0 ft-NGVD; resume pumping only if S-176_H < 5.0 ft

Terminate pumping if S-176_H > 5.0 ft-NGVD and heavy rainfall is forecasted

Water supply level at S-331_H = 4.0 ft-NGVD

If angel's well < 5.5 ft-NGVD; Pre-storm drawdown target level = 4.0 ft-NGVD

If angel's well > 5.5 ft-NGVD; Pre-storm drawdown target level = 3.5 ft-NGVD

Source: USACE Interim Operational Plan (2002)

2012 ERTF

If LPG2 < 5.5 ft-NGVD, only canal design limits apply at S-331_H

If LPG2 is between 5.5 and 6.0 ft-NGVD, S-331_H daily average range of operation is between 4.5 and 5.0 ft-NGVD

If LPG2 > 6.0 ft-NGVD and LPC1 (Las Palmas) or S-357_H daily average > 6.2 ft-NGVD, S-331_H daily average range of operation is between 4.0 and 4.5 ft-NGVD

If LPG2 > 6.0 ft-NGVD but LPC1 (Las Palmas) or S-357_H daily average < 6.2 ft-NGVD, S-331_H daily average range of operation is between 4.5 and 5.0 ft-NGVD; The operation plan includes provisions to lower this range to 4.0 and 4.5 ft-NGVD based on conditions

Terminate pumping if S-176_H > 5.5 or S-331_T > 6.0 ft-NGVD

Water supply level at S-331_H = 3.5 ft-NGVD

If LPG1 or LPG2 < 5.5 ft-NGVD; Pre-storm drawdown target level = 4.0 ft-NGVD

If LPG1 and LPG2 > 5.5 ft-NGVD; Pre-storm drawdown target level = 3.5 ft-NGVD

Source: USACE Everglades Restoration Transition Plan (2012)

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List of Appendices

[Appendix: A Part V Supplement 37 - Supplement 37 Addendum - Supplement 52 \(1963, 1967, 1973\)](#)

[Appendix B: 83 Base Model Run \(1999\)](#)

[Appendix C: Concurrency Agreement Test 7 \(1995\)](#)

[Appendix D: Examination of MOD Waters, C-111 Project, and Experimental Water Deliveries \(1999\)](#)

[Appendix E: Appendix E Test 7 Year One \(1997\)](#)

[Appendix F: Farmers - ENP Agreement \(1984\)](#)

[Appendix G: Farmers-District agreement \(1987\)](#)

[Appendix H: FWS Reasonable and Prudent Alt \(1999\)](#)

[Appendix I: ISOP2000 and 2001](#)

[Appendix J: C&SF WCP Interim Operational Plan \(2002\)](#)

[Appendix K: Appendix K ERTF Tables \(2012\)](#)

[Appendix L: C-111 Spreader canal western project Operating Manual \(2011\)](#)