APPENDIX J

SYSTEM OPERATING MANUAL

This page intentionally left blank

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES

SYSTEM OPERATING MANUAL - VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

U.S. ARMY CORPS OF ENGINEERS

JACKSONVILLE DISTRICT

January 2020

HISTORY OF REVISIONS

The table below is intended to include a listing of all revisions incorporated into this Volume of the System Operating Manual. In addition, when revisions are incorporated to this Volume, each page containing a revision will be identified at the bottom of the page with the date the revision was incorporated. Revisions may include water management operating criteria newly approved by the South Atlantic Division after completion of this Volume. This includes, but is not limited to, a Project Operating Manual for a Comprehensive Everglades Restoration Project.

REVISION	DATE	ADDITIONAL INFORMATION
Draft Master Water Control Manual	June 1996	
WCAs, ENP, ENP-SDCS Water Control Plan	October 2012	
Draft System Operating Manual, WCAs, ENP, ENP-SDCS Water Control Plan, SBC Project Basins 1, 2, and 4 Water Control Plans	January 2020	ONGOING

NOTICE TO USERS

It is recommended that hardcopies of this Volume of the Master Water Control Manual/System Operating Manual be preserved in good condition so that inserts can be made to keep the manual complete and current. As revisions are incorporated into this Volume, each page containing a revision, identified by the revision date at the bottom of the page, will be inserted at the appropriate location in the document. Documents containing newly approved water management operating criteria such as a Project Operating Manual for a Comprehensive Everglades Restoration Project will be inserted into Appendix A of this Volume, as appropriate. Note that for ease of use when viewing electronically, Internet webpages are provided as hyperlinks.

Emergency regulation assistance

In the event that unusual conditions arise, emergency regulation assistance can be achieved by contacting the following:

Jacksonville District (SAJ) Water Management Section Chief: XXX XXX-XXXX

Jacksonville District (SAJ) Water Management Section Staff: XXX XXX-XXXX

LIST OF Abbreviations/Acronyms

C&SF	Central and Southern Florida
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMP	Corrugated Metal Pipe
CPC	National Oceanic and Atmospheric Administration Climate Prediction Center
DM	Design Memorandum, Design Memoranda
DOI	United States Department of the Interior
DEP	Florida Department of Environmental Protection
EM	United States Army Corps of Engineers Engineer Manual
ENSO	El Niño/Southern Oscillation
ER	United States Army Corps of Engineers Engineer Regulation
ET	Evapotranspiration
FWCC	Florida Fish and Wildlife Conservation Commission
FWS	United States Fish and Wildlife Service
HRD	Climate Prediction Center Hurricane Research Division
HW	Headwater
MPF	Maximum Probable Flood
MTIF	Miccosukee Tribe of Indians of Florida
MWCM	Master Water Control Manual
mph	Miles per hour
NAVD	North American Vertical Datum
N/A	Not Applicable
NHC	National Oceanic and Atmospheric Administration National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NGVD	National Geodetic Vertical Datum

O&M	Operation and Maintenance
SAD	United States Army Corps of Engineers South Atlantic Division
SAJ	United States Army Corps of Engineers Jacksonville District
SAJP	United States Army Corps of Engineers Jacksonville District Pamphlet
RC	Reinforced Concrete Pipe
SCADA	Supervisory Control And Data Acquisition
SCL	Seaboard Coast Line Railroad
SERFC	National Weather Service Southeast River Forecast Center
SFWMD	South Florida Water Management District
SM	Square Mile(s)
SPF	Standard Project Flood
STOF	Seminole Tribe of Indians of Florida
TW	Tailwater
U.S.	United States
USGS	United States Geological Survey
WCP	Water Control Plan

Elevations (grades): All references to elevation (+0.6 feet or –3.3 feet, for example) are above or below the National Geodetic Vertical Datum (NGVD) of 1929.

Side Slopes: References to side slopes (such as 1V:6H) indicate the proportion between vertical and horizontal.

Project and Related Components

“B-“	indicates Bridge
“C-“	indicates Canal
“L-“	indicates Levee
“S-“	indicates water management Structure (spillway, culvert)

CENTRAL AND SOUTHERN FLORIDA PROJECT

SYSTEM OPERATING MANUAL - VOLUME 4

WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS, JACKSONVILLE DISTRICT

JACKSONVILLE, FLORIDA

Table of Contents

1 INTRODUCTION 1-1
1.1 Authorization for manual 1-1
1.2 Purpose and Scope 1-1
1.3 Related Manuals and Reports 1-2
1.3.1 Prior Operation and Maintenance Manuals 1-3
1.3.2 Design Memoranda 1-3
1.3.3 C&SF Project, Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement 1-3
1.4 Project Owner 1-3
1.5 Operating Agency 1-4
1.5.1 U.S. Army Corps of Engineers 1-4
1.5.2 Seminole Tribe of Florida (STOF) 1-4
1.5.3 South Florida Water Management District (SFWMD) 1-4
1.6 Regulating Agencies 1-5
1.7 Vertical Datum 1-5
2 REGIONAL DESCRIPTION 2-1
2.1 Location 2-1
2.2 Purpose 2-1
2.3 Physical Components 2-1
2.3.1 Seminole Big Cypress Basin 1 2-2
2.3.2 Seminole Big Cypress Basin 2 2-3
2.3.3 Seminole Big Cypress Basin 4 2-4
2.3.4 Stormwater Treatment Area 1 East (STA-1E) 2-5
2.3.5 Water Conservation Area 1 (WCA-1) 2-7
2.3.6 Water Conservation Area 2 (WCA-2) 2-9
2.3.7 Water Conservation Area 3 (WCA-3) 2-13
2.3.8 Everglades National Park-South Dade Conveyance System (ENP-SDCS) 2-19
2.4 Related Control Facilities 2-29
2.4.1 East Coast Canals (ECC) 2-29
2.5 Real Estate Acquisition 2-29
2.6 Public Facilities 2-29
2.6.1 Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR) 2-30
2.6.2 The Everglades Wildlife Management Area (EWMA) 2-30

2.6.3 Big Cypress National Preserve (BCNP) 2-30
2.6.4 Everglades National Park (ENP) 2-30
3 REGIONAL HISTORY 3-1
3.1 Authorization of Project 3-1
3.1.1 Flood Control Act of 1948 3-1
3.1.2 Flood Control Act of 1950 3-1
3.1.3 Flood Control Act of 1954 3-1
3.1.4 Flood Control Act of 1958 3-1
3.1.5 Flood Control Act of 1962 3-2
3.1.6 Flood Control Act of 1965 3-2
3.1.7 Flood Control Act of 1968 3-2
3.1.8 River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970 3-2
3.1.9 Supplemental Appropriations Act of 1984 3-2
3.1.10 Joint Resolution of 1985 3-2
3.1.11 Water Resources Development Act (WRDA) of 1988 3-3
3.1.12 Everglades National Park Protection and Expansion Act of 1989 3-3
3.1.13 Energy and Water Development Appropriations Act of 1992 3-3
3.1.14 The Water Resource Development Act of 1992 3-3
3.1.15 The Water Resource Development Act of 1996 3-4
3.1.16 The Water Resource Development Act of 2000 3-4
3.1.17 Consolidated Appropriations Resolution, 2003 3-4
3.1.18 The Water Resource Development Act of 2007 3-4
3.1.19 The Water Resources Reform and Development Act (WRRDA) of 2014 3-5
3.1.20 The Water Resources Reform and Development Act (WRRDA) of 2016 3-5
3.1.21 The Water Resources Development Act (WRDA) of 2018 3-5
3.2 Planning and Design 3-5
3.2.1 General 3-5
3.2.2 Water Conservation Areas–General 3-6
3.2.3 Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration - Detailed Design Memorandum (DDM), Dated March 2004 3-6
3.2.4 Water Conservation Area 1 3-6
3.2.5 Water Conservation Area 2 3-8
3.2.6 Water Conservation Area 3 3-10
3.2.7 Everglades National Park-South Dade Conveyance System (ENP-SDCS) 3-14
3.3 Construction 3-18
3.4 Related Projects 3-22
3.4.1 Everglades Construction Project (ECP) and Everglades Nutrient Removal (ENR) Project 3-22
3.4.2 Stormwater Treatment Areas (STAs) 3-22

3.4.3 C-139 Annex Restoration Project (C-139 Annex) 3-27
3.4.4 Rotenberger Wildlife Management Area (RWMA) 3-27
3.4.5 Holey Land Wildlife Management Area 3-28
3.4.6 Site 1 Impoundment 3-29
3.4.7 Seminole Big Cypress Reservation Water Conservation Plan Critical Project (SBC Project) 3-30
3.4.8 Pump Stations 3-30
3.4.9 North Springs Improvement District (NSID) 3-31
3.4.10 Water Conservation Area 1 3-31
3.4.11 Water Conservation Area 2 3-32
3.4.12 Water Conservation Area 3 3-32
3.4.13 ENP-South Dade Conveyance System (ENP-SDCS) 3-33
3.5 Dam Safety History/Issues 3-33
3.6 Principal Regulation Issues 3-34
3.6.1 Difficulty in Achieving Design Release Downstream of S-12s 3-34
3.6.2 Problems with Water Storage in Water Conservation Area 2B and 3B 3-34
3.6.3 Water Supply Releases from Water Conservation Areas During Low Water Conditions 3-35
3.6.4 Maintenance of Marsh Vegetation in Water Conservation Areas to Prevent Wind Tides 3-35
3.6.5 Regulatory Outlet Water Conservation Area 3B 3-35
3.6.6 Competing Needs for Water 3-35
3.6.7 Everglades Ecosystem 3-35
3.7 Modifications to Regulations 3-36
3.7.1 Interim Action Plan 3-36
3.7.2 Water Conservation Area 1 3-37
3.7.3 Water Conservation Area 2 3-38
3.7.4 Water Conservation Area 3 3-39
3.7.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS) 3-40
4 WATERSHED CHARACTERISTICS 4-1
4.1 General Characteristics 4-1
4.1.1 Seminole Big Cypress (SBC) Basin 4-1
4.1.2 Water Conservation Areas (WCAs) 4-1
4.1.3 Everglades National Park (ENP) 4-2
4.1.4 Las Palmas Community (8.5 Square Mile Area) 4-2
4.1.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS) .. 4-2
4.1.6 CONTRIBUTING DRAINAGE AREAS 4-3
4.2 Topography 4-3
4.3 Geology and Soils 4-3

4.3.1 Seminole Big Cypress (SBC) Basin 4-4
4.3.2 Water Conservation Area 1 (WCA-1) 4-4
4.3.3 Water Conservation Area 2 (WCA-2) 4-4
4.3.4 Water Conservation Area 3 (WCA-3) 4-5
4.3.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS) .. 4-5
4.4 Vegetation 4-5
4.5 Climate 4-5
4.5.1 Temperature 4-6
4.5.2 Precipitation 4-6
4.5.3 Evapotranspiration (ET) 4-7
4.5.4 Winds 4-8
4.6 Storms and Floods 4-9
4.6.1 Flood of 1947 4-9
4.6.2 Flood of 1960 4-9
4.6.3 Hurricane Betsy — September 7-9, 1965 4-10
4.6.4 Storm Event — April 24-25, 1979 4-10
4.6.5 Tropical Storm Dennis — August 16-18, 1981 4-10
4.6.6 Rainstorm — April 23-26, 1982 4-10
4.6.7 Tropical Storm Bob — July 22-24, 1985 4-10
4.6.8 Storm Event — January 15-17, 1991 4-11
4.6.9 Storm Event — October 8-10, 1991 4-11
4.6.10 Hurricane Andrew - August 16-28, 1992 4-11
4.6.11 Hurricane Irene — October 13-17, 1999 4-12
4.6.12 Unnamed Storm — October 3-4, 2000 4-12
4.6.13 Hurricanes Charley, Frances, Ivan and Jeanne — August - September, 20044-12
4.6.14 Hurricanes Dennis, Katrina, Rita, and Wilma — July - October, 2005 4-13
4.6.15 Tropical Storm Fay - August 17-23, 2008 4-14
4.6.16 Tropical Storm Isaac — August 24-28, 2012 4-14
4.6.17 Heavy Rainfall Event — January 9–10, 2014 4-14
4.6.18 Heavy Rainfall Event — February 2015 4-15
4.6.19 Heavy Rainfall Events — December 2015 4-15
4.6.20 El Niño Event — December 2015 - January 2016 4-16
4.6.21 Extreme Rainfall Event — June 1-8, 2017 4-16
4.6.22 Hurricane Irma — September 9–11, 2017 4-17
4.7 Runoff Characteristics 4-17
4.8 Water Quality 4-17
4.9 Channel and Floodway Characteristics 4-18
4.10 Upstream Structures 4-19
4.11 Downstream Structures 4-19

4.12 Economic Data 4-19
4.12.1 Population 4-19
4.12.2 Agriculture 4-20
4.12.3 Industry 4-20
4.12.4 Flood Damages 4-20
5 DATA COLLECTION AND COMMUNICATION NETWORKS 5-1
5.1 Hydrometeorological Stations 5-1
5.1.1 Facilities 5-1
5.1.2 Reporting 5-3
5.1.3 Maintenance 5-4
5.2 Water Quality Stations 5-4
5.3 Sediment Stations 5-4
5.3.1 Facilities 5-4
5.3.2 Reporting 5-4
5.3.3 Maintenance 5-4
5.4 Recording Hydrologic Data 5-4
5.5 Communication Network 5-5
5.5.1 Regulating Office with Project Office 5-5
5.5.2 Between South Florida Water Management District and Others 5-5
5.6 Communication with Project 5-5
5.6.1 Between Regulating Office and Project Office 5-5
5.6.2 Between Regulating/Project Office and Others 5-5
5.7 Project Reporting Instructions 5-6
5.8 Warnings 5-6
6 HYDROLOGIC FORECASTS 6-1
6.1 General 6-1
6.1.1 Role of USACE 6-1
6.1.2 Role of Other Agencies 6-1
6.2 Flood Condition Forecasts 6-1
6.3 Conservation Purpose Forecasts 6-1
6.4 Long-range Forecasts 6-2
6.4.1 Requirements 6-2
6.4.2 Methods 6-2
6.5 Drought Forecast 6-3
6.5.1 Requirements 6-3
6.5.2 Methods 6-3
6.6 Water Quality Forecasting 6-3
7 WATER CONTROL PLAN 7-1

7.1 General Project Purposes, Goals, Objectives, and Benefits 7-1
7.2 Project Relationships 7-3
7.3 Major Constraints 7-3
7.3.1 Protection of the Cape Sable Seaside Sparrow and Other Listed Species 7-3
7.3.2 U. S. Highway 41/Tamiami Trail South of L-29 Borrow Canal 7-5
7.3.3 8.5 Square Mile Area 7-5
7.3.4 Water Supply Releases to Lower East Coast from WCAs during Low Water Conditions 7-6
7.3.5 Maintenance of Marsh Vegetation in WCAs to Prevent Wind Tides 7-6
7.3.6 WCA-2B and WCA-3B 7-7
7.3.7 WCA-3B Release Capability 7-7
7.3.8 WCA-3A Release Capability 7-7
7.3.9 S-12 Stability and Risk of Overtopping 7-8
7.3.10 L-31N/C-111 7-8
7.3.11 Pump Station Mechanical Longevity 7-8
7.4 Operational Strategy to Meet Project Objectives 7-9
7.4.1 Achieving Natural System Goals, Objectives, and Benefits 7-9
7.4.2 Flood Risk Management 7-9
7.4.3 Water Quality 7-10
7.4.4 Water Conservation/Water Supply 7-13
7.4.5 Recreation 7-15
7.4.6 Fish and Wildlife 7-15
7.4.7 Navigation 7-17
7.4.8 Overall Plan for Water Management 7-18
7.5 Pre-storm/Storm Operations 7-63
7.5.1 Hurricane and Tropical Storm Regulations 7-63
7.5.2 Pre-storm / Storm / and Storm Recovery Operations for SDCS 7-63
7.5.3 Operations for Other than Named Events 7-67
7.6 Consistency with the Identification of Water and Reservations or Allocations for the Natural System 7-67
7.7 Consistency with Savings Clause and State Assurance Provisions 7-67
7.8 Drought Contingency Plans 7-67
7.9 Flood Emergency Action Plans 7-68
7.10 Deviation from Normal Regulation 7-68
7.10.1 Emergencies 7-68
7.10.2 Unplanned Minor Deviations 7-68
7.10.3 Planned Deviations 7-69
7.11 Rate of Release Change 7-69
7.12 Seepage Control 7-69

7.13 Aquifer Storage and Recovery System Plan 7-69
7.14 Consistency with the Adaptive Management Program and Periodic CERP Updates 7-69
7.15 References 7-70
7.16 Annexes 7-71
7.16.1 COP AM Uncertainty #16b (Water Quality in NESRS) 7-71
7.16.2 COP AM Uncertainty ID #12b (Tamiami Trail Flow Formula [TTFF] and Drought) 7-81
8 EFFECT OF WATER CONTROL PLAN 8-1
8.1 General 8-1
8.2 Flood risk management 8-3
8.2.1 Spillway Design Flood (SDF) 8-5
8.2.2 Inflow Design Flood (IDF) 8-5
8.2.3 Reservoir Design Flood (RDF) 8-6
8.2.4 Other Floods 8-6
8.3 Recreation 8-6
8.4 Water Quality 8-7
8.5 Fish and Wildlife 8-8
8.6 Water Supply 8-8
8.7 Hydroelectric Power 8-9
8.8 Navigation 8-9
8.9 Drought Contingency Plans 8-9
8.10 FLOOD EMERGENCY ACTION PLAN 8-10
8.11 Frequencies 8-10
8.11.1 Inflow Probability 8-10
8.11.2 Pool Elevation Duration and Frequency 8-10
8.11.3 Key Control Points 8-25
8.12 Other Studies 8-34
9 WATER MANAGEMENT 9-1
9.1 Responsibilities and Organization 9-1
9.1.1 U.S. Army Corps of Engineers (USACE) 9-1
9.1.2 South Florida Water Management District (SFWMD) 9-2
9.1.3 Seminole Tribe of Florida (STOF) 9-3
9.1.4 Other Federal Agencies 9-3
9.1.5 State and County Agencies 9-3
9.1.6 Other Native American Tribes 9-4
9.1.7 Private Organizations 9-4
9.2 Interagency Coordination 9-4
9.2.1 Local Press and USACE Bulletins 9-4

9.2.2 National Weather Service (NWS) ... 9-5
9.2.3 U.S. Geological Survey (USGS) ... 9-5
9.2.4 Power Marketing Agency ... 9-5
9.2.5 Other Federal, State, and Local Agencies ... 9-5
9.3 Interagency Agreements ... 9-5
9.4 Commissions, River Authorities, Compacts, and Committees ... 9-6
9.5 Non-Federal Hydropower ... 9-6
9.6 Reports ... 9-6

List of Tables

Table 3-1: Dates of Construction and Transfer TO SFWMD within the WCAs, ENP, ENP-SDCS region ... 3-18
Table 3-2: Everglades National Park Seven Point Plan ... 3-41
Table 4-1: Pan Evaporation in Inches at Selected Stations ... 4-7
Table 4-2: Heavy Rainfall Events - December 2015 ... 4-15
Table 4-3: 1990 and 2010 Population by county ... 4-20
Table 4-4: Annual Flood Damages Prevented by the C&SF Project ... 4-21
Table 4-5: Monthly Mean Average Temperatures ... 4-22
Table 4-6: Monthly Total Precipitation ... 4-22
Table 5-1: USGS Stations ... 5-6
Table 5-2: SFWMD and ENP Stations ... 5-16
Table 7-1. Water Supply Deliveries Allowed when Approaching Identified Canal Stages in ENP-SDCS. ... 7-15
Table 7-2. TTFF coefficients and associated standard error. ... 7-34
Table 7-3. Operating Criteria. ... 7-43
Table 7-4. Pre-Storm Drawdown Targets. ... 7-65
Table 7-5. Pre-Storm Drawdown Sequencing. ... 7-65
Table 7-6. Recovery Operations. ... 7-66
Table C.7-7. COP AM Uncertainty ID#16b (Water Quality in NESRS) management option matrix.7-75
Table C.7-8. COP AM Uncertainty ID #12b (Tamiami Trail Flow Formula and Drought) management option matrix. ... 7-86
Table 8-1: WCAs BAMM SPF Elevations and Flows ... 8-6
Table 8-2: WCA-1 Peak Stage Elevations (1965-2005) ... 8-12
Table 8-3: WCA-2A Peak Stage Elevations (1965-2005) ... 8-15
Table 8-4: WCA-2B Peak Stage Elevations (1965-2005) ... 8-18
Table 8-5: WCA-3A Peak Stage Elevations (1965-2005) ... 8-21
Table 8-6: WCA3B Peak Stage Elevations (1965-2005) ... 8-24
Table 8-7: S-10s Peak Flow (1965-2005) ... 8-27
Table 8-8: S-11s Peak Flow (1965-2005) ... 8-29
Table 8-9: S-12s Peak Flow (1965-2005) ... 8-31
Table 8-10: S-333s Peak Flow (1965-2005) ... 8-33
Table 8-11: Significant Milestones preceding COP ... 8-34
Table 9-1: Pertinent Jacksonville District Water Management Section Personnel ... 9-2

Table 9-2: Pertinent Sfwmd Office of Operations Personnel 9-2
Table 9-3: Pertinent STOF Environmental Resource Management Department Personnel 9-3
Table 9-4: Hydrometeorological Reports 9-7

List of Figures

Figure 2-1: C-111 South Dade NDA and SDA Project Area Features 2-27
Figure 3-1: Stormwater Treatment Areas and Water Conservation Areas 3-23
Figure 3-2: CSSS HABITAT MAP 3-45
Figure 7-1. Infrastructure Map. 7-20
Figure 7-2. WCA-1 Map 7-22
Figure 7-3. WCA-1 Regulation Schedule 7-23
Figure 7-4. WCA-2A Map 7-25
Figure 7-5. WCA-2A Regulation Schedule 7-26
Figure 7-6. WCA-3A and WCA-3B Map 7-28
Figure 7-7. WCA-3A Regulation Schedule 7-29
Figure 7-8. S-339 and S-340 Regulation Schedule 7-32
Figure C.7-9. Monthly count of low water closure days in WCA3 – COP Alt Q, with years when TTFF drought conditions test would be implemented indicated by heavy black outline. Design test implementable only in 1973-1974, 1989-1990, and 1990-1991.7-83
Figure C.7-10. Normalized duration curves of depths at specific gages in WCA3. a) Gage WCA3_3B_71 (top), b) WCA3_3A_28 (middle), and c) WCA3_3A-NE (lower). Curves for WCA_3_3-69 and WCA3-3 gages are similar but not shown..... 7-84
Figure 8-1. WCA-1 Average Stage 8-11
Figure 8-2. WCA-1 Stage Duration Curve 8-11
Figure 8-3. WCA-2A Average Stage 8-14
Figure 8-4. WCA-2A Stage Duration Curve 8-14
Figure 8-5. WCA-2B Average Stage 8-17
Figure 8-6. WCA-2B Stage Duration Curve 8-17
Figure 8-7. WCA-3A Average Stage 8-20
Figure 8-8. WCA-3A Stage Duration Curve 8-20
Figure 8-9. WCA-3B Average Stage 8-23
Figure 8-10. WCA-3B Stage Duration Curve 8-23
Figure 8-11. S-10s Flow Duration Curve 8-26
Figure 8-12. S-11s Flow Duration Curve 8-28
Figure 8-13. S-12s Flow Duration Curve 8-30
Figure 8-14. S-333s Flow Duration Curve 8-32

LIST OF PLATES

Plate No.	Title
2-1	COMPREHENSIVE PLAN MAP
2-2	WATER CONSERVATION AREA 1
2-3	WATER CONSERVATION AREA 2A AND 2B
2-4	WATER CONSERVATION AREA 3A AND 3B
2-5	SOUTH DADE CONVEYANCE SYSTEM
2-6	SEMINOLE BIG CYPRESS PROJECT OVERVIEW

LIST OF APPENDICES	
APPENDIX A	STRUCTURE DESCRIPTIONS
APPENDIX B	DROUGHT CONTINGENCY PLAN
APPENDIX C	AGREEMENTS WITH NON-FEDERAL SPONSORS
APPENDIX D	CODE OF FEDERAL REGULATIONS
APPENDIX E	STANDING INSTRUCTIONS TO STRUCTURE OPERATOR
APPENDIX F	USFWS BIOLOGICAL OPINION FOR EVERGLADES RESTORATION TRANSITION PLAN PERTINENT INFORMATION
APPENDIX G	WATER CONTROL PLANS AND PROJECT OPERATING MANUALS

1 INTRODUCTION

1.1 AUTHORIZATION FOR MANUAL

This volume of the System Operating Manual (SOM) for the Central and Southern Florida (C&SF) Project is prepared pursuant to and in compliance with the following applicable authorities:

- Section 7 of the Flood Control Act of 1944 (33 U.S.C. § 709)
- U.S. Army Corps of Engineers (USACE), South Atlantic Division (SAD) Memorandum of Approval Subject: Water Conservation Areas (WCAs), Everglades National Park (ENP), and ENP– South Dade Conveyance System (ENP-SDCS) Water Control Plan (WCP), dated 14 November 1994
- Section 601(h)(3) of the Water Resources Development Act of 2000 (WRDA), Public Law (P.L.) 106-541, 114 Stat. 2688, enacted December 11, 2000
- 33 Code of Federal Regulations (CFR) Section (§) 222.5, Water control management (ER 1110-2-240)
- 33 CFR § 208.11, Regulations for use of storage allocated for flood control or navigation and/or project operation at reservoirs subject to prescription of rules and regulations by the Secretary of the Army in the interest of flood control and navigation
- 33 CFR § 385.5(a), Guidance Memoranda (GM) of the Programmatic Regulations for the Comprehensive Everglades Restoration Plan (CERP)
- 33 CFR §385.28(b), Operating Manuals of the Programmatic Regulations for the CERP
- Engineer Regulation (ER) 1110-2-240, Engineering and Design, Water Control Management, dated May 30, 2016
- Engineering Manual (EM) 1110-2-3600, Engineering and Design, Management of Water Control Systems, dated October 10, 2017
- ER 1110-2-8156, Engineering and Design, Preparation of Water Control Manuals, dated December 11, 2018

1.2 PURPOSE AND SCOPE

Operating Manuals are the set of documents that describe how to operate the components of the C&SF Project and the CERP Projects to ensure that the goals and purposes of the CERP are achieved. Operating Manuals include the SOM and Project Operating Manuals (POM). Operating Manuals contain water control plans, regulation schedules, and operating criteria for project and/or system regulations as well as additional information necessary to operate projects to ensure that the goals and purposes of the CERP are achieved. A SOM provides an integrated system-wide plan for the operation of components of the C&SF Project and the CERP Project features to ensure that projects function in a coordinated, systematic way. The SOM shall initially be based on the existing completed C&SF Project features and shall be developed by the Corps of Engineers as provided in 33 CFR § 222.5(g) (ER 1110-2-240) and by the local sponsor (non-federal) as its laws and regulations require. A POM provides guidance on operational

concerns relevant to individual projects. As CERP progresses POMs will serve as supplements to the SOM and provide greater detail on the incremental features necessary for integrating the operation of the individual CERP project with the system operation described in the SOM. A WCP prescribes water management operations for congressionally authorized project purposes to accomplish those purposes to the greatest extent possible while seeking to minimize the risk to public safety. WCPs are approved by USACE. Existing WCPs, regulation schedules, and Master Water Control Plans for the C&SF Project shall remain in effect until approval of the SOM.

This document is Volume 4 in a series of volumes that together comprise the SOM for the entire C&SF Project (refer to Section 1.3). Volume 4 of the SOM includes the WCAs, ENP, ENP-SDCS, and Seminole Big Cypress (SBC) basins. Volume 4 of the SOM is an update to the 1996 Master Water Control Manual (MWCM) and the 2012 WCP. The Central and Southern Florida Ecosystem Restoration Critical Project, Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project (SBC Project) is located within the SBC Basin. The SBC Project WCPs for Basin 1, 2 and 4 are provided in Appendix G and will be updated to POMs in the future.

The purpose of Volume 4 of the SOM is to assist the USACE Jacksonville District Water Management Section and the non-federal sponsors, South Florida Water Management District (SFWMD, and the Seminole Tribe of Florida (STOF)] personnel in the day-to-day operation of the water management system (see Section 1.5). Additionally, this SOM serves to assemble and preserve, as a convenient reference source, information pertinent to the C&SF Project components. Chapter 2 of this volume describes the project location, authorizations, and purpose detail on project areas, components, and features (canals, levees, structures) which comprise the project. Chapters 3 and 4 provide historical information and watershed characteristics for the project area. Chapters 5 and 6 provide information on data collection and communication networks, and hydrologic forecasts for the project area. Chapters 7, 8 and 9 describe the WCP, its effects, and water control management for the project.

1.3 RELATED MANUALS AND REPORTS

The development of the SOM for the C&SF Project based upon existing (aside from the first edition of Volume 7) WCMs is ongoing and will consist of the following volumes:

- Volume 1, System-wide
- Volume 2, Kissimmee River-Lake Istokpoga Basin
- Volume 3, Lake Okeechobee and Everglades Agricultural Area
- Volume 4, Water Conservation Areas, Everglades National Park, and ENP-South-Dade Conveyance System
- Volume 5, East Coast Canals
- Volume 6, Upper St. Johns River Basin
- Volume 7, Southwest Florida

1.3.1 Prior Operation and Maintenance Manuals

The Operation and Maintenance (O&M) Manual for the C&SF Project (USACE, Jacksonville District Pamphlet 1130-2-13, 1954-55) consists of three volumes for facilities operated and maintained by the USACE and SFWMD, the non-federal sponsor. A fourth volume describes facilities operated and maintained by the USACE. The O&M Manual has had multiple revisions (Change 29 is dated 15 March 1983). Periodically, as facilities are completed and transferred to SFWMD, the O&M Manual is revised and updated. The O&M Manual contains O&M regulations and procedures for operation during both normal and high water periods. The water control criteria found in this volume of the SOM supersede the water control criteria in the O&M Manual.

1.3.2 Design Memoranda

The USACE has prepared a series of general design memoranda (GDM), detail design memoranda (DDM), and Detailed Design Reports (DDRs) for the C&SF Project, its canals and water control structures from 1951 through the present (Section 3-2). See Table 1-1 at the end of this chapter for a list of Design Memoranda (DM) prepared for the entire C&SF Project.

1.3.3 C&SF Project, Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement

Section 601 of the Water Resources Development Act (WRDA) of 2000 approved the Comprehensive Everglades Restoration Plan (Plan) contained in the Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, dated April 1, 1999. As stated in Section 601(h) of WRDA 2000 “the overarching objective of the Plan is the restoration, preservation, and protection of the South Florida ecosystem while providing for other water-related needs of the region, including flood protection and water supply.” The Plan approved by Congress contained 68 major components that anticipated the creation of approximately 217,000 acres of reservoirs and wetland-based water treatment areas, wastewater reuse plants, seepage management, and the removal of levees and canals in natural areas. These components are expected to increase storage and water supply for the natural system, as well as for urban and agricultural needs, while continuing to fulfill the original objectives of the existing C&SF Project. CERP Project Implementation Reports (PIRs) bridge the gap between the conceptual level of detail contained in the Plan and the detailed design necessary to prepare plans and specifications required to proceed to construction, providing CERP project delivery teams the opportunity to optimize the features described in the Plan

1.4 PROJECT OWNER

The USACE operates the main outlets of WCA-1, WCA-2 and WCA-3 as authorized in House Document (H.D.) 643. The local sponsor for the SBC Project is the STOF. The SBC Project is operated by the STOF and is located on the Big Cypress Seminole Indian Reservation. The SFWMD is the local sponsor for the C&SF Project covered by this volume and operates the project in accordance with regulations prescribed by the USACE. The SFWMD was created in

1949 by the Legislature of the State of Florida as the C&SF Flood Control District, and renamed in 1976.

1.5 OPERATING AGENCY

1.5.1 U.S. Army Corps of Engineers

The USACE operates and maintains the main outlets to WCA-1 (S-10A, S-10B, and S-10C), WCA-2A (S-11A, S-11B, and S-11C), WCA-3A (S-12A, S-12B, S-12C, and S-12D), and WCA-3B (S-355A and S-355B). These structures are operated either manually and/or remotely. Table 1-2 lists key USACE water control management personnel.

TABLE 1-2: U.S. ARMY CORPS OF ENGINEERS KEY WATER CONTROL MANAGEMENT PERSONNEL

Name	Phone Number
XXXXXXXX, Chief Water Management Section, EN-WW	XXX XXX-XXXX
XXXXXXXX, Chief Water Resources Engineering Branch, EN-W	XXX XXX-XXXX
XXXXXXXX, Chief Engineering Division, EN	XXX XXX-XXXX

1.5.2 Seminole Tribe of Florida (STOF)

STOF is responsible for O&M of the SBC Project. The STOF operates and maintains the C&SF Project features within SBC Basin 1, SBC Basin 2, and SBC Basin 4 either manually and/or remotely.

TABLE 1-3: SEMINOLE TRIBE KEY WATER CONTROL MANAGEMENT PERSONNEL

Position	Area of Responsibility	Phone Number
Director, Environmental Resource Management Department	Water Management	XXX XXX-XXXX

1.5.3 South Florida Water Management District (SFWMD)

SFWMD is responsible for O&M of the remaining C&SF project works covered in this volume. Table 1-3 lists the SFWMD Headquarters Water Managers Operations Control Center contact number and SFWMD Field Stations where key water control management personnel are for coordination with the USACE Jacksonville District Water Management Section. Please reference the following link https://www.sfwmd.gov/locations. Additionally, SFWMD operates and maintains canals and structures which are not part of the Federal C&SF Project.

TABLE 1-4: SOUTH FLORIDA WATER MANAGEMENT DISTRICT KEY WATER CONTROL MANAGEMENT PERSONNEL

Area of Operations	Phone Number	Location
SFWMD: Water Managers Operations Control Center	XXX XXX-XXXX	3301 Gun Club Road, West Palm Beach, FL 33406
SFWMD Field Stations		
Clewiston	XXX XXX-XXXX	2425 Hookers Point Road, Clewiston, FL 33440
Fort Lauderdale	XXX XXX-XXXX	2535 Davie Road, Davie, FL 33317
Homestead	XXX XXX-XXXX	2195 NE 8th Street, Homestead, FL 33033
Miami	XXX XXX-XXXX	9001 NW 58th Street, Miami, FL 33178
West Palm Beach	XXX XXX-XXXX	801 Sansburys Way Royal, Palm Beach, FL 33411

1.6 REGULATING AGENCIES

The USACE is responsible for prescribing regulations and key operating criteria for all project works for authorized project purposes. The Florida Fish and Wildlife Conservation Commission (FWC) is responsible for the management of fish and wildlife resources consistent with project purposes. The U.S. Fish and Wildlife Service (FWS), U.S. Department of the Interior (DOI) is responsible for administering the Endangered Species Act (ESA) and also managing the fish and wildlife resources in the Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR). The National Park Service (NPS), DOI is responsible for preserving the resources of ENP. Florida Department of Environmental Protection (FDEP) is responsible for regulating the quality of water and for coastal zone management, including enforcement of the State of Florida Coastal Zone Management Plan.

1.7 VERTICAL DATUM

All elevations referenced in this SOM are in feet, and reference the National Geodetic Vertical Datum of 1929 (feet, NGVD). This section will be updated as the North American Vertical Datum of 1988 (NAVD) is incorporated into WCAs, ENP, ENP-SDCS component of the C&SF Project. At that time, a table will included that correlates the NGVD datum to the NAVD datum to facilitate the datum transition.

TABLE 1-1: DESIGN MEMORANDA FOR THE C&SF PROJECT

Part I	Agricultural and Conservation Areas
Part II	Kissimmee River Basin and Related Areas
Part III	Upper St. Johns River Basin and Related Areas
Part IV	Lake Okeechobee and Outlets
Part V	Coastal Areas South of St. Lucie Canal
Part VI	General Studies and Reports

Part	Supplement*	Title	Date
I	Basic Report	Agricultural and conservation areas (with preliminary information on Lake Okeechobee and principal outlets)	10 Jul 51
I	1	Geology and soils	6 Dec 51
I (1)	1	Agricultural area levees	29 Dec 51
I	3	DM, Pump Station 5A	28 Nov 52
V	2	DM, Canal 4	22 Feb 52
V	3	DM, Canal 9 and Structure 29	22 Feb 52
V (2)	4	Hydrology and hydraulic design, Greater Miami area (preliminary draft)	23 Feb 52
V (3)	1	DM, Canal 11	27 Feb 52
I	6	DM, Gates and operating machinery of control structures 5A-E, 5A-W, and 5A-S	5 Mar 52
I	Addendum to 3	DM, Pump Station 5A	24 Mar 52
VI (1)	Section 1	Modified first phase plan	26 Mar 52
I	5	Test levee investigations	28 Mar 52
VI (1)	Section 3 (advance copy)	Schedules, outlines, and costs for preparation of definite project report	8 May 52
VI (1)	Section 2 (advance copy	Construction schedule and cost estimates, authorized first phase	9 May 52
I	4	Structural design (works planned for construction through fiscal year [FY] 1953)	18 Jul 52
V	7	DM (revised), Canal 11, Pump Station 3, Control Structure 13A	8 Aug 52
V	8	DM, Canals 12 and 13, Control Structures 33 and 36	31 Oct 52
V	9	DM (revised), Canal 11, Pump Station 13	17 Nov 52
V(4)	6	DM, Pump Station 9	28 Nov 52
V	10	DM, Vehicle-operated gate hoists	4 Dec 52
I	8	DM, Development of plan of protection for agricultural area	6 Feb 53
I	7	DM, Permeability investigations by well-pumping tests	16 Feb 53

Part	Supplement*	Title	Date
VI	Section 4	Modified first phase plan, 1953	20 Feb 53
IV	1	DM, Effectiveness of Lake Okeechobee Outlets	12 Mar 53
V	5	DM Geology and soils	30 Apr 53
V	Section 5	DM, Channel roughness	1 May 53
I	10	DM, Pump Station 6	27 May 53
I	9	DM, Hydrology and hydraulic design of West Palm Beach Canal and related works (L-10 and L-12)	8 Jun 53
I	11	DM, Hydrology and hydraulic design of 17 Jun 53 West Palm Beach Canal and related works (L-18, L-19, L-20, and S-7)	17 Jun 53
I	13	DM, Hydrology and hydraulic design of 6 Jul 53 North New River Canal and related works (L-18, L-19, L-20, and S-7)	6 Jul 53
I	12	DM, Hillsboro Canal (Levees 14 and 15)	15 Jul 53
I	15	DM, Pump Station 2	29 Jul 53
V	II	DM, Hydrology and hydraulic design 31 Jul 53 of design of Hollywood Canal (C-10)	31 Jul 53
I	14	DM, Hydrology and hydraulic design 17 Aug 53 of Miami Canal and related works (L-23, L-24, L-25, S-3, and S-8)	17 Aug 53
VI	Section 6	DM, Rainfall-frequency estimates	4 Sep 53
IV	Supplement 2 (Section 1)	Hydrology and hydraulic design DM, 13 Oct 53 Section Storage level in Lake Okeechobee at the beginning of critical hurricanes	13 Oct 53
I	16	DM, West Palm Beach Canal (Levees 10 & 12)	15 Oct 53
I	17	DM, Pump Station 13	30 Oct 53
I	18	DM, Revision of hydrology and hydraulic design of West Palm Beach, Hillsboro North New River, and Miami Canals	16 Nov 53
I	19	DM, North New River Canal (Levees 20, 19, and 18)	1 Dec 53
IV	Supplement 2 (Section 2)	Hydrology and hydraulic design DM, Hurricane winds over Lake Okeechobee	31 Dec 53
IV	Supplement 2 (Section 5)	Hydrology and hydraulic design DM Lake-regulating facilities	12 Jan 54
IV	Supplement 2 (1) (Section 3)	Hydrology and hydraulic design DM, Wind tides produced by hurricanes	21 Jan 54

Part	Supplement*	Title	Date
IV	3	DM, Prototype tests of Lake Okeechobee type sector gates at Ortona lock	28 Jan 54
I	30	DM, Miami Canal (Levees 25, 24, and 23)	5 Feb 54
V	12 (Revised)	DM, Hydrology and hydraulic design, canals in Greater Miami area (C-2 through C-9)	23 Mar 54
VI	Section 7	DM, Interim report on evaluation of Manning's n in vegetated areas	2 Apr 54
IV	Supplement 2 (1) (Section 4)	Hydrology and hydraulic design DM, Wave action coincident with wind tides	27 Apr 54
V	13	DM, Water- and salinity-control structures in Greater Miami area	2 Jul 54
IV	Supplement 2 (Section 6)	Hydrology and hydraulic design DM, Resistance of levees to wave erosion	13 Aug 54
V	14	DM, Snapper Creek Canal (C-2) and Control Structure 22	1 Oct 54
IV	4	DM, Effects of fresh-water discharges through St. Lucie Canal	27 Oct 54
I	21	DM, Agricultural area levees, Levees 4 (east), 5, and 6	1 Nov 54
I	22	DM, Agricultural area levees, Levees 2, 3, and 4 (west)	19 Nov 54
V	15	DM, Snake Creek Canal extension (C-9, Section 4)	15 Dec 54
VI	Section 8	DM, Rainfall-excess evaluation	5 Jan 55
VI (1)	Section 10	Project authorizations	10 Mar 55
VI	Section 9	DM, Regimen of runoff	16 Mar 55
IV	Supplement 2 (Section 5A)	Hydrology and hydraulic design DM, additional lake-regulating facilities	28 Mar 55
V	16	DM, Canal 17 and Control Structures 43 & 44	5 Apr 55
V	17	DM, Snapper Creek Canal (C-2) navigation requirements	13 May 55
I (1)	23	DM, Levee 39 and Spillway 10	20 Jun 55
II	1	DM, Moore Haven-Newhall area (C-19, L-41, L-42, L-51, S-47B, S-47D, and S-8l)	21 Jul 55
II	2	DM, Hydrology and hydraulic design, Lake Istokpoga-Indian Prairie area (Canals 39A, 40, 41, and 41A, and Structures 66, 68, 70, 71, 72, 75, 82, 83, and 84)	28 Nov 55

Part	Supplement*	Title	Date
I	24	DM, Pump Station 7	13 Dec 55
V	19	DM, Canal 9, Section 1	6 Dec 56
V	18	DM, Little River Canal (C-7)	17 Jan 56
II	4	General DM, Hydrology and hydraulic design, Fisheating Creek area (C-22 and S-69)	24 Apr 56
II	3	DM, Lake Istokpoga-Indian Prairie area (Canals 39A, 40, and 41, and Structures 70, 71, 72, 75, and 82)	31 May 56
VI	Section II	DM, Meteorologic and water-level networks, parts I and V	19 Jun 56
IV	5	Special report on mullet migrations through St. Lucie lock and Dam, 1955-56	20 Jun 56
IV	Supplement 2, Section 3 (Revised)	Hydrology and hydraulic design DM, Wind tides produced by hurricanes	26 Jul 56
IV	Supplement 2, Section 4 (Revised)	Hydrology and hydraulic design DM, Wave action coincident with wind tides	27 Jul 56
V	20	General and Detail DM, Canal 18 and Control Structure 46	20 Aug 56
V	21	Detail DM, Biscayne Canal (C-8) and Control Structure 28	24 Sep 56
II	5	General DM, Kissimmee River Basin	8 Oct 56
VI	Section 12	Summary report, 1954 authorized works on which general DM studies will not be completed by end of 1956	11 Oct 56
II	6	DM, Plan of regulation for Lake Istokpoga	12 Oct 56
III	1	General DM, St. Lucie County canals and control structures (Canals 23, 23A, 24, & 25, & Control Structures 48, 49, 50, 97, 98, & 99)	23 Jan 57
III	2	General DM, upper St. Johns River Basin	20 Mar 57
IV	6	General DM, Caloosahatchee River and control structures (Canal 43 and lock and Spillway Structures 77, 78, and 79)	24 Apr 57
I	26	Detail DM, Pump Station 8	27 May 57
V (1)	22	Detail DM, Canal 10 (Hollywood and Spur Canals)	26 Sep 57

Part	Supplement*	Title	Date
I	25	General DM, Plan of regulation for Conservation Area 1	29 Nov 57
II	7	Detail DM, Canal 41A (Slough and Stub Canals) and Structures 66, 68, 83, & 84	22 Jan 58
I	27	General DM, Plan of regulation for Conservation Area 2	28 Feb 58
IV	Supplement 2 (1) (Section 7)	Hydrology and hydraulic design, Preliminary draft of General DM, Combinations of hydrologic and hydraulic factors affecting height of levees	14 Apr 58
V	23	General and Detail DM, Canal 14 and Control Structures 37A, 37B, and 38A	5 May 58
IV	8	DM, General development plan, recreation, public use, and operation	6 May 58
V	23 (Revised)	DM, Levee 39, Spillway 10, and interim modifications to Levees 7 and 40	Ju1 58
III	3	Detail DM, Canals 23A and 24 (North Fork St. Lucie River and Diversion Canal) and Control Structure 49	19 Sep 58
II	8	Detail DM, Automatic electric control system for Structures 66, 68, 70, 71,72, systems for structures 66,68, 70, 71, 72, 75, 82, 83, and 84, Lake Istokpoga-Indian Prairie area	30 Oct 58
II	5 (Section 1)	Kissimmee River Basin, General DM, Modification of Kissimmee River (C-38) for fish and wildlife	31 Oct 58
I	28	Detail DM, Levee 38 (east), Section 1	23 Dec 58
V	24	General DM, Canals 15 and 16 and Control Structures 40, 41, and 42	31 Dec 58
IV	Supplement 2 (Section 7)	Hydrology and hydraulic design General DM, Combinations of hydrologic and hydraulic factors affecting height of levees	25 Feb 59
V	25	General DM, Canal 1 and Control Structure 21	27 Feb 59
V	26	Detail DM, Cathodic Protection for Control Structures 22 & 29	10 Mar 59
V	27 (Section 5)	General and Detail DM, Canal 9 and Control Structure 30	20 Apr 59
IV (5)	9	Detail DM, Detail development plan, recreation facilities on Canals 43 & 44	14 May 59
IV	7	General and Detail DM, Lake Okeechobee northwest shore levees (Levees 48, 49, and 50,	29 May 59

Part	Supplement*	Title	Date
		Interceptor Dikes 59, 60, and 61, and Pump Stations 127, 128, 129, 130, 131, and 132)	
I	29	Detail DM, Levee 38, Section 2 (raising U.S. Highway 27 between Structures 11A and 11C)	28 Ju1 59
I	30	General DM, Levee 28 (Section 2) and related works	15 Sep 59
IV	11	General DM, Prevention of levee erosion by tree planting	24 Sep 59
I	31	Detail DM, Levees 35B and 38 (Section3), spoil islands--Levees 35B and 38 (Section 2), and Control Structure 38	13 Oct 59
IV (6)	10	General DM, Biological investigations of St. Lucie Estuary in connection with Lake Okeechobee discharges through St. Lucie Canal	15 Oct 59
V	29	General and Detail DM, Modification of Control Structure 13A in Canal 11	22 Oct 59
V	28	Detail DM, Canal 1 (Black Creek) and Control Structure 21	30 Oct 59
V	30	General DM, Levee 31 and related works	6 Nov 59
III	4	Detail DM, Canal 25 (Belcher Canal) and Control Structures 50, 98, and 99	10 Dec 59
V	22 (Revised)	Detail DM, Canal 10 (Hollywood and Spur Canals)	20 May 60
I	33	General DM, Conservation Area 3	22 Jun 60
VI	Section 13	Detail DM, Hydraulic design of inlet structures	24 Jun 60
III	5	Detail DM, Canal 23 and Control Structures 48 and 97	18 Jul 60
IV	13	Detail DM, Pump Stations 127, 129 and 131	7 Sep 60
IV	12	Detail DM, Canal 43, Section 1 (Caloosahatchee River)	22 Sep 60
I	31	General and Detail DM, Canal 1 and Control Structures 21, 148, and 149	29 Sep 60
I	34	Detail DM, Levees 67A and 29, Section 3, and Control Structure 151	30 Sep 60
I	35	Detail DM, Levee 29, Sections 1 and 2, and Control Structures 12A, B, C, D, E, and 14	7 Nov 60

Part	Supplement*	Title	Date
IV	14	Detail DM, Herbert Hoover Dike, Levees D-1, D-2 (part), and D-3 (part)	26 May 61
I	36	General DM, Hydrologic and meteorologic gaging programs, Conservation Area 3	31 May 61
II	9	Detail DM, Canal 38, Section 1 Kissimmee River, and Control Structure 65E	21 Jun 61
II	10	Detail DM, Canals 31 and 35 (St. Cloud and South Port Canals) and Control Structures 59 and 61	23 Jun 61
IV	16	Detail DM, Structure 79, lock and spillway on Canal 43	7 Jul 61
IV	15	Detail DM, Canal 43, Section 2 (Caloosahatchee River)	4 Aug 61
V	32	Detail DM, Levee 31 East, Section 1 (Old Cutler Road to Goulds Canal), and Control Structure 21B	5 Jan 62
V	33	Detail DM, Canal 1, Section 3, and Control Structure 149	26 Jan 62
I	32	Detail DM, Levee 28, Sections 2, 3, and 5	2 Mar 62
II	11	Detail DM, Structure 65D	14 Mar 62
I	38	Detail DM, Levee 68A	22 Mar 62
I	37	Detail DM, Structures 24B, 31, and 150 (Conservation Area 3)	27 Apr 62
V	34	Detail DM, Canals 15 and 16 and Control Structures 40 and 41	28 Jun 62
II	13	Detail DM, Spillways and locks on Canal 38, Structures 65, 65A, 65B, and 65C	20 Jul 62
II	12	Detail DM, Canal 38, Sections 2 and 3 (Kissimmee River)	17 Aug 62
IV	17	Detail DM, Canal 43, Section 3 (Caloosahatchee River)	22 Aug 62
IV	18	Detail DM, Herbert Hoover Dike, Levees D2 (Part), D9 and D4	18 Sep 62
II	14	Detail DM, Canals 36 and 37 (Cypress-Hatchineha Canal and Hatchineha-Kissimmee Canal)	19 Sep 62
IV	20	Detail DM, Structures 77 & 78 on Canal 43	15 Nov 62
II	15	Detail DM, Canal 38, Sections 4, 5 and 6 (Kissimmee River)	11 Feb 63
IV	21	Detail DM, Lake Okeechobee Northeast Shore Area (L-47, L-62, L-63, L-64, L-65, S-133, S-134,	12 Mar 63

Part	Supplement*	Title	Date
		S-135, S-152, S-153, S-154, tieback levees, inlet structures, etc.)	
V	35	Detail DM, Levee 31E, Section 2 (Goulds Canal to Florida City Canal), and Structures 20G and 21A	29 Mar 63
I	39	General DM, Nine-Mile Canal Area (C-20, C-21, L-D1 borrow canal, S-4, S-47, S-169, S-170, railroad bridges, etc.)	29 Mar 63
VI	Section 14	Project authorizations to date	30 Apr 63
IV	19	Preliminary Master Plan, Caloosahatchee River	31 May 63
V	36	General and Detail DM, Cutler Drain Area (C-100, C-100A, C-100B, C-100C, S-118, S-119, S-120, S-121, S-122, and S-123)	23 Jul 63
I	40	Detail DM, Levee 28 interceptor and feeder canals	23 Aug 63
IV	22	Detail DM, Herbert Hoover Dike, Levee D3 (remainder)	5 Sep 63
V	37	General DM, South Dade County	12 Sep 63
III	6	Detail DM, Canals 54 and 56 (Sebastian and Poinsett Outlet Canals), Levee 73, Sec. 1 (Taylor Ck. portion of Jane Green Levee), and Structures 55, 96, 157, and 164	18 Dec 63
V	38	Detail DM, Canal 111, Section 1, and Control Structure 18C	31 Dec 63
I	41	Detail DM, Pump Station 140	19 Jun 64
IV	23	Detail DM, Canal 43, Sections 4 and 5 (Caloosahatchee River)	9 Sep 64
II	16	Detail DM, Canals 33 and 34 (Alligator- Gentry Canal and Canoe Creek Canal	28 Sep 64
V	39	Detail DM, Canals 102 (Princeton Canal, 102(N), and Control Structures 165, 194, and 195	19 Nov 64
V	41	General and Detail DM, Structures 124 and 125 (C-42 and related areas)	15 Dec 64
V	40	Detail DM, Canals 103 (Mowry Canal), 22 Jan 65 103(N), and 103(S), and Control Structures 20F, 166, 167, 179, and 196	22 Jan 65
I	42	Detail DM, Levee 38 (West), Section 1	11 Feb 65
IV	24	Detail DM, Herbert Hoover Dike, Levee 47, and Control Structure 191	8 Mar 65
IV	25	Detail DM, Pump Stations 133 and 135	30 Apr 65

Part	Supplement*	Title	Date
IV	19B (C-1)	Construction DM, Olga Lock and Dam (S-79), Public-use facilities	8 Jun 65
V	42	Detail DM, Levee 31 East, Section 3 30 Ju1 65 (Florida City Canal to Card Sound Road) and Control Structures 20 and 20A	30 Jul 65
V	43	Detail DM, Canal 111, Sections 2 and 3, Canal 111(E), and Control Structures 176, 177, and 178	31 Aug 65
II	17	Detail DM, Canals 30 and 32 and Control Structures 57 and 58	30 Nov 65
V	44	Detail DM, Levee 31(N) and Control Structure 173	31 Jan 66
II	18	Detail DM, Canals 29, 29A, 29B, and Control Structure 62	29 Ju1 66
IV	26	Detail DM, Levees 64, 65, St. Lucie Canal north tieback levee, and Control Structure 153	28 Oct 66
V	45	Detail DM, Canals 109 and 110, and Control Structure 18	15 Dec 66
V	46	General DM, Canals 4, 5, and 6, and Control Structures 25, 25A, 25B, and 26	18 Apr 67
IV	28	Detail DM, lock Structure 193	5 Jun 67
IV	27	Detail DM, Levees 62, 63(N), 63(S), Canal 59 and Control Structure 192	14 Sep 67
I	43	Detail DM, Levee 13 (Cross Canal)	31 Oct 67
V	47	Detail DM, Levee 31(W), Canal 113, and Control Structures 174 and 175	17 Nov 67
III	7	Detail DM, Levee 73, Section 2, Canals 57 and 58, and Control Structures 161, 162, 163, and 221	28 Feb 68
I	44	Detail DM, Pump Station 4	22 Apr 68
V	48	Detail DM, Canals 106, 107, and 108 and Control Structures 19 and 198	23 Aug 68
II	Supplement 5 Section 2	General DM, Modification of Plan for Canals 46 and 46A and Structures 87, 87A, 87B, and 87C	11 Apr 69
I	45	Detail DM, Canal 21 and Control Structure 169	6 Jun 69
V	45 (Revised)	Detail DM, Canals 109 and 110, and Control Structures 18 and 199	14 Oct 69
IV	27 (Revised)	Detail DM, Levees 62, 63(N), 63(S), Canal 59, and Control Structure 192	20 Oct 69
IV	29	Detail DM, Seaboard Coast Line Railroad Bridge B-142 Over Levee 63(N) Borrow Canal	10 Aug 70

Part	Supplement*	Title	Date
III		Detail DM, Levee 72, Control Structure 160, Culverts 1 through 6	18 Aug 70
I	47	Detail DM, Canal 20, Levees D1 and D3 Connecting Canal and Control Structures 47, 233, 234, and 235	30 Dec 70
V	50	Detail DM, Coastal Areas South of St. Lucie Canal-Control Structure 25 in Miami Canal (C-6)	26 Nov 71
IV	30	Detail DM, Lake Okeechobee and Outlets St. Lucie Canal Tieback Levees	13 Jan 72
I	46	General and Detail DM, Pump Station 236	28 Feb 72
V	49	General and Detail DM, Canals 12N and 13, Control Structures 224 and 237	4 Apr 72
V	51	General and Detail DM, West Palm Beach Canal and Related Areas with Detail Design Appendix on Pump Station 319	Jun 72
I	47	Detail DM, Canal 20 (Revised)	12 Jun 72
I	49	General and Detail DM, Modification of Levees 7, 35B, and 38, Section 2 (U.S. Highway 27—Between Structures 11A and 11C), and Deletion of Canal 302	31 Aug 72
V	54	Detail DM, Canal 51 and Control Structures 155 and 155A	Nov 72
V	53	Detail DM, Control Structures 25 and 25A in Comfort Canal (C-5) and 25B in Tamiami Canal (C-4)	Nov 72
IV	31	General and Detail DM, Port Mayaca lock (S-308B) and Spillway (S-308C)	Nov 72
V	52	General DM Conveyance Canals to ENP and South Dade County with Detail Design Appendix on Pump Station 331 and Enlargement of Reaches of Levee 31(N) Borrow Canal, C-1, and C-103	Jun 73
V	55	Detail DM, Levee 29, Section 3, Borrow Canal Enlargement, Pump Station 332, and Control Structures 194(Mod), 333, 334, 335, 336, and 338	Aug 74
V	56	Detail DM, Levee 30, Borrow Canal Enlargement and Control Structures 32A and 337	Mar 76
IV	52	General and Detail DM, Lock Structure 310 (S-310)	May 76

Part	Supplement*	Title	Date
I	48	General DM, Hendry County Area with Detail Design Appendix on Structure 239 and Canals 139 and 139 South	Feb 77
I	53	General and Detail DM on Structures 339 and 340	Sep 77
I	51	General and Detail DM on L-18 and L-19 (North New River Canal), and L-24 and L-25 (Miami Canal) Bump Removal	Mar 78
V	52 (Addendum 1)	General and Detail DM, Enlargement of Canal 304 and Culvert Structure 151	Jun 78
V	57	Buttonwood Canal Improvements and Related Works, ENP, Structure 341	Ju1 79
V	41 (Addendum 1)	Detail DM, Canal 51-East End and Control Structure 155	Dec 81
II	19	General DM, Nicodemus Slough Area	Jan 82
IV	33 (HGS-4)	General DM, Spillway Structures 351	Jun 84
III	11	General DM, St. Lucie County Water Supply Element, C-131, Enlargement C-28 Portion, PS-2l4, S-115, S-116, S-117, S-118, PS-307, PS-313, S-112, and S-348	Jun 84
III	2 (Addendum 3)	General DM Upper St. Johns River Basin with Draft Environmental Impact Statement (EIS)	Ju1 84
V	54	Detail DM Canal 51-West End, Control Structure 155A and Pump Station 319	Ju1 85
IV	34	DM, Spillway Structure 351 (HGS-4)	Jun 85
IV	35	General DM, Spillway Structure 352 (HGS-4)	Aug 85
IV	37	Detail DM Spillway Structure 352 (HGS-5)	May 86
III	12	Detail DM Structure 96B and Tieback Levee	Ju1 86
IV	36	General DM, Spillway Structure 354 (HGS-3)	Dec 86
III	13	Detail DM, Structure l61A and Tieback Levee Structure 255, Levee 74N (Part) and Levee 74E	Mar 87
IV	38	Detail DM, Spillway Structure 354 (HGS-3)	Apr 87
III	14	Detail DM, S-252A, S-252B and S-252C Levee 78 and Levee 79	Aug 87
III	15	Detail DM, Structure 96C and 96D	Oct 88
III	15	Detail DM, Structure 96C and 96D (Revised)	Feb 89

Part	Supplement*	Title	Date
III	16	Detail DM, S-250A, S-250B, S-250C, S-251 and S-254, Levee 74W, L-77 and L-74N (Part)	Mar 87
II	20	General DM, Shingle Creek, C-120A, C-120B, S-353 and Environmental Structures ES-1, ES-2, and ES-3	Sep 89
III	17	Detail DM, Levee 75 (Section 1)	Oct 89
III	18	Detail DM, Levee 74 N. Part, Levee 75 Remainder, and Structure 256	Mar 91
I	55	Feature DM, Agricultural And Conservation Areas	Sep 93
(1)		C&SF Project, Modified Water Deliveries (MWD) to Everglades National Park General DM	1992
V	54 (Addendum2) (Revised)	Detail DM, Canal 51-West End, Control Structures 155A and 360, Pump Station 319 and Levee 85	Sep 97

* NOTES:

(1) Superseded by later studies

(2) Superseded by Part V, Supplement 12, dated 23 March 1954

(3) Superseded by Part V, Supplements 7 and 9, dated 8 August 1952 and 17 November 1952, respectively

(4) Superseded previous DM (Part V, Supplement 6, dated 8 September 1952)

(5) Superseded by DDM No. 1, Okeechobee Waterway, Florida, dated 17 December 1959

(6) Superseded by consultant's report, dated 15 October 1959

This page intentionally left blank.

2 REGIONAL DESCRIPTION

This chapter (2) describes the Federal components of the C&SF Project within WCAs, ENP, ENP-SDCS Basin. Features which are integrated or pertinent to the Federal project but are non-Federally built are listed in Chapter 3 of this SOM.

2.1 LOCATION

The Water Conservation Areas, Everglades National Park (ENP), and ENP-South Dade Conveyance Basin (WCAs, ENP, ENP-SDCS) is located in a region of south Florida known as the Everglades (Plate 2-1-Comprehensive Plan map dated 30 September 1989). The WCAs include WCA-1, WCA-2, and WCA-3 which are adjacent to and south of the Everglades Agricultural Area (EAA) (Plate 2-2 through Plate 2-5 WCAs and SDCS maps). WCA-1 is approximately 15 miles west of West Palm Beach. WCA-2 is approximately 15 miles west of Fort Lauderdale, Florida. WCA-3 and ENP-SDCS are approximately 20 miles west and southwest of Miami, Florida, respectively. ENP extends from Tamiami Trail (U.S. Highway 41 located immediately south of WCA-3) to Florida Bay and the Gulf of Mexico. ENP-SDCS is east of ENP and extends from Tamiami Trail (U.S. Highway 41 located immediately south of WCA-3) to Biscayne Bay and Florida Bay. The WCAs, ENP, ENP-SDCS expands across parts of 6 counties in Florida: Palm Beach County, Hendry County, Broward County, Miami-Dade County, Collier County, and Monroe County.

2.2 PURPOSE

The congressionally authorized project purposes for the WCAs, ENP, ENP-SDCS component of the C&SF Project are: flood control (flood damage reduction); navigation; water supply for agricultural irrigation, municipalities and industry, regional groundwater control, and salinity control; enhancement of fish and wildlife; and recreation. Refer to **Table 2-11**, Volume 1, Master Water Control Plan, for public laws authorizing these purposes.

2.3 PHYSICAL COMPONENTS

The WCA-1, 2, and 3 are completely contained by levees, except for approximately a 7 mile gap in the levee on the Big Cypress National Preserve (BCNP)/WCA-3A boundary. The Seminole Big Cypress Basin is northwest of WCA-3A and consists of three Seminole Big Cypress Reservation Water Conservation Plan Critical Project (SBC Project) sub-basins (Basins 1, 2, and 4), as shown on Plate 2-6, that may release water to the BCNP and structure 190 (S-190) located on the L-28 Interceptor Canal. There is a levee system on the east side of the East Everglades (eastern boundary of the WCAs), also called the East Coast Protective Levee (ECPL), which protects the urban, agricultural and industrial areas. The ENP-SDCS is a water conveyance system bounded on the north by L-29 and C-4, on the east by developed areas of south Miami-Dade and the East Coast Canal (ECC) system, on the west by ENP, and on the south by ENP Panhandle and Biscayne Bay. WCAs, ENP, ENP-SDCS are managed by a system of canals, pump stations, and water management structures. The main canals include The West Palm Beach Canal, Miami Canal, North New River Canal, South New River Canal, Hillsboro Canal,

Tamiami Canal (L-29 Borrow Canal), L-31N Borrow Canal, and Canal111 (C-111) (Plate 2-2 through Plate 2-5 WCAs and SDCS maps).

2.3.1 Seminole Big Cypress Basin 1

The Seminole Big Cypress Basin is located in the northwest corner of the Seminole Big Cypress Reservation. It is bound by the West Feeder Canal to the south, the Reservations Western boundary to the west, and the existing field ditch system to the east and north. The SBC Project features in this area provide water quality improvements, ecosystem restoration, water storage capacity, and flood control. Features include Water Resource Areas (WRAs), Irrigation Storage Cells (ISCs), levees, water management structures, and pump stations. For operational criteria see the Interim Water Control Plan for Seminole Big Cypress Reservation Water Conservation Plan Critical Project – Basin 1 (located in Appendix G of this document). Basin 1 contains four canals (I1ANE, I1AS, I1FS and I1ES) used for the conveyance of basin water. Project features can be seen in Figure 2 of the Interim Water Control Plan for Seminole Big Cypress Reservation Water Conservation Plan Critical Project Basin 1 in Appendix G.

2.3.1.1 Levees

A system of levees encompass each of the WRAs (WRA-1W and WRA-1E) and each of the ISCs (I1A, I1B, I1C, I1D, I1E, and I1F). Total leveed embankment is approximately 12 miles including SBC 1, SBC WRA-1W, and SBC WRA-1E. These include eight different levee segments (SBC 1-1E, SBC 1-1F, SBC 1-1B, SBC 1-1A, SBC WRA-1W, SBC 1-1D, SBC WRA-1E, and SBC 1 1C).

2.3.1.2 Structures

Below is a list of the Federal water management structures located within the Seminole Big Cypress Basin 1.

2.3.1.2.1 EP1

EP1 is an equalization structure which hydrologically connects WRA-1 West-1W and WRA-1E (which are two cells of shallow wetlands). EP1 is a five barrel free flowing corrugated aluminum pipe culvert around 250 feet long and with each barrel measuring 60 inches in diameter.

2.3.1.2.2 OUT1A/B

OUT1A and B are outfall structures for WRA-1 into the West Feeder Canal. They both are double-barrel, corrugated aluminum pipe culverts, each is 70 feet long, with each barrel measuring 48 inches in diameter.

2.3.1.2.3 Siphon 1

Siphon 1 provides additional flood control for WRA 1 by siphoning water from that area under the West Feeder Canal into a spreader swale which releases water to the Native area south of the West Feeder Canal. Siphon 1 consists of a high-density polyethylene, double-barrel culvert; it is

450 feet long and each barrel is 60 inches in diameter. The riser/weir box is 42 feet long. The spreader swale is 2,400 feet long.

2.3.1.2.4 Irrigation Storage Cell Structures

Overflow structures are located within the ISCs and consist of a fixed weir which will release water above the maximum depth in the cells. ISCs are used to store water for flood protection. The cells contain three types of culvert structures: overflow structures (OF1A, OF1C2, OF1C3, OF1D2 and OF1D3), irrigation return structures (IR1A, IR1C, IR1D and IR1E), and irrigation return/overflow structures (OF1B, OF1C1, OF1D1, OF1E, and OF1F). For full structure details see water control plan (Appendix G).

2.3.1.3 Pumps

Basin 1 contains 10 pump stations (P1, P2-1, P2-2, P3-1, P3-2, P3-3, P4, P5, P6-1, P6-2, P7-1, P7-2, P8, P9, and P10) which operate for both flood damage reduction and water supply. Pumps P4, P5, P8, P9 and P10 transfer excess water away from the citrus groves and other agricultural fields located inside the basin to the ISCs. P6 and P7 transfer water from agricultural fields and pastures to ISCs located adjacent to a WRA. P1 provides irrigation water from the West Feeder Canal into citrus groves. P2 and P3 transfer water from the agricultural fields and Billie Swamp Safari Wildlife Area into WRA1W. For pump station data please refer to the water control plan (Appendix G).

2.3.2 Seminole Big Cypress Basin 2

The Seminole Big Cypress Basin 2 is located in the northwest corner of the Seminole Big Cypress Reservation. It is bound by the West Feeder Canal to the south, the existing field ditch system to the west that serves as a common boundary between Basin 1 and Basin 2, the existing field ditch system approximately two miles east of the western boundary which would have served as the common boundary with Basin 3, and by the Reservation's boundary to the north. The project features in this area provide water quality improvements, ecosystem restoration, water storage capacity, and flood damage reduction. For operational criteria see the Big Cypress Seminole Indian reservation Water Conservation Plan Critical Restoration Project Water Control Plan for Basin 2 (Appendix G). Basin 2 contains two Borrow Canals (WRA-2E and WRA-2W) used for the conveyance of basin water and one canal for agricultural drainage (Canal 1). Project features can be seen in Figure 7-2 of the Interim Water Control Plan for Seminole Big Cypress Reservation Water Conservation Plan Critical Project Basin 2 in Appendix G

2.3.2.1 Levees

Levees surround two water resource area cells (WRA-2E and WRA-2W). Total leveed embankment is 6.38 miles with two segments (WRA-2E and WRA-2W).

2.3.2.2 Structures

Below is a list of the Federal water management structures located within the Seminole Big Cypress Basin 2.

2.3.2.2.1 EP2

EP2 is an equalization structure which connects water resource areas 2 east and 2 west to allow unrestricted water movement between the two cells. The structure is a single-barrel, corrugated aluminum pipe culvert, 269 feet long.

2.3.2.2.2 Siphon 2

Siphon 2 provides additional flood damage reduction for WRA-2 by siphoning water from that area under the West Feeder Canal into a spreader swale which releases water to the Native area south of the West Feeder Canal. Siphon 2 design discharge is 244 cfs. Siphon 2 consists of a high-density polyethylene, two-barrel culvert; it is 450 feet long and each barrel is 60 inches in diameter. The riser/weir box is 42 feet long. The spreader swale is 2,400 feet long.

2.3.2.2.3 OUT2A/B

OUT2A and B are outfall structures for WRA-2 into the West Feeder Canal. OUT2A is a single-barrel culvert and OUT2B is double-barrel culvert; both are corrugated aluminum pipe, 73 feet long.

2.3.2.3 Pump Stations

Basin 2 has four pump stations (P11, P14, P15, and P27) which operate for flood damage reduction and water supply. P11 and P27 serve as irrigation pumps for water supply throughout the year and are intended to run only during dry weather conditions when supplemental water is needed for irrigation. P11 and P27 are designed to pump water from the West Feeder Canal to irrigation canals and are controlled by the water level of the irrigation canal to which they are pumping. P11 releases into WRA-2 West Canal and P27 releases into Cowbone Island Canal. P14 and P15 serve as flood damage reduction pumps and are intended to run only during wet weather conditions. P14 is designed to pump water from the Cowbone Island Canal into WRA-2W and is controlled by the water level in that canal. P15 is designed to pump water from the WRA-2E irrigation canal (which receives water from the citrus groves and agricultural fields) into WRA-2E.

2.3.3 Seminole Big Cypress Basin 4

The Seminole Big Cypress Basin 4 is located north of the Seminole Big Cypress Reservation. The northern boundary is an unimproved road along the north boundary of Township 48 South which is also the divide line of Township 47 South (T47S) and 48 South (T48S) of Hendry County (U.S. Geological Survey Quad Sheets Goddens Strand, Fla., and Cow Bone Island, Fla.) and the southern boundary is approximately one mile south of the northern boundary. The eastern boundary runs along the North Feeder Canal and the westward extent is near vicinity of County Road No. 833 (BIA Road No.1281). SBC Project features in this area provide water quality improvements, ecosystem restoration, water storage capacity, and flood damage reduction and are the WRA 4, a stormwater cell (S4A), levees, water management structures, and pump stations. For operational criteria see the Big Cypress Seminole Indian reservation Water Conservation Plan Critical Restoration Project Water Control Plan for Basin 4 Appendix G).

Basin 4 contains four Borrow Canals (WRA4E, S4A, WRA4A, WRA4B, WRA4C, and WRA4D) used for the conveyance and drainage of basin water. Project features can be seen in Figure 2 of the Interim Water Control Plan for Seminole Big Cypress Reservation Water Conservation Plan Critical Project Basin 4 in Appendix G.

2.3.3.1 Levees

Basin 4 levees encompass WRA 4 and one stormwater cell (S4A). Total leveed embankment is approximately 3 miles consisting of SBC S4A and SBC WRA-4.

2.3.3.2 Structures

Below is a list of the Federal water management structures located within the Seminole Big Cypress Basin 4.

2.3.3.2.1 OUT4

OUT4 is an outfall structure which allows flow from WRA-4 into the North Feeder Canal via WRA-4E canal. The design discharge of OUT4 is approximately 15 cfs.

2.3.3.2.2 OF4A

OF4A is an uncontrolled, single-barrel, corrugated aluminum pipe culvert structure, 56 feet long and 36 inches in diameter, that releases water from S4A into the WRA-4.

2.3.3.3 Pump Stations

Basin 4 contains two pump stations (P25 and P26) which provide flood damage reduction by transferring water from S4A canal into S4A stormwater cell.

2.3.3.4 Structure 190 (S-190)

S-190 is located on the L 28 Interceptor Canal about 32 miles south of Clewiston. This structure is a reinforced concrete, gated spillway with release controlled by two cable operated, vertical lift gates. Operation of the gates is automatically controlled in accordance with the established operational criteria. This structure maintains optimum upstream water control stages in the North and West Feeder Canals, and prevents over drainage of these canals. Detailed S-190 structure description and its operating criteria are listed in Appendix A of the SOM.

2.3.4 Stormwater Treatment Area 1 East (STA-1E)

STA-1E is located approximately 20 miles west of West Palm Beach, Florida, south of State Road (S.R.) 80 and C-51, adjacent to the northeast boundary of WCA-1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge). STA-1E features include levees, water management structures, and pump stations. STA-1E consists of three parallel treatment paths, or flow-ways, with eight treatment cells flowing from north to south. This created wetland marsh system will provide an effective treatment area of approximately 5,000 within the eight treatment cells, and an additional 1,046 acres in the distribution cells upstream of the eight cells.

2.3.4.1 Levees

Below is a list of the Federal levees located within STA-1E.

2.3.4.1.1 Levee 85 (L-85)

L-85 encompasses the north, east and southern portions of STA-1E and is approximately 9 miles long. L-85 is a part of the ECPL, acting as a barrier between STA-1E and the urban areas to the east as well as holding water in STA-1E for treatment.

2.3.4.1.2 Levee 40 (L-40)

L-40 forms the western boundary of STA-E as well as the eastern boundary of WCA-1. The total length is approximately 29 miles from West Palm Beach Canal to Hillsboro Canal at the junction with L-36 (WCA-2A). L-40 is considered part of the ECPL. L-40 has a construction grade ranging from 26.0 feet to 27.0 feet, NGVD and provides for the management of floodwater. L-40 contains a gated spillway, S-39, and four SFWMD structures, G-94A, G-94C, and G-94D. The L-40 Borrow Canal is on the west side of the levee.

2.3.4.2 Structures

Below is a list of the Federal water management structures located within STA-1E.

2.3.4.2.1 Structure G-311

G-311 is a three-bay gated spillway with a symmetrical ogee weir located at the northern edge of STA-1E south of S-5AS. The primary purpose of G-211 is to move water from the STA-1 Inflow Basin and into STA-1E, with a secondary purpose of moving water between STA-1E (federal) and 1W (non-federal). G-311 can also redirect flows from the S-319 pump station into the STA-1 Inflow Basin. G-311 can be operated remotely or manually.

2.3.4.3 Pump Stations

Below is a list of the Federal pump stations located within STA-1E.

2.3.4.3.1 Pump Station 319 (S-319)

S-319 is located on the C-51 at the northern rim of STA-1E, east of S-5AE and west of S-155A. S-319 pumps water from the C-51 canal into STA-1E with five diesel engine-driven pumps which have a total capacity of 3,980 cfs. S-319 releases water into the East Distribution Cell and can then be routed to the eastern and central flow-ways, where it acts as the primary inflow structure. S-319 can be operated remotely or manually. S-319 was designed to pump all permitted inflows to STA-1E (generally at a rate of one inch per day) plus seepage inflow from C-51.

2.3.4.3.2 Pump Station 362 (S-362)

S-362 is located at the southern tip of STA-1E on the L-40 Borrow Canal which is inside WCA-1. S-362 acts as the primary outflow pumping station moving treated water from STA-1E into WCA-1. S-362 consists of seven pumps: five diesel-driven pumps and two electric motor

driven pumps with a combined nominal capacity of 4,200 cfs. S-362 can be operated remotely or manually. The design pumping capacity is equivalent to the inflow pump stations S-319 and S-361 and direct rainfall over STA-1E.

2.3.4.3.3 Pump Station 361 (S-361)

S-361 is located immediately east of STA-1E and provides flood damage reduction to the lands to its south and east. These areas were previously managed by C-51, but with the addition of STA-1E, S-361 was needed to provide management of those areas similar to before construction. S-361 also acts as seepage control for STA-1E. The design capacity of S-361 is 75 cfs provided by three vertical electric pumps (diesel power available as backup). S-361 can be operated remotely or manually.

2.3.5 Water Conservation Area 1 (WCA-1)

WCA-1, with an area of 221 square miles, is completely contained by Levee 7 (L-7), L-40 and L-39. Inflows to WCA-1 can occur from STA-1 through a Federal pump station (S-362 at STA-1E), through non-Federal structures (G-300, G-301 at STA-1W) and non-Federal pump stations (G-251 and G-310 at STA-1W). Additional inflows to WCA-1 from Federal pump station 5A (S-5A) (G-300 and G-301) as well as from Federal pump station S-6 (through non-Federal structure G-338). Releases from WCA-1 are made through the three major Federal outlet structures, S-10A, S-10C, and S-10D, and two smaller spillways S-39 and S-5A(S). Non-Federal WCA-1 outflow structures G-94A, G-94C and G-94D located on L-40 are mainly used for water supply deliveries to the agricultural and urban areas to the east of WCA-1. Outflows can also be made out of G-338.

2.3.5.1 Levees

Below is a list of the Federal levees associated with WCA-1.

2.3.5.1.1 Levee 7 (L-7)

L-7 begins at the Hillsboro Canal, Pump Station 6 (S-6) and extends 17.0 miles to the West Palm Beach Canal defining the northwest boundary of WCA-1. L-7 provides for the conservation of floodwater runoff with a construction grade elevation ranging from 21.3 feet to 22.0 feet, NGVD.

2.3.5.1.2 Levee 40 (L-40)

L-40 forms the eastern boundary of WCA-1 and extends southward 28.8 miles from West Palm Beach Canal to Hillsboro Canal at the junction with L-36 (WCA-2A). L-40 is considered part of the ECPL. -40 has a construction grade ranging from 26.0 feet to 27.0 feet, NGVD and provides for the management of floodwater. L-40 contains a gated spillway, S-39, and four SFWMD structures: G-94A, G-94C, and G-94D. The L-40 Borrow Canal is on the west side of the levee.

2.3.5.1.3 Levee 39 (L-39)

L-39 separates WCA-1 and WCA-2. L-39 runs for approximately 13.0 miles along the south side of Hillsboro Canal from Pump Station S-6 to L-40 and contains S-10A, S-10C, and S-10D for water releases from WCA-1 into WCA-2. Construction grades of L-39 range from 21.0 feet to 27.0 feet, NGVD.

2.3.5.2 Structures

Below is a list of the Federal water management structures located within WCA-1.

2.3.5.2.1 Structure 5A East (S-5AE)

S-5AE is a double-barrel, reinforced concrete box culvert located on C-51 (West Palm Beach Canal) at the L-40 intersection. S-5AE has a design discharge of 700 cfs. S-5AE functions primarily with S-219 but also with with S-5AW, S-5AS, and S-5AE to manage runoff and provide water supply releases to the C-51 east of L-40. L-8 Basin runoff can be moved through S-5AE via C-51 to tide.

2.3.5.2.2 Structure 5A South (S-5AS)

S-5AS is a gravity flow spillway located in the L-8 Borrow Canal south of C-51 where L-7 intersects the L-40 Borrow Canal. S-5AS has a design discharge of 2,000 cfs controlled by two cable operated, vertical lift gates. S-5AS functions with S-5AE, S-5AW, and S-5A to manage flood runoff from the L-8 basin via STA-1E and/or STA-1W as well as to make water supply releases from WCA-1. Recent retrofit of the structure allows runoff flows moving in the north direction to be captured at the L-8 FEB, or diverted to STA-1E via S-5AE and S-319.

2.3.5.2.3 Structure 5AW (S-5AW)

S-5AW is a double-barrel, reinforced concrete box culvert located on the C-51 at the intersection of the L-8. S-5AW has a design discharge of 700 cfs controlled by motor operated sluice gates. S-5AW functions with S-5AE, S-5AS, and S-5A to control irrigation releases in the L-10 and L-12 basins as well as to pass flood runoff from L-8 Borrow Canal and C-51 into WCA-1 via the S-5A and STA-1.

2.3.5.2.4 Structures 10A, 10C, and 10D (S-10A, S-10C and S-10D)

S-10A, S-10C, and S-10D (S-10s) are located in L-39 on the southwest boundary of WCA-1 approximately 15 miles west of Boca Raton. The S-10s are gated, four-bay, spillways with a combined design discharge of 14,400 cubic cfs. The S-10s are the primary outlet structures for releases from WCA-1 to WCA-2. The S-10s can be operated manually or remotely by the Jacksonville District Water Management Section.

2.3.5.2.5 Structure 39 (S-39)

S-39 is a gated reinforced concrete spillway located where L-40 crosses the Hillsboro Canal. S-39 has a design discharge of 800 cfs controlled by one remotely or manually operated tainted

gate. The primary purpose of S-39 is to release water from WCA-1 to the Hillsboro Canal for water supply during dry periods. S-39 has also been used to send water east to tide from WCA-1.

2.3.5.3 Pump Stations

Below is a list of the Federal pump stations located within WCA-1.

2.3.5.3.1 Pump Station 5A (S-5A)

S-5A is located west of S-5AW near the intersection of L-40, L-8 Borrow Canal, C-51, and L-12 Borrow Canal. S-5A has six pumps with a total capacity of 4,600 cfs. S-5A pumps water from the L-12 Borrow Canal, L-8 Borrow Canal, and C-51 into WCA-1 via STA-1 primarily for flood damage reduction. Recent retrofit of the structure allows runoff flows moving in the north direction to be captured at the L-8 FEB, or diverted to STA-1E via S-5AE and S-319.

2.3.5.3.2 Pump Station 6 (S-6)

S-6 is located in northern end of the Hillsboro Canal at the junction of L-7 and L-6. S-6 has three pumps for a total capacity of 2,925 cfs and pumps water from the Hillsboro Canal into WCA-2 via STA-2. S-6 may also operate in conjunction with non-Federal structure G-338 to send untreated water to WCA-1 in the event of extreme high water upstream of WCA-1. Also, when conditions warrant, S-6 may also be used to move Lake Okeechobee releases south for treatment in STA-2.

2.3.5.3.3 Pump Station 362 (S-362)

S-362 is located at the northern end of the L-40 Borrow Canal and is the outflow pumping station for STA-1E. S-362 has seven pumps: five diesel engine-driven pumps (three 960 cfs pumps and two 550 cfs pumps) and two additional 110 cfs electric motor driven pumps, for a combined nominal capacity of 4,200 cfs. S-362 is used to pump treated water from STA-1E project into WCA-1.

2.3.6 Water Conservation Area 2 (WCA-2)

WCA-2 is located south of WCA-1, north of WCA-3 and is 210 square miles, subdivided by L-35B into WCA-2A and 2B. The Hillsboro Canal separates WCA-2 from WCA-1 and the North New River Canal separates WCA-2 from WCA-3. A levee system encompasses WCA-2, including L-35B (the WCA-2A/WCA-2B divider levee), L-39 (border with WCA-1), L-6, L-35 (and L-35 Borrow Canal), L-35A, L-36, L-38E, and L-38W (and L-38 Borrow Canal). Inflows into WCA-2 occur through the Federal structures S-10s and S-7 and from STA-2 via non-Federal structures G-335 and G-436. Releases from WCA-2A are made through the three major Federal outlet structures, S-11A, S-11B, and S-11C (S-11s) into WCA-3A. Releases are also made from WCA-2A into WCA-2B through Federal structures S-144, S-145, and S-146. Additionally, releases can be made out of WCA-2A via Federal structure S-143 into the North New River Canal and east to tide via Federal structure S-38. Releases out of WCA-2B can be made through Federal structure S-124 to the North New River Canal.

2.3.6.1 Levees

Below is a list of Federal levees associated with WCA-2.

2.3.6.1.1 Levee 6 (L-6)

L-6 forms the northwestern boundary of WCA-2A. L-6 extends from the junction of the Hillsboro Canal with L-7 (S-6 Pump Station) to the junction of the North New River Canal with L-5 (S-7 Pump Station). L-6 consists of a low interior levee on the northwest side and a high exterior levee on the southeast side with a Borrow Canal in between. As part of the outer-encirclement perimeter levees, L-6 protects the agricultural land to the northwest from water in WCA-2 and hurricane driven wind tides and waves. L-6 Borrow Canal contains the non-Federal divide structures G-336A-F and G-336G which release from STA-2 into the northeast and southwest segments of the L-6 Borrow Canal, respectively. Treated releases from STA-2 via G-336G (non-federal) enter an area of WCA-2A along a gap in the L-6 levee, located just north of S-7. L-6 on the exterior is approximately 11 miles long and approximately 11 miles for the interior portion.

2.3.6.1.2 Levee 35 (L-35)

L-35 forms the southern boundary of WCA-2B. L-35 begins at S-34E and extends southeast along the north bank of North New River Canal from the junction of L-37 with North New River Canal to the south end of L-35A. L-35 is approximately 5 miles long and protects lands to the south and east of the levee from water within WCA-2B.

2.3.6.1.3 Levee 35A (L-35A)

L-35A forms the southeastern boundary of WCA-2B. It extends approximately 6 miles northeastward from the southeast end of L-35, on the north bank of North New River Canal, and connects to the south end of L-36. Along with the other perimeter levees, L-35A protects the urban areas to the east from water within WCA-2 and hurricane driven wind tides and waves. L-35A is considered part of the ECPL. L-35A Borrow Canal contains S-124.

2.3.6.1.4 Levee 35B (L-35B)

L-35B originates where U. S. Highway 27 crosses S-11A ends at the western end of Pompano Canal (C-14). L-35B is an interior levee between WCA-2A and WCA-2B which is subject to overtopping during hurricane wind tides and wave run-up. L-35B contains three culvert structures, S-144, S-145, and S-146. L-35B has the dual function of controlling wind tides and waves in WCA-2B and providing a more adequate means of regulating the water levels within the WCA-2.

2.3.6.1.5 Levee 36 (L-36)

L-36 forms the eastern boundary of WCA-2. L-36 extends north from the north end of L-35A to S-39 at the junction of L-40 with the Hillsboro Canal. L-36 contains Structures 38 and 38B. Along with the other perimeter levees, L-36 protects the eastern urban area from water within

WCA-2 and hurricane driven wind tides and waves. L-36 is approximately 11 miles long and is considered part of the ECPL.

2.3.6.1.6 Levee 38 (L-38E and L-38W)

L-38, consisting of L-38 East (L-38E) and L-38 West (L-38W), forms the southwest boundary of WCA-2A, separating WCA-2 and WCA-3. L-38 is parallel to and on both sides of U.S. Highway 27, extending southeast from S-7 to S-11C and then south to S-34E. L-38 is approximately 5 miles long and provides flood damage prevention for U.S. Highway 27. L-38 contains spillway structures S-11A, 11B, and 11C and a weir structure S-141.

2.3.6.2 Structures

Below is a list of the Federal water management structures located within WCA-2.

2.3.6.2.1 Structures 11A, 11B and 11C (S-11A, S-11B and S-11C)

S-11A, S-11B, and S-11C (S-11s) are located in L-38 approximately 2 miles north of where U.S. Highway 27 and State Road (S.R.) 84 intersect, and are spaced approximately two miles apart. The S-11s are gated, four-bay spillways which are the main outlets for WCA-2 and have a total design discharge of 17,200 cfs. Water flows west from WCA-2A into WCA-3A. The S-11s are operated manually at the direction of the Jacksonville District Water Management Section.

2.3.6.2.2 Structure 34E (S-34E) (formerly S-34)

S-34E, formerly named S-34, was completely rebuilt by the SFWMD in 2019 and re-named S-34E. S-34E is located in North New River Canal where the L38E canal meets the L35 canal, northeast of the I-75 and U.S. Highway 27 intersection in west Broward County. S-34E is a double-barrel corrugated aluminum pipe (CAP) gated culvert which releases water from WCA-2 to provide water supply along the North New River Canal during dry periods and has a total design discharge of 600 cfs. If conditions warrant, S-34E may also release floodwater from WCA-2A and/or WCA-2B into North New River Canal.

2.3.6.2.3 Structure 38 (S-38)

S-38 is a double-barrel corrugated metal pipe culvert (CMP) located in L-35B in the southeast corner of WCA-2A where L-36, C-14, and L-35B Borrow Canal intersect. S-38 has a design discharge of 500 cfs with sluice gates which can be controlled remotely or manually. S-38 releases water from WCA-2A for management of water in the area as well as provides water supply in the area served by C-13 (via S-38C) and C-14.

2.3.6.2.4 Structure 38A (S-38A)

S-38A is a double-barrel CMP culvert, located in the L-36 Borrow Canal on the east perimeter of WCA-2, just north of C-14. S-38A has a total design discharge of 190 cfs controlled by two dual variable crests, manually operated, multi-leaf slide gates. S-38A, together with S-38B, controls the seepage from WCA-2A and release from the North Springs Improvement District (NSID)

Pump Station at S-38B by regulating water in the southern part of L-36 Borrow Canal. S-38A has a design flow of 190 cfs.

2.3.6.2.5 Structure 38B (S-38B)

S-38B is a single-barrel CMP culvert located in the L-36 Borrow Canal approximately mid-way between S-38 and S-39. Flow at S-38B is controlled by a slide gate mounted on the upstream (north) side of the structure. This culvert helps control the seepage from WCA-2A by regulating the water level in the southern half of the L-36 Borrow Canal.

2.3.6.2.6 Structure 38C (S-38C)

S-38C is a double-barrel CMP culvert located in the L-36 Borrow Canal south of C-14 and S-38. Flow at S-38C is controlled by flashboards on the upstream (north) side of the structure. S-38C releases water in L-36 Borrow Canal south of C-14.

2.3.6.2.7 Structure 39A (S-39A)

The structure, a rectangular, double-barrel reinforced concrete, gated culvert located in southern Palm Beach County at the northern end of the L-36 Borrow Canal near its junction with the Hillsboro Canal, is adjacent to WCA-1 and 2A. S-39A has a design discharge capacity of 700 cfs. S-39A gates can either be remotely or manually operated.

2.3.6.2.8 Structure 124 (S-124)

S-124 is gated, three-barrel, reinforced concrete box culvert, located in the L-35A Borrow Canal immediately north of North New River Canal. S-124 is a divide structure between the C-13 and North New River Basins and has a design discharge of approximately 550 cfs, controlled by sluice gates. S-124 functions together with S-125, S-38C and S-36 to control the water elevation in the C-13 Basin, east of WCA-2 by releasing excess water from the C-13 Basin to the North New River Canal. S-124 also helps control seepage through L-35A from WCA-2B.

2.3.6.2.9 Structure 141 (S-141)

S-141 is a three-bay, variable height weir structure located at the southwest corner of WCA-2B, in L-38E approximately 175 feet east of U.S. Highway 27. S-141 has a design discharge of approximately 435 cfs controlled by manually operated, twin stem, stainless steel downward-opening slide gates on the upstream (east) side of the structure. S-141 helps manage the water level in WCA-2B by releasing to the North New River Canal.

2.3.6.2.10 Structure 143 (S-143)

S-143 is a double-barrel CMP culvert located in the L-35B and North New River Canal, south of S-11A. Flow at S-143 is controlled by two manually operated sluice gates which releases water from WCA-2A to the North New River Canal via S-34E. The design flow of S-143 is approximately 500 cfs.

2.3.6.2.11 Structures 144, 145 and 146 (S-144, 145, and 146)

S-144, S-145, and S-146 are single-barrel culverts located in interior L-35B which separates WCA-2A from WCA-2B located five, seven and nine miles east of U.S. Hwy. 27, respectively. S-144, S-145, and S-146 have a design discharge of 210 cfs each controlled by one manually operated sluice gate at each structure. S-144, S-145, and S-146 move water from WCA-2A into WCA-2B.

2.3.6.3 Pump Stations

Below is a list of the Federal pump stations located within WCA-2.

2.3.6.3.1 Pump Station 7 (S-7)

S-7 is located in the North New River Canal at the junction of L-18, L-5, L-6, and L-38. S-7 has a gravity flow spillway and three pumps which have a total design discharge of 2,490 cfs. S-7 moves water from STA 3/4 via the North New River Canal into WCA-2A. Water from STA 3/4 must first pass through non-Federal structure G-371 in the North New River Canal before reaching S-7 and WCA-2. Also, when conditions warrant, S-7 may also be used to move Lake Okeechobee releases south for treatment in STA 3/4.

2.3.7 Water Conservation Area 3 (WCA-3)

WCA-3 is the largest of the three conservation areas, encompassing 925 square miles. WCA-3 is subdivided into WCA-3A and WCA-3B by parallel levees, L-67A and L-67C. The Miami Canal crosses WCA-3 from northwest to southeast to facilitate the flow of water through WCA-3. An interior levee system in the southeastern corner of WCA-3 reduces seepage into an extremely pervious aquifer. WCA-3 outer perimeter levees consist of L-4, L-5, L-38 (which separates WCA-3 from WCA-2A and 2B), L-37, L-33, L-30, L-29, and L-28 which contains a gap to allow for natural drainage from Collier County. Interior levees within WCA-3 include L-67A and L-67C, and L-68A. L-67 Extension (L-67 Ext.) extends south from the junction of L-30 and L-29 into ENP for about 6 miles. The L-67 Ext was designed to permits water deliveries from WCA-3A to Shark River Slough (SRS) via S-12s while reducing the depth and duration of flooding in the area formerly known as Southwest Dade County, which is now known as Northeast Shark River Slough (ENP Expansion Area).

Water can enter WCA-3A from WCA-2A via Federal structures S-11A, S-11B, and S-11C. Water can also enter WCA-3 from the STAs via Federal structures S-150 and S-8 as well as non-Federal structures G-404. Water can also enter WCA-3 from the east urban areas via S-9 and S-9A, from the west at S-140 and from the SBC Basin at S-190. Water leaves WCA-3 southward into ENP via the main Federal outlet structures S-12A, S-12B, S-12C, and S-12D. Water can move out of WCA-3A west into BCNP through Federal structures S-343A, S-343B, and S-344. Water can move out of WCA-3A to the east into L-29 Borrow Canal via Federal structure S-333. Water can move out of WCA-3A into WCA-3B via Federal structures S-151 and S-152. Water can move out of WCA-3B east via Federal structures S-31 and S-337 as well as south into the L-29 Borrow Canal and ENP via S-355A and S-355B. WCA-3 contains internal structures which include Federal structures S-31, S-32, S-32A, S-337, S-339, S-340, and S-335.

2.3.7.1 Levees

Below is a list of Federal levees associated with WCA-3.

2.3.7.1.1 Levee 4 (L-4)

L-4, approximately 3.5 miles long, and L-5 form the northern boundary of WCA-3A. L-4 begins west of the northwest corner of WCA-3A at the junction of L-28 and follows the Palm Beach-Broward County line eastward for approximately 6.5 miles to the Miami Canal. L-4 consists of a low interior levee on the north side (near Rotenberger Wildlife Management Area) and a high exterior levee on the south side with a Borrow Canal in between. L-4 consists of approximately 3.5 miles of the northern WCA-3A boundary.

2.3.7.1.2 Levee 5 (L-5)

L-5, approximately 14.5 miles long, extends from the Miami Canal to the North New River Canal along the Palm Beach-Broward County line. Along with L-4, it forms the northern boundary of WCA-3A. L-5 consists of a low interior levee on the north side (near Holey Land Wildlife Management Area - STA 3/4) and a high exterior levee on the south side with a Borrow Canal in between. The gated spillway for S-8 is located in the L-5.

2.3.7.1.3 Levee 28 (L-28)

L-28 forms the west boundary of WCA-3A and is approximately 19.5 miles long. L-28 contains a tieback levee to allow natural drainage to enter WCA-3A from Collier County. Pump Station S-140 and culvert structure S-344 are located in L-28. The L-28 Borrow and L-28 Interceptor Canals are located adjacent to the L-28.

2.3.7.1.4 Levee 29 (L-29)

L-29 forms the southern boundary of WCA-3A and extends easterly to join L-30 at the southeast corner of WCA-3B. L-29 contains structures S-12A, S-12B, S-12C, S-12D, S-14, S-333, S-334, S-343A, S-343B, S-355A and S-355B. The top of L-29 Levee spanning from S-343A to S-333 is the western portion of the Tamiami Trail (U.S. Highway 41). East of S-333, L-29 Levee and the Tamiami Trail are separated with L-29 Levee positioned north of the L-29 borrow canal and the Tamiami Trail maintained its eastward path and is located south of the L-29 borrow canal.

2.3.7.1.5 Levee 30 (L-30)

L-30, approximately 14 miles long, forms the southeast side of WCA-3B. L-30 begins at L-29 where it intersects with L-31N. L-30 runs north and crosses over the Miami Canal to S-32A. L-30 contains S-335, S-337, and S-31. S-32A is at the north end of L-30 in the Dade-Broward Dike. L-30 is considered part of the East Coast Protective Levee.

2.3.7.1.6 Levee 33 (L-33)

L-33 is located west of U.S. Highway 27 is approximately 8 miles long and extends between the south Broward County line and L-37. L-33 and L-37 delineate the east perimeter of WCA-3B.

The Borrow Canal of L-33 is connected to the Miami Canal by S-32. L-33 is considered part of the ECPL.

2.3.7.1.7 Levee 38 (L-38E and L-38W)

L-38 consists of L-38 East (L-38E) and L-38 West (L-38W), forms the southwest boundary of WCA-2A, separating WCA-2 and WCA-3 and is approximately 5 miles long. L-38 is parallel to and on both sides of U.S. Highway 27, extending southeast from S-7 to S-11C and then south to S-34E. L-38 provides flood damage prevention for U.S. Highway 27. L-38 contains spillway structures S-11A, 11B, and 11C and a weir structure S-141.

2.3.7.1.8 Levee 67A (L-67A)

L-67A begins at spillway structure S-333 in the L-29 and extends northeast for approximately 26 miles to L-33, south of Pump Station 9 in the North New River Canal. L-67A contains Structure 151. L-67A reduces seepage under east side L-30 and 33 of WCA-3A. The L-67A Borrow Canal is located adjacent to L-67A.

2.3.7.1.9 Levee 67C (L-67C)

L-67C begins at the L-67A north of the S-333 structure and runs in the northeast direction east of and parallel to L-67A. L-67C connects again to the L-67A approximately 1.3 miles south west of pump station S-9. L-67C reduces seepage under the east side (L-30 and 33) of WCA-3A.

2.3.7.1.10 Levee 67 Extension (L-67 Ext)

L-67 Extension begins at L-67A near S-333 and extends south into ENP for approximately eight miles (four miles were degraded in 2002).

2.3.7.1.11 Levee 68A (L-68A)

L-68A originates at the junction of L-37 and C-11 Extension and extends northward parallel to and approximately one mile west of L-37, ending where L-37 and North New River Canal intersect. L-68A reduces seepage under the ECPL and is part of the Davie Agricultural Area Levee System.

2.3.7.1.12 Levee 37 (L-37)

L-37 originates at the junction of L-68A and C-11 Extension and extends northward parallel to and approximately one mile east of L-68A, ending where L-68A and North New River Canal intersect. L-37 reduces seepage under the ECPL and is approximately 6 miles long.

2.3.7.2 Structures

Below is a list of the Federal water management structures located within WCA-3.

2.3.7.2.1 Structure 12 (12A, B, C, and D)

S-12A, S-12B, S-12C, and S-12d (the S-12s) are all four gated spillways. The S-12 structures are gated spillways located in L-29 (U.S. Highway 41) on the southern perimeter of WCA-3A

and are considered the main outflow from WCA-3A. Flow at each S-12 structure is controlled by six cable operated vertical lift gates. The S-12s have a design discharge capacity is 32,000 cfs at a stated headwater elevation of 12.4 feet, NGVD, and a tailwater elevation of 11.9 feet, NGVD. However, based on review of actual stage-flow measurements by the U.S. Geological Survey (USGS) at the structures, the S-12s may not be able to achieve this design discharge capacity due to several limiting factors including, but not limited to, tailwater constraints and limited headwater/tailwater differential. The S-12s provide an important source of flow into ENP.

2.3.7.2.2 Structure 14 (S-14)

S-14 is located in the L-29 immediately west of S-12A. S-14 has a design discharge of 500 cfs with two manually operated sluice gates. The purpose of S-14 is to provide gravity drainage from L-28 borrow pit to ENP; however, S-14 has not functioned as intended and is normally closed.

2.3.7.2.3 Structure 31 (S-31)

S-31 is a three-barrel culvert that is located where L-30 crosses the Miami Canal. S-31 releases water from WCA-3B into the Miami Canal and has a design discharge of 700 cfs controlled by remotely operated sluice gates. S-31 helps regulate water levels in WCA-3B. If conditions necessitate, S-31can be used in conjunction with S-151 to help release water from WCA-3A to the tide.

2.3.7.2.4 Structure 32 (S-32)

S-32 connects the Miami Canal and the borrow canal of L-33. S-32 is located in a county road adjacent to the Miami Canal. Flow at S-32 is controlled by manually operated sluice gates and controls drainage of the area between L-33 and U.S. Highway 27. S-32 allows water to be stored upstream of Miami Canal and released during periods of low flow which helps to reduce seepage under L-33.

2.3.7.2.5 Structure 32A (S-32A)

S-32A is a gated culvert structure at the north end of L-30 immediately south of the Miami Canal. Flow at S-32A is controlled by a manually operated sluice gate. S-32A operates in conjunction with S-335, to prevent seepage under L-30 from WCA-3B, and facilitates the southward release of water at S-335.

2.3.7.2.6 Structure 142 (S-142)

S-142 is a doubled-barrel culvert located east of U. S. Highway 27 in L-38W and is located between S-34E and S-11A. S-142 has a design discharge of 500 cfs and is controlled by remotely operated sluice gates. S-142 releases water from WCA-3A to supply water along the North New River Canal.

2.3.7.2.7 Structure 150 (S-150)

S-150 is a three-barrel, cast-in-place concrete culvert located on the northern perimeter of WCA-3A in L-5 near the intersection of L-38W. S-150 has a design discharge of 1,000 cfs and is controlled by remotely operated slide gates. S-150, together with S-7 and S-8 releases water from STA 3/4 into WCA-3A.

2.3.7.2.8 Structure 151 (S-151)

S-151 is a six-barrel CMP culvert located in L-67A in the Miami Canal approximately 6.5 miles northwest of S-31. S-151 has a design discharge of 1,105 cfs and is controlled by remotely operated sluice gates. S-151 releases water from WCA-3A to South Miami-Dade County and along the Miami Canal for WCA-3A regulation and water supply needs and to maintain water levels in WCA-3B. S-151 also provides capacity for water releases through structure S-31 to the east coast. An in-kind replacement of S-151 was completed by SFWMD in 2019 and is projected to return to service in June 2020. The new structure is a four eight by eight foot cast-in-place concrete box culvert structure with single leaf slide gates.

2.3.7.2.9 Structure 152 (S-152)

S-152 is a ten-barrel, 60-inch diameter, high-density polypropylene culvert located in the L-67A canal approximately 12.3 miles southwest of S-151. S-152 flow is controlled by manually operated vertical slide gates. S-152 operates to move water from WCA-3A into WCA-3B and has a design discharge of 750 cfs. S-152 is meant to be a temporary structure constructed as part of the Decomp Physical Model (DPM) field test.

2.3.7.2.10 Structure 190 (S-190)

S-190 is a reinforced concrete, gated spillway with release controlled by two cable operated vertical lift gates. S-190 is located on the L-28 Interceptor Canal (northwest WCA-3A) and it maintains optimum upstream water control stages in the east and west feeder canals; and prevents over drainage of these canals. S-190 has a design discharge of 2,960 cfs and serves as the connection between SBC Basin and WCA-3A.

2.3.7.2.11 Structure 339 (S-339)

S-339 is a sheet pile barrier dam located in the C-123 (the Miami Canal). S-339 is approximately six miles north of Everglades Parkway (I-75, Alligator Alley). S-339 has a release rate of 1,100 cfs and consists of a vertical wall across C-123 with three manually operated slide gates. S-339 prevents over drainage of the northern portion of WCA-3A and helps to transfer water to ENP, Metropolitan Miami, and areas of south Miami-Dade County.

2.3.7.2.12 Structure 340 (S-340)

S-340 is a sheet pile barrier dam located in the Miami Canal approximately 2.4 miles south of Everglades Parkway. S-340 has a release rate of 1,100 cfs and consists of a vertical wall across C-123 with three manually operated slide gates on the face of the wall. S-340 prevents over

drainage of the northern portion of WCA-3A and helps to transfer water to ENP, Metropolitan Miami, and areas of south Miami-Dade County.

2.3.7.2.13 Structure 343A (S-343A)

S-343A is a three-barrel CMP culvert located in the western portion of L-29 with flow controlled by slide gates. S-343A along with 343B, can divert up to 390 cfs from WCA-3A into BCNP to supplement outflows of WCA-3A into ENP.

2.3.7.2.14 Structure 343B (S-343B)

S-343B is identical to S-343A and is also in the western portion of L-29. S-343B is a gated culvert, and along with 343A, can divert up to 390 cfs from WCA-3A into BCNP to supplement outflows of WCA-3A into ENP.

2.3.7.2.15 Structure 344 (S-344)

S-344 is a two-barrel CMP culvert located where the Borrow Canal crosses from the east to the west side of L-28. S-344 has a release rate of 135 cfs and is controlled by a slide gate. S-344 may pass flow to eastern BCNP during dry conditions as well as release water from WCA-3A during wet conditions.

2.3.7.2.16 Structure 355A (S-355A)

S-355A is a single-bay, reinforced concrete ogee weir spillway with vertical lift slide gate controls. S-355A is located in levee 29 (L-29), north of both the L-29 Borrow Canal and U.S. Highway 41 (Tamiami Trail). S-355A has a design discharge of 1,000 cfs; however, flows of this magnitude have not been experienced through this structure. The primary function of S-355A is to make release out of WCA-3B into ENP.

2.3.7.2.17 Structure 355B (S-355B)

S-355B is a single bay, reinforced concrete ogee weir spillway with vertical lift slide gate controls. S-355B is located in L-29, north of both the L-29 Borrow Canal and Tamiami Trail. S-355B has a design discharge of 1,000 cfs; however, flows of this magnitude have not been experienced through this structure. The primary function of S-355B is to make release out of WCA-3B into ENP.

2.3.7.3 Pump Stations

Below is a list of the Federal pump stations located within WCA-3.

2.3.7.3.1 Pump Station 8 (S-8)

S-8 is in the Miami Canal at the junction of L-23, L-4, and L-5. S-8 has four axial-flow horizontal pumps as well as a gravity spillway. The spillway bay on S-8 is parallel to the pump bays. S-8 pumps and the spillway have a total design capacity of 4,160 cfs and 500 cfs, respectively. S-8 pumps water from STA 3/4 and STA 5 via the Miami Canal into WCA-3A.

Also, when conditions warrant, S-8 may also be used to move Lake Okeechobee releases south for treatment in STA 3/4 and 5.

2.3.7.3.2 Pump Station 9 (S-9)

S-9 is located at the junction of L-37 and C-11, approximately one-half mile west of U.S. Highway 27. S-9 has three pumps, with a combined design capacity of 2,880 cfs, to pump runoff generated in the east coast urban area into WCA-3.

2.3.7.3.3 Structure 9A (S-9A)

S-9A is located at the junction of L-37 and C-11, adjacent to S-9. S-9A has four pumps, with a combined design capacity of 500 cfs (2 diesel units at 175 cfs each and 2 electric units at 75 cfs each), to pump runoff generated in the east coast urban area into WCA-3. The purpose of S-9A is to help control seepage out of WCA-3A into C-11.

2.3.7.3.4 Structure 140 (S-140)

S-140 is in L-28 approximately 0.4 miles north of I-75 (alligator Alley) within the Miccosukee Indian Reservation. S-140 has a gated gravity spillway and three pumps with a design discharge of 1,300 cfs and the spillway has gravity design discharge rate of 300 cfs. The purpose of S-140 is to release excess drainage water from the Levee 28 Borrow Canal into WCA-3, at the rate of 7/16 inch per day from the tributary drainage area. The S-140 drainage area is 110 square miles north and east of the interceptor canal and west of L-28.

2.3.8 Everglades National Park-South Dade Conveyance System (ENP-SDCS)

The levees with in ENP-SDCS are L-29, L-30, L-31N, L-31W, L-315, L-316, L-332 Tieback, and L-357W. The structures within ENP-SDCS include S-18C, S-24A, S-173, S-176, S-177, S-178, S-194, S-196, S-197, S-199, S-316A, S-316B, S-316C, S-318, S-322F, S-322H, S-323A, S-323B, S-327, S-328, S-331, S-332B, S-332C, S-332D, S-332DX1, S-333, S-334, S-335, S-336, S-337, S-355A, S-355B, S-356 S-357, S-357N, S-360E and S-360W. L-29 and L-30 were included in the previous sections describing WCA-3. The canals with ENP-SDCS include C-1, C-4, C-6, C-102, C-103, and C-111. The levees and structures to be described here are all south of WCA-3 and west of Homestead, Florida. Sub-areas within the ENP-SDCS include 8.5 Square Mile Area (8.5 SMA or Las Palmas Community), the Northern Detention Area (NDA), the Southern Detention Area (SDA), and the S-332D Detention Area (DA).

2.3.8.1 Levees

Below is a list of Federal levees associated with ENP-SDCS.

2.3.8.1.1 Levee 31 North (L-31N)

L-31N is located in southeast Miami-Dade County and prevents overland flows from the Everglades area into the agricultural development in south Dade area. The L-31N Borrow Canal conveys runoff from the area between the levee drainage divide and the south Miami-Dade area southward into C 111, and L-31W Canal. Structures S-24A and S-173 and pump station S-331

are contained in this levee. Under certain conditions, the L-31N canal can be used to convey releases from WCA-3A.

2.3.8.2 Structures

Below is a list of the Federal water management structures located within ENP-SDCS.

2.3.8.2.1 Structure 18C (S-18C)

S-18C is a reinforced gated spillway located within the C-111 canal approximately 6 miles south of S-177. S-18C has a design discharge of 2,100 cfs and is controlled by two cable operated, vertical lift gates. S-18C is used to maintain a desirable freshwater head against northerly saltwater intrusion into C-111 and passes minimum required deliveries to the C-111 and flood releases to the eastern panhandle of ENP.

2.3.8.2.2 Structure 24A (S-24A)

S-24A, which is currently not operational, is in the L-31N canal approximately three miles south of the intersection of L-29 and L-31N. S-24A is a double-barrel 54-inch CMP culvert with sluice gates. The purpose of S-24A is to provide drainage of the area between L-31 and Krome Avenue (S.R. 997) solely for flood damage reduction.

2.3.8.2.3 Structure 173 (S-173)

S-173 is a single-barrel concrete pipe culvert located at the drainage divide on the L-31N Borrow Canal adjacent to S-331. S-173 has a design discharge of 100 cfs and is controlled by a remotely operated sluice gate. S-173 may be used in conjunction with S-331 to pass water south to protect areas to the west including the 8.5 SMA of L-31N.

2.3.8.2.4 Structure 176 (S-176)

S-176 is a gated spillway located in C-111 approximately five miles west of Homestead, Florida. S-176 has a design discharge of 630 cfs. S-176 together with S-332B, S-332C and S-332D, maintains a desirable water control stage upstream in L-31N Borrow Canal. S-176 also passes the design flood (40% of the SPF) without exceeding upstream flood design stage, and restricts downstream flood stages and velocities to non-damaging levels. S-176 can also be used for water supply and salinity control at S-18C.

2.3.8.2.5 Structure 177 (S-177)

S-177 is a gated spillway located in C-111 south of S.R. 27. S-177 has a design discharge of 1,400 cfs. S-177 helps to maintain stages upstream in C-111, passes the design flood (40% of the SPF), and during floods helps to restrict downstream stages and velocities to non-damaging levels. S-177 can also be used for water supply and salinity control at S-18C.

2.3.8.2.6 Structure 178 (S-178)

S-178 is a single-barrel gated culvert and is located at the north end of C-111E, approximately 110 feet upstream of S.R. 27. S-178 has a design discharge of 500 cfs. S-178 maintains optimum water control stages in C-111E, passes the design flood (40% of the SPF) and restricts downstream flood stages and velocities to non-damaging levels. S-178 flow is controlled by 2 manually operated gates.

2.3.8.2.7 Structure 194 (S-194)

S-194 is a double box concrete culvert structure located on C-102 (Princeton) Canal west of Krome Avenue (S.R. 997), about six miles upstream from S-165 and seven miles north of Homestead, Florida. S-194 has a design discharge of 190 cfs. Its control is effected by remotely controlled dual-leaf slide gates mounted on a reinforced concrete structure. S-194 functions as a drainage divide structure and a control for stages in C-102 to the west and may also convey either water supply or excess water from the L-31N Canal to the east when capacity is available. This structure was replaced in-kind by SFWMD in 2019.

2.3.8.2.8 Structure 196 (S-196)

S-196 is a single-barrel, reinforced concrete pipe culvert located on C-103 approximately 350 feet upstream from Richards Road. S-196 has a design discharge of 200 cfs and is controlled by a manually operated sluice gate. S-196 is a drainage divide structure and a control for stages in C-103. S-196 allows limited runoff to the east when capacity is available and provides supplemental water supply during dry periods.

2.3.8.2.9 Structure 197 (S-197)

S-197 is a four-barrel cast-in-place concrete box culvert located upstream of the mouth of the C-111 Canal approximately 3 miles from the shore of Manatee Bay and 750 feet east of U.S. Highway 1 in Southern Miami-Dade County. S-197 has a design discharge of 2,400 cfs and is controlled by manually operated vertical slide gates. It is anticipated that in the future S-197 will have remote and automated controls. S-197 is used to maintain optimum upstream water control stages in C-111 as well as prevents saltwater intrusion during high tides and blocks reverse flow during storm surges. S-197 may be opened for flood damage reduction.

2.3.8.2.10 Structure 327 (S-327)

S-327 is a concrete weir in the southern side of the C-111 SD high head cell (HHC). This weir is 1,600 feet long with crest elevation 8.1 feet NGVD, approximately 2.5-3.0 feet above grade. S-327 was previously 1,850 feet long; however, 250 feet of the weir was degraded to the existing lime rock surface.

2.3.8.2.11 Structure 333 (S-333)

S-333 is a gated spillway located on L-67 at the southeast corner of WCA-3A approximately 30 miles west of Miami. S-333 has a design discharge of 1,350 cfs and is controlled by a cable operated vertical lift gate. S-333 functions principally as a component of the conveyance system

which supplies water from WCA-3A to south and east Miami-Dade County to Shark River and Taylor Slough areas of ENP.

2.3.8.2.12 Structure 333N (S-333N)

S-333N is a gated spillway located at the intersection of L-67A and L-29 Borrow Canals adjacent to S-333. S-333N has a design discharge of 1,150 cfs and is controlled by vertical lift roller gates. S-333N is a component of the conveyance system which supplies water from WCA-3A to south and east Dade County to Shark River and Taylor Slough areas of ENP.

2.3.8.2.13 Structure 334 (S-334)

S-334 is a gated spillway located on the east end of L-29 Borrow Canal approximately 20 miles west of Miami and near L-30. S-334 has a design discharge of 1,230 cfs. As an element of the conveyance system, S-334 functions primarily to make supplemental water deliveries to south and east Miami-Dade County. S-334 can also be used to pass all or a portion of releases from WCA-3A made through S-333.

2.3.8.2.14 Structure 335 (S-335)

S-335 is a single bay spillway located at the south end of L-30 Borrow Canal, upstream of U.S. Highway 41, and west of State Highway 27. S-335 has a design discharge of 525 cfs and is controlled by a vertical operated vertical lift gate. S-335 functions mainly to make water deliveries to south and east Miami-Dade County, to Taylor Slough or to maintain the hydraulic ridge. S-335 may also be used to maintain optimum stages in the L-30 as well as make releases from WCA-3.

2.3.8.2.15 Structure 336 (S-336)

S-336 is a gated culvert located on the Tamiami Canal east of the junction of L-30 and L-31N Borrow Canals. S-336 has a design discharge of 145 cfs. S-336 can be used to divert flows via the L-30, L-31N, or L-29 Borrow Canals to supply water in east Miami-Dade County and ENP. S-336 also diverts floodwater from WCA-3A to the Tamiami Canal and when necessary can also help prevent saltwater intrusion in the eastern structures.

2.3.8.2.16 Structure 337 (S-337)

S-337 is a gated culvert located in L-30 where L-30 crosses the Miami Canal. S-337 has a design discharge of 605 cfs and operates together with S-31 and S-151 to release water from WCA-3 to supply water needs in south and east Miami-Dade County. In addition, S-337 may be used in conjunction with S-151 and S-335 to provide WCA-3A water for flows toward Taylor Slough and maintenance of the hydraulic ridge along the C-111 detention areas.

2.3.8.2.17 Structure 338 (S-338)

S-338 is a double-barrel CMP culvert located at the point where C-1 crosses Krome Avenue (S.R. 997) approximately 12 miles north of Homestead. S-338 has a design discharge of 170 cfs and is controlled by electric gear driven sluice gates. S-338 provides water supply releases

during dry periods and also provides flood damage reduction releases from the area between Krome Avenue and L-31N and north of S-331.

2.3.8.3 Pump Stations

Below is a list of the Federal pump stations located within ENP-SDCS.

2.3.8.3.1 Pump Station 331 (S-331)

S-331 is a three unit pumping plant located on the L-31N Borrow Canal approximately nine miles north of Homestead. S-331 has a design discharge of 1,160 cfs. S-173 is co-located with S-331 and may be used in conjunction with S-331 to pass water to the south. Whenever stages allow, syphon operations at S-331 are used to deliver water south. S-331 may be used for water supply, water deliveries to Taylor Slough and maintenance of hydraulic ridge in the C-111 detention areas, environmental water deliveries to Biscayne Bay, and flood mitigation of 8.5 SMA.

2.3.8.3.2 Pump Station 332B (S-332B)

S-332B is a five-unit pump station located approximately 5.5 miles south of S-331, along the L-31N canal. S-332B has four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pump with flap gates on downstream (discharge) side and has a design capacity of 575 cfs. S-332B pumps water from the L-31N canal and releases through five, 60 inch diameter pipes. Three of the S-332B pump outlets release 0.40 miles to the west (also called S-332BW) into the Southern Detention Area (SDA) while the two remaining pipe outlets release 0.13 miles to the northwest (also called S-332BN) into the Northern Detention Area (NDA). S-332B operates with S-332C, S-332D and S-176 to manage desired water levels in the L-31N Canal reach between S-331 and S-176.

2.3.8.3.3 Pump Station S-332C (S-332C)

S-332C is a five-unit pump station located approximately 7.80 miles south of S-331, along the L-31N canal on the west bank, in Miami-Dade County. S-332C has four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pump with flap gates on downstream side and has a design capacity of 575 cfs. The hydraulic design parameters for the S-332C pump station are the same as the S-332B pump station. S-332C releases into the middle section of the SDA and operates with S-332B, S-332D and S-176 to manage desired water levels in the L-31N Canal reach between S-331 and S-176

2.3.8.3.4 Pump Station 332D (S-332D)

S-332D is a five-unit pump station located approximately 10.25 miles south of S-331, along the L-31N canal. S-332D has four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pump with flap gates on downstream side and has a design capacity of 575 cfs. S-332D releases water directly into the Frog Pond high head cell which allows water to either flow north through S-332DX1 into the SDA or south into the Frogpond Detention Cell towards Taylor Slough. S-332D is used to pump water from the L-31N canal, upstream of S-176, into an S-332D Detention Area to facilitate flows to Florida Bay via Taylor Slough. S-332D is used with

S-332B, S-332C, and S-176 to manage desired water levels in the L-31N Canal reach between S-331 and S-176.

2.3.8.3.5 Pump Station 356 (S-356).

S-356 is a four-unit pump station located along Tamiami Canal adjacent to the S-334 gated spillway. S-356 has four (4) 125 cfs diesel engine-driven pumps with flap gates on downstream side for a total design discharge of 500 cfs. S-356 is intended to manage water stages in the L-31N and L-30 Canals between G-211 and S-335 by pumping water from the L-31 North canal west of S-334 structure into the L-29 Borrow Canal (Tamiami Trail Canal).

2.3.8.4 8.5 Square Mile Area

The 8.5 Square Mile Area (8.5 SMA) lies within a region commonly referred to as the Rocky Glades, occupying the western slope of the Atlantic Coastal Ridge. It is bounded on the west and north by a protective levee (L-357W) approximately seven miles in length, on the north by SW 104th Street, on the south by SW 168th Street (Richmond Drive), and separated from more intensively developed urban lands to the east by the L-31N flood protection levee and Borrow Canal. The 8.5 SMA is located in the East Everglades, approximately 20 miles southwest of Miami, approximately ten miles north of Homestead, and 6.6 miles south of U.S. Highway 41 (Tamiami Trail). The 8.5 SMA is bounded roughly on the west and north by North East Shark River Slough (NESRS), on the south by the Taylor Slough headwaters and on the east by the urban and agricultural areas east of L-31N. The outer perimeter levees are L-357W (which separates 8.5 SMA from NESRS) and L-31N. S-357 pumps in the 8.5 SMA detention cell which is comprised of the L-359 (perimeter levees) and interior levees L-360E and L-360W. Levees L-360E and L-360W direct water from S-357 into the Northern Detention Area (NDA). A seepage collection canal C-358 that situated between the southern border of the 8.5 SMA and northern border of the 8.5 SMA detention cell diverts seepage through S-357N to the headwater to S-357.

2.3.8.4.1 Levees

The levees in 8.5 SMA consist of the Levee 357 (L-357), Levee 357 West (L-357W), Levee 359 (L-359), Levee 360 East (L-3560E), and Levee 360 West (L-360W).

2.3.8.4.2 Levee 357 (L-357)

L-357 is located in Miami-Dade County within 8.5 SMA to provide flood mitigation in the area from water in ENP, specifically Shark River Slough. L-357 is approximately 13 miles long and includes a seepage canal through the middle of 8.5 SMA.

2.3.8.4.3 Canals

Below is a list of the Federal canals within the 8.5 SMA.

2.3.8.4.3.1 Canal 357 (C-357)

C-357 is a seepage collection canal located in the middle of 8.5 SMA. C-357 begins in the northern quadrant of 8.5 SMA near SW 136th Street and G-596 gauge, tracks westward for about

1.3 miles to the intersection of SW 136th Street and SW 205th Avenue, and then heads directly south for about 2.1 miles to the terminus at S-357 pump station. C-357 is designed to maintain groundwater levels within 8.5 SMA the same levels as existed prior to the implementation of the MWD Project.

2.3.8.4.3.2 Canal 358 (C-358)

C-358 is a seepage collection canal located at the southern boundary of 8.5 SMA and south of SW 168th Street. C-358 begins at the intersection of L-357 Levee and SW 168th Street and travels eastward for about 0.75 miles to the terminus at S-357N structure. C-358 was designed to provide flood mitigation to the southern area of 8.5 SMA.

2.3.8.4.4 Structures

Below is a list of the Federal water management structures located within 8.5 SMA.

2.3.8.4.4.1 Structure 357 North (S-357N)

S-357N is a three-barrel High Density Polyethylene (HDPE), gated culvert located on the C-358 seepage collection canal, which is just south and runs parallel to Richmond Drive, along the southern boundary of the 8.5 SMA. S-357N has a design discharge 325 cfs and is controlled by three manually operated double leaf slide gate systems which were designed to accommodate variable flow regimes: (1) weir flows by lowering the top gate; (2) orifice flows by raising the lower gate; or (3) submerged or un-submerged, uncontrolled flows by raising both the top and bottom gates above the top (crown) of the culvert. S-357N hydraulically connects the C-358 Seepage Canal to the C-357 Canal in order to provide flood mitigation for 8.5 SMA by discharging groundwater inflows from the southwest corner of 8.5 SMA into the upstream side of S-357 pump station.

2.3.8.4.5 Pump Stations

Below is a list of the Federal pump stations located within 8.5 SMA.

2.3.8.4.5.1 Pump Station 357 (S-357)

S-357 is a four-unit pump station located on the south end of the C-357 canal, approximately 3 miles west of Krome Avenue, and approximately 300 feet south of SW 168th Street (Richmond Drive) between SW 205th and SW 206th Avenues. S-357 has four (4) 125 cfs diesel engine-driven pumps and one (1) 75 cfs electric-driven pump. The purpose of S-357 is to help provide flood mitigation in the 8.5 SMA and to preserve hydroperiods within ENP.

2.3.8.5 C-111 South Dade Northern Detention Area (NDA)

The NDA receives inflows from the 8.5 SMA S-357 pump station via the 8.5 Detention Cell Flow-way (established by L-360E and L-360W). The NDA is located in the northern part of the Rocky Glades and is bounded on the west by the L-315 levee and on the east by the L-316 levee. The L-318 is a berm located inside of the western levee (L-315) of the NDA for the purpose of creating an internal flow-way used to maintain a hydraulic ridge that reduces seepage losses from

ENP to the east (including the L-31N Canal). The flow-way berm divides the NDA into two areas, the western flow-way area and an eastern detention area, which are connected via the S-318 weir. The western flow-way contains 640 acres and the eastern detention area contains 800 acres. The total acreage within the NDA area is approximately 1,440 acres. The berm is approximately 17,675 feet long (including the S-318 weir length of 3,000 feet). The area extends northward from the S-332B pump station to the 8.5 SMA Detention Cell. The NDA is provides a hydraulic ridge to reduce seepage losses from ENP between the 8.5 SMA Detention Cell and the S-332B pump station. A portion of the S-332B pump station capacity (up to 250 cfs) releases into the NDA, with the inflow location near the southeast corner of the NDA. The L-316 levee contains four emergency overflow weirs (S-316A, S-316B, S-316C and S-316D) on the eastern side of the NDA, with potential to release to the eastern buffer area if depths exceed approximately 3.5 feet. (Figure 2-1)

2.3.8.5.1 Levees

The levees contained within the NDA consist of the Levee 315 (L-315), Levee 316 (L-316) and Levee 318 (L-318).

2.3.8.5.2 Structures

The structures contained within the NDA consist of the emergency overflow weirs Structure 316A (S-316A), Structure 316B (S-316B), Structure 316C (S-316C) Structure 316D (S-316D) and the interior weir S-318.

2.3.8.6 C-111 South Dade Southern Detention Area (SDA)

The C-111 South Detention Area (SDA) is immediately south of the NDA but is not connected to NDA. The SDA extends from the S-332B pump station to the S-332D pump station. The SDA is bounded on the west by the L-320 levee and on the east by the L-322 levee. The SDA forms the hydraulic ridge to reduce seepage losses from ENP between the S-332B and S-332D pump stations. The SDA receives inflow from S-332B, S-332C, and S-332DX1. The SDA is approximately 300 feet wide and covers an area of approximately 1,310 acres. The L-321 berm is internal to the SDA and extends from S-332B south to S-332D. However there are corridors bounded by L-321 that allow flow into the SDA from S-332B and S-332C. L-321 contains three 800 feet long weirs L-321 weirs S-321A, S-321B, and S-321C that allow water to flow eastward toward L-322. The S-321A weir is positioned between S-332B and S-332C while weirs S-321B and S-321C are positioned between S-332C and S-332D. Three emergency overflow weirs are contained within L-322 (S-322F, S-322G, S-322H) on the eastern side of the SDA with the potential to release to the State-owned eastern buffer area if depths exceed approximately 3.5 feet. Also contained with L-322 weirs S-322A, S-322C, S-322E provide three evenly spaced controlled outflow locations from the northern portion of the SDA into the remnant Partial Connector Detention Area formed by L-323. Weirs S-323A and S-323B provide controlled outflow locations from the remnant Partial Connector Detention Area to the State-owned buffer lands east of the SDA (Reference Figure 2-1).

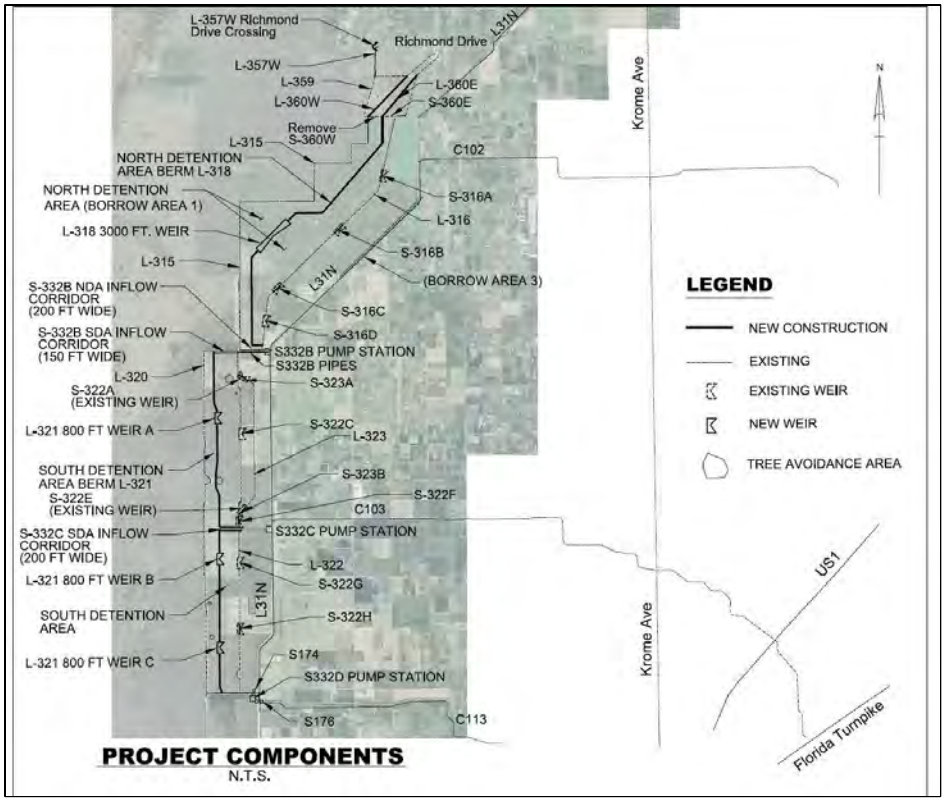


FIGURE 2-1: C-111 SOUTH DADE NDA AND SDA PROJECT AREA FEATURES

2.3.8.6.1 Levees

The levees contained within the NDA consist of the Levee 320 (L-320), Levee 321 (L-321), Levee 322 (L-322) and Levee 323 (L-323).

2.3.8.6.2 Levee 320, 321, 322, and 323 (L-320, L-321, L-322, and L-323)

The L-320, L-322 and L-323 are located in Miami-Dade County south of 8.5 SMA and form the Southern Detention Area. The Southern Detention Area provides floodwater storage for the 8.5 SMA.

2.3.8.6.3 Structures

The weir structures contained within the SDA include the weir structures titled Levee 321 (L-321A), L-321B, L-321C and Structure 322A (S-322A), S-322C, S-322E, S-322F, S-322G, S-322H, S-323A, S-323B.

2.3.8.6.3.1 Structure 332DX1 (S-332DX1)

S-332DX1 is a four-barrel corrugated aluminum pipe (CAP) structure located approximately 0.5 miles west of S-332D. S-332DX1 has a design discharge rate of 250 cfs and is controlled by vertical lift gates and may pass either way through the structure. Forward flow, is defined as the flow passing south to north, from the S-332D High Head Cell (HHC) to the Southern Detention

Area (SDA). Reverse flow would be considered from the SDA to the HHC. The purpose of S-332DX1 is to provide conveyance from Frog Pond HHC into the C-111 SDA.

2.3.8.7 S-332D Detention Area (DA)

The S-332D Detention Area consists of the S-332D High Head Cell (HHC) and the S-332D Detention Area (DA) Internal Weirs, Culverts, and Berms. The purpose of the HHC is to convey water from the S-332D pump station westward and then south over the S-327 weir into the S-332D DA. The northern levee of the S-332D DA is the southern side of the HHC, the western and southern levees of the detention area are the L-31W levee, and the eastern levee of the detention area are the L-329, L-328, and L-327 (formerly named the S-332D Tieback Levee). Internal weirs, culverts and berms and the S-205 weir release water complete the S-332D DA. Water flows south from the S-332D HHC (over S-327 weir) to two northern cells (Cell 1 and Cell 2), then south (over the S-329 weir) into the S-332D flow-way into the southernmost cell of the S-332 DA. Water then exits the S-332D DA through the 2,100-foot S-205 weir in the L-31W levee into Taylor Slough. The S-328 gated culvert, located in the southwest corner of Cell 1, provides the ability to release from Cell 1 into the L-31W canal to go around the southern portion of the S-332D Detention Area if necessary to ensure water deliveries reach Taylor Slough.

2.3.8.7.1 Levees

The levees contained within the S-332 DA consist of the L-31W, L-327, L-328 and L-329.

2.3.8.7.1.1 Levee 31 West. (L-31W)

L-31W extends from its junction with L-31N at the location of the S-332D pump station to the ENP boundary and then follows southward for approximately eight miles. L-31W prevents flooding from the ENP in agricultural and industrial areas to the east. L-31W Borrow Canal conveys flow and replenishes the fresh water supply in Taylor Slough. L-31W contains Federal culvert S-328, federal weir S-205, and non-Federal culvert G-737.

2.3.8.7.2 Structures

The structures contained within the S-332 DA consist of the weirs Structure 327 (S-327), weir Structure 329 (S-329) and gated culvert Structure 328 (S-328).

2.3.8.7.2.1 Structure 328 (S-328)

S-328 is an eight-barrel CMP culvert located in the southwest corner of Cell 1 of the S-332D Detention Area. S-328 flow is controlled by manually operated gates and has a design discharge of 500 cfs. S-328 may be used to make deliveries (up to 250 cfs) to Taylor Slough when S-332D flows are greater than 250 cfs. S-328 has a design discharge of 500 cfs.

2.4 RELATED CONTROL FACILITIES

The WCAs, ENP, and ENP-SDCS component of the C&SF Project are surrounded by other C&SF components which are described in Volumes 3 and 5 of this SOM. Volume 3 describes Lake Okeechobee and the Everglades Agricultural Area and describes upstream structures and regulation responsible parties. Volume 5 East Coast Canals describes the C&SF Project features operated by SFWMD and the various local drainage district network of canals, levees, pump stations, and/or water management infrastructure downstream of the WCAs, ENP, ENP-SDCS.

2.4.1 East Coast Canals (ECC)

Some ECC structures directly interact and affect operations of structures within the WCA, ENP, ENP-SDCS Basin. There are many features within the ECC Basin, which are discussed at full in Volume 5 of this SOM. Features which are relevant to this Basin are listed below, with some basic information, but Volume 5 should be consulted for full details.

2.4.1.1 Structure 22 (S-22)

S-22 is a single barrel corrugated metal pipe culvert located in the City of Miami at the N.E. 27th Avenue crossing of C-5. S-22 releases flood runoff and prevents saltwater intrusion into the C-5. Water levels at S-22 can affect operations at ENP-SDCS structure S-336.

2.4.1.2 Structure 25 (S-25)

S-25 is a single barrel corrugated metal pipe culvert located in the C-5 upstream of Northwest 27th Avenue at the exit ramp from SR 836. S-25 and controls upstream water levels to prevent saltwater intrusion and provide flood damage reduction.

2.4.1.3 Structure 25B (S-25B)

S-25B is a two bay reinforced concrete gated spillway located in the C-4 downstream of Northwest 42nd Avenue and south of Northwest 21st Street. S-25B controls upstream water levels to prevent saltwater intrusion and provide flood damage reduction.

2.4.1.4 Structure 381 (S-381)

S-381 is a water control structure with 2 pneumatically controlled bladder gates located on the C-11 to the east of U.S. Highway 27. S-381 is a divide structure and helps reduce seepage out of WCA-2 but can also be used to facilitate releases out of WCA-2 to the east or to convey C-11 West Basin runoff to S-9. S-9/S-9A operations can be affected by S-381.

2.5 REAL ESTATE ACQUISITION

Real estate acquisitions within WCA-ENP-SDCS have been completed in accordance with prior project authorizations including MWD, C-111 SD and CERP C-111 SC projects.

2.6 PUBLIC FACILITIES

The fish and wildlife resources within the WCAs have been separated into two areas, the Arthur R. Marshall Loxahatchee National Wildlife Refuge and the Everglades Wildlife

Management Area. The canals offer plenty of fishing and boating opportunities throughout the area and there have been numerous access sites and concession businesses developed for public use by federal, state and local agencies within these areas. The NPS manages the ENP consistent with its recognition as a national wilderness area.

2.6.1 Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR)

WCA-1 includes LNWR, the natural resources within the LNWR are managed by the U.S. Fish and Wildlife Service under an agreement with the SFWMD. The SFWMD also contracts concessions to commercial businesses and monitors them for compliance with these contracts. The Hillsboro Concession Facility (Loxahatchee Recreation Area), a daily fee full-service concession, exemplifies public use facilities as it consists of an interpretive center, nature boardwalk, wildlife observation area and a seven-mile canoe trail. Primary activities offered are fishing, boating, airboat rides and waterfowl hunting during the hunting season.

2.6.2 The Everglades Wildlife Management Area (EWMA)

The EWMA is located within WCA-2 and WCA-3. The Francis Taylor Wildlife Management Area, a portion of EWMA, is located within WCA-3B. These areas are managed by the Florida Fish and Wildlife Conservation Commission (FWC) under an agreement with SFWMD. Sawgrass Recreation Area, a concession corner of the area off U.S. Highway 27. A full service concession, the Everglades Holiday Park, is within WCA-3 and near pump station 9 (S-9). There are also private fish camps within the area. The primary activities are fishing, airboating, hunting, and frogging. The MTIF has use rights for the area in WCA-3 south of Alligator Alley.

2.6.3 Big Cypress National Preserve (BCNP)

The Big Cypress Swamp spans approximately 1,205 square miles (771,000 acres) from southwest of Lake Okeechobee to the Ten Thousand Islands in the Gulf of Mexico. The 570,000-acre BCNP was established by Big Cypress Enabling Legislation Public Law 93-440 in 1974 to protect natural and recreational values of the Big Cypress watershed and to allow for continued traditional uses such as hunting, fishing, and oil and gas production. It was also established to provide an ecological buffer zone and protect the ENP's water supply. In 1988, Congress passed the Big Cypress National Preserve Addition Act, Public Law 100-301, which added 146,000 acres to the BCNP.

2.6.4 Everglades National Park (ENP)

ENP spans the southern tip of the Florida Peninsula and most of Florida Bay, and is the only subtropical preserve in North America. ENP has been designated a World Heritage Site, and International Biosphere Reserve, and a Wetland of International Importance. Millions of people from all over the world visit ENP each year. In 2017, ENP received 1,018,557 visitors. Less than 0.1% (1,200 of the total 1.4 million acres) of ENP is developed. Visitors to the ENP can choose from activities such as nature study, sightseeing, fishing (both saltwater and freshwater), boating, canoeing, bird watching, hiking, and camping. Although charter fishing, group tours, and guided excursions are available, the park mainly offers primitive recreation experiences. The recreational facilities for public use include five visitor information center nature observation

sites, 48 designated backcountry (water-based) campsites, 3 campgrounds totaling 423 sites, 156 miles of trails (including canoe trails), 2 environmental education camps, 4 marinas and 5 boat ramps. The commercial concessions licensed by the National Park Service, to serve the area, consist of three air taxis to Fort Jefferson National Monument, 24 charter boats, six canoe outfitters, three nature photographers, and one bus company. ENP is home to more than 400 bird species, 25 mammal species, 60 amphibian and reptile species, 125 fish species, 55 threatened and endangered flora species and 13 endangered wildlife species.

This page intentionally left blank.

3 REGIONAL HISTORY

The purpose of this chapter is to provide information on non-Federal infrastructure relationship to the WCA, ENP, ENP-SDCS component of the C&SF Project. The historical progression of water management operations and documentation related to the WCA, ENP, ENP-SDCS component of the C&SF Project is also included.

3.1 AUTHORIZATION OF PROJECT

The C&SF Project, which includes the WCAs, ENP, ENP-SDCS components, began with the Flood Control Act of 1948 (P.L. 858, 80th Congress, 2nd Session), which authorized Phase 1 of the Comprehensive Plan for Flood Control and Other Purposes (Comprehensive Plan). However, the Federal participation began much earlier with the Rivers and Harbors Act of July 3, 1930, which established the first Federal effort of flood control in the C&SF Project area.

3.1.1 Flood Control Act of 1948

The Flood Control Act of 1948 (P.L. 858, 80th Congress, 2nd Session) authorized Phase 1 of the C&SF Project. Phase 1 consisted of levees, channels and control works of Lake Okeechobee; protection and major drainage of the EAA; conservation of water for control of regional groundwater levels; the protection of east coast urban areas from overflow from the Everglades; flood control and water control for salinity control in the existing urban areas along the east coast; and the main outlets for the WCAs.

3.1.2 Flood Control Act of 1950

Further authorization was contained in section 204 of the Flood Control Act approved May 17, 1950 (P.L. 516, 81st Congress, 2nd Session). This Act authorized most of the works necessary to afford flood protection to the rich agricultural development south of Lake Okeechobee and to the highly developed urban area along the lower east coast of the State.

3.1.3 Flood Control Act of 1954

The remainder of the Comprehensive Plan was authorized by the Flood Control Act of 1954 (P.L. 780, 83rd Congress, 2nd Session). The works authorized by the 1954 Act are presented in House Document 643. This included flood control, water conservation, and navigation in the upper St. Johns and Kissimmee River Basins; an increase in the outlet capacity of the Caloosahatchee River from Lake Okeechobee; the remainder of the protective levees for the EAA and the WCAs; and the remaining salinity barrier in South Dade County.

3.1.4 Flood Control Act of 1958

The Flood Control Act of 1958 (P.L. 85-500) authorized cost sharing for the project works authorized by the 1954 Act. It also authorized the deletion of several project works from the Comprehensive Plan. The 1958 Act also authorized flood protection for 64 square miles in Hendry County.

3.1.5 Flood Control Act of 1962

The Flood Control Act of 1962 (P.L. 87-874) authorized modification and extension of the C&SF Project for flood control and major drainage in the following areas: West Palm Beach Canal, Boggy and Shingle Creeks in the Kissimmee River Basin, South Dade County, and Cutler Drain area of Dade County.

3.1.6 Flood Control Act of 1965

The Flood Control Act of 1965 (P.L. 89-298) authorized flood protection projects in Hendry County and southwest Dade County. The 1965 Act also provided for a seasonal plan in southwest Dade County which would provide levees, canals, water control structures, and pump stations.

3.1.7 Flood Control Act of 1968

The ENP-SDCS was authorized under the Flood Control Act of 1968 (P.L. 90-483). It authorized modification to the existing project in accordance with Senate Document 101 and House Document 369, in the interest of improved conservation and distribution of available water to South Dade and Everglades National Park and extended flood protection.

3.1.8 River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970

This Act (P.L. 91-282) provided funding for the accelerated construction of canals and pump stations to meet the increased water requirements of the ENP. The Act further provided for the delivery from the project of a minimum of 315,000 acre-feet of water according to a monthly distribution and to locations stated in the NPS letter of October 20, 1967, to the Chief of Engineers, or 16.5 percent of total project deliveries for all purposes, whichever is less. Senate Document (S.D.) 91-895 which accompanied the law, provided a formula for deciding when the 16.5 percent quantity applied. The formula was found to be faulty and has not been applied since the earliest months of the application of this Act.

3.1.9 Supplemental Appropriations Act of 1984

This Act, (P.L. 98-181) modified the schedule for delivery of water from the C&SF Project to the ENP as required in the River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970. It also authorized, for a period of two years, an experimental program for the delivery of water to ENP for the purpose of determining an improved schedule for water delivery.

3.1.10 Joint Resolution of 1985

Section 115 of this Resolution (P.L. 99-190) amended the Supplemental Appropriations Act of 1984 (P.L. 98-181) by extending the date for completion of the experimental water delivery program to ENP to January 1, 1989.

3.1.11 Water Resources Development Act (WRDA) of 1988

The WRDA 1988 (P.L. 100-676) amended the Supplemental Appropriations Act of 1984 by extending the date for completion of the experimental water delivery program to ENP to January 1, 1989.

3.1.12 Everglades National Park Protection and Expansion Act of 1989

This Act (P.L. 101-229) modified the boundaries of the ENP to provide for the protection of lands, waters, and natural resources within the park and authorized the construction of modifications, based on the experimental program, to the C&SF Project to improve water deliveries to ENP and, to the extent practicable, to restore the natural hydrological conditions within ENP.

Section 104 (b)-(h) also authorized and directed the Secretary of the Army (Secretary) to construct a flood protection system for the residential area in the East Everglades and adjacent agricultural areas, if the Secretary determines those areas will be adversely affected by operation of the project. To protect agricultural areas, in accordance with this Act, the Secretary must find that there is a substantial reduction in the areas' present economic utility which is attributable solely to the project modification or the residential flood protection system. The Secretary was directed to review the operation of the modified project within 18 months, and periodically thereafter, to determine whether agricultural areas are being adversely affected and to protect the areas if necessary. However, any preventive measure shall be implemented in a manner that presents the least prospect of harm to the natural resources of ENP. The Secretary was also directed to coordinate the construction program with the Secretary of the Interior to permit the Park's expansion (land acquisition) program to proceed concurrently.

Section 104(j) required the preparation of a General Design Memorandum (GDM) for project works within the C-111 basin area of the East Everglades and directed that it take all measures which are feasible and consistent with the purposes of the project to protect natural values associated with ENP.

3.1.13 Energy and Water Development Appropriations Act of 1992

This Act (P.L. 102-104) authorized the continuation of the experimental water delivery program established under P.L. 98-181, Supplemental Appropriations Act of 1984, until the modifications to the C&SF Project authorized by the Supplemental Appropriations Act of 1984 (P.L. 101-229), Everglades National Park Protection and Expansion Act of 1989, were completed and implemented.

3.1.14 The Water Resource Development Act of 1992

The WRDA 1992 (P.L. 102- 580) authorized the USACE to perform the C&SF Project Reformulation Study (Reformulation Study). The Reformulation Study reexamined the C&SF Project under current needs and demands in order to determine the feasibility of operational and/or structural changes in order to optimize its authorized purposes, including environmental

restoration and protection. In May 1993, USACE initiated the 18-month Reformulation Study with an anticipated 3 additional years of planning after completion of initial study.

3.1.15 The Water Resource Development Act of 1996

The WRDA 1996 (P.L. 104-303) authorized the USACE to provide for the construction of Stormwater Treatment Area 1 East (STA-1E), an enlarged stormwater detention area. WRDA 1996 also authorized the USACE to implement the recommended plan of improvement contained in a report entitled ‘‘Central and Southern Florida Project, Final Integrated General Reevaluation Report and Environmental Impact Statement, Canal 111 (C–111), South Dade County, Florida’’, dated May 1994, including acquisition by non-Federal interests of such portions of the Frog Pond and Rocky Glades areas as are needed for the project. The USACE, with the STOF as the non-federal sponsor, was authorized to construct the Big Cypress Seminole Indian Reservation Water Conservation Plan Project (SBC Project) under the continuing authority of Section 528(b)(3) of WRDA 1996.

3.1.16 The Water Resource Development Act of 2000

The WRDA 2000 (P.L. 106-541) authorized the USACE to begin work on the CERP. To expedite its implementation, USACE was authorized to implement modifications to the C&SF Project that; (1) were described in the CERP; and (2) would produce a substantial benefit to the restoration, preservation and protection of the South Florida ecosystem. WRDA 2000 authorized the USACE to promulgate programmatic regulations to ensure that the goals and purposes of the CERP are carried out, which resulted in the CERP Guidance Memoranda (CGM). The USACE was authorized to construct the Water Conservation Area 3 Decompartmentalization and Sheet Flow Enhancement Project – Physical Model (DPM) under the continuing authority of WRDA 2000. The DPM is a limited duration, fully controlled field test being conducted pursuant to that agreement as a design effort to gather information to formulate decompartmentalization of WCA 3 and to use for the design of CERP features.

3.1.17 Consolidated Appropriations Resolution, 2003

The Consolidated Appropriations Resolution, 2003 (P.L. 108-7) amended the Everglades National Park Protection and Expansion Act of 1989 which identified Alternative 6D (the Selected Alternative in the July 2000 Central and Southern Florida Project, Modified Water Deliveries to Everglades National Park, Florida 8.5 Square Mile Area General Reevaluation Report [GRR] and Final Supplemental Environmental Impact Statement) as the plan to be built, authorized relocation of residents, and other provisions.

3.1.18 The Water Resource Development Act of 2007

The WRDA 2007 (P.L. 110-114) authorized the USACE to carry out the CERP project for ecosystem restoration, water supply, flood control, and protection of water quality, Central and Southern Florida, Indian River Lagoon, Florida. WRDA 2007 also authorized USACE to carry out the Site 1 Impoundment Project, in Palm Beach County lorida, a CERP project. Congressional managers developing WRDA 2007 expressed dismay at the relatively rapid cost

increase and high cost of the 2005 MWD Tamiami Trail Revised General Reevaluation Report (RGRR) plan; and directed proponents in the DOI and USACE to re-evaluate the 2005 Plan and develop less costly alternatives. That direction served as the basis for the Tamiami Trail Modifications (TTM) described in the TTM Final Limited Reevaluation Report (LRR) and Environmental Assessment (EA) and its addendum (USACE 2008).

3.1.19 The Water Resources Reform and Development Act (WRRDA) of 2014

The WRRDA 2014 (P.L. 113-121) authorized the USACE to carry out the CERP C-111 Spreader Canal Western Project in south Miami-Dade County and the CERP Broward County Water Preserve Area Project.

3.1.20 The Water Resources Reform and Development Act (WRRDA) of 2016

Add info authorized CERP CEPP

3.1.21 The Water Resources Development Act (WRDA) of 2018

Add info authorized CERP CEPP PACR for EAA Reservoir

3.2 PLANNING AND DESIGN

Throughout the history of the C&SF Project there have been many modifications to the project through various authorizations (legislature) which requires planning and design of new infrastructure and operations. This section aims to capture a brief history of these changes. The Flood Control Act of 1948 authorized Phase I of the Comprehensive Plan presented in H.D. 643. The remainder of the Comprehensive Plan was authorized by the Flood Control Act of 1954. The 1954 authorization specifically recognized that the Comprehensive Plan of improvement would require refinement and modifications which could be made at the discretion of the Chief of Engineers, as long as the modifications were within the scope and purpose of the authorization.

3.2.1 General

Many reports and Design Memoranda (DM) used in the planning and design of the flood control system were prepared as a result of the C&SF Project. Many of these reports recommended additions, deletions, or modifications to the original authorized project. These recommendations were made as a result of more detailed studies or at the request of the local sponsor. The original sponsor for the project was the Central and Southern Florida Flood Control District (C&SFFCD) created by the Florida Legislature in 1949. The C&SFFCD assumed the responsibilities of the Okeechobee Flood Control District and the Everglades Drainage District. However, in 1976 the State of Florida reorganized the flood control districts and the new local sponsors for the C&SF Project became the SFWMD and the St. Johns River Water Management District (SJRWMD). The SFWMD is the non-federal sponsor for most of the WCAs, ENP, ENP-SDCS components of the C&SF Project, the STOF is the non-federal sponsor for the SBC Project.

3.2.2 Water Conservation Areas–General

The functions of the WCAs as approved in the 1948 and 1954 Flood Control Acts were considered to be: (1) to act as a depository for excess water from the agricultural areas; (2) to provide the levees needed to prevent Everglades floodwaters from inundating the east coast; (3) to aid in recharging underground freshwater reservoirs; (4) to provide a water supply for east coast agricultural lands; (5) to benefit fish and wildlife in the Everglades; and (6) to release excess water to ENP and water from storage to assist in restoring and maintaining natural conditions.

3.2.3 Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration - Detailed Design Memorandum (DDM), Dated March 2004

The Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration - DDM, dated March 2004 is a documentation report that summarizes the design parameters and development for the 100% Design Submittal on the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration, Hendry County, Florida as part of the C&SF Project under the continuing authority and responsibility of the USACE, Jacksonville District and the Seminole Tribe of Florida (STOF).

3.2.4 Water Conservation Area 1

The Flood Control Act 1948 envisioned a series of levee-encircled pools for the conservation of floodwaters. WCA-1 levees include L-7, L-39 and L-40. S-10s would serve as outlet for passage of floodwaters from WCA-1 to WCA-2. Inflow would be contributed from the L-8 Borrow Canal, rainfall over WCA-1, and pumped inflow from S-5 and S-6.

3.2.4.1 Partial Definite Project Report, Part I, dated July 10, 1951

Partial Definite Project Report, Part I, dated July 10, 1951 changed the inflow into WCA-1 by increasing the pump capacity from one half inch daily to three quarters of an inch daily. It also changed the maximum conservation stage in WCA-1 to elevation 17.0 feet, NGVD. The capacities of S-5A and S-6 at the WCAs (West Palm Beach and Hillsboro Canals, respectively) were increased to serve the entire drainage areas tributary to the canals. S-5A would pump into WCA-1 and S-6 would pump into WCA-1 when the stage was below 17.0 feet, NGVD and at other times the S-6 pumping would be into WCA-2.

3.2.4.2 Partial Definite Project Report, Part I, Addendum to Supplement 3-Design Memorandum Dated 24 March 1952

Partial Definite Project Report, Part I, Addendum to Supplement 3-DM dated 24 March 1952 presented detail design and cost information for S-5A. The March 1952 report also recommended the adoption of a horizontal pump design and further recommended that the structure be redesigned to include provisions for three additional pumps.

3.2.4.3 Partial Definitive Project Report, Part IV, Section I-Modified First Phase Plan, Dated 26 March 1952

Partial Definitive Project Report, Part IV, Section I-Modified First Phase Plan, dated 26 March 1952 decreased the capacity of S-6 since S-2 would remove agricultural drainage from a portion of the Hillsboro Canal drainage area.

3.2.4.4 Plan Selected at Conference of 29 August 1952

Plan Selected at the 29 August 1952 Conference held at the USACE and attended by representatives of the Office of the Chief of Engineers, USACE, SAD, and USACE concluded that the S-6 should be constructed to remove 3/4 of an inch daily runoff from the drainage area within the authorized 1948 encirclement.

3.2.4.5 Partial Definite Project Report, Part I, Supplement 8-Design Memorandum, Dated 6 February 1953

Partial Definite Project Report, Part I, Supplement 8-DM, dated 6 February 1953 proposed that S-5A and S-6 be constructed to full capacities based on the requirement to remove 3/4 of an inch daily runoff from the drainage area within the larger encirclement included in the 1954 authorization.

3.2.4.6 Partial Definite Project Report, Part IV, Section 4-Modified First Phase Plan, Dated 20 February 1953

Partial Definite Project Report, Part IV, Section 4-Modified First Phase Plan, dated 20 February 1953 proposed deleting S-1 and using S-5A to transfer all runoff from the West Palm Beach Canal agricultural area southward to WCA-1 to affect greater benefits and to make water available to east coast interests. The canal and S-5A would be used to transfer water from Lake Okeechobee to the conservation area when such transfer was desirable and when their full capacities were not needed for drainage of the agricultural area.

3.2.4.7 Partial Definitive Project Report, Part I-Supplement 9-Design Memorandum, Hydrology and Hydraulic Design of Hillsboro Canal and Related Works, Dated 8 June 1953

Partial Definitive Project Report, Part I-Supplement 9-DM, Hydrology and Hydraulic Design of Hillsboro Canal and Related Works, dated 8 June 1953 indicated that S-6 should release into WCA-1 at all times and that additional spillway capacity should be provided through L-39.

3.2.4.8 Part I, Supplement 25-General Design Memorandum (GDM), Plan of Regulation for WCA-1, Dated 29 November 1957

Part I, Supplement 25-GDM, Plan of Regulation for WCA-1, dated 29 November 1957 provided a new plan of improvement for WCA-1 which would provide for seasonal regulation between elevations 14 and 17 feet, NGVD, levees and three spillway units capable of storing seasonal floodwaters for use during dry periods; providing a reasonable degree of erosion resistance

against wind tides and wave actions caused by hurricanes; and providing adequate spillway capacity to prevent flood crests from exceeding elevation 17.3 feet, NGVD. This GDM was approved by Chief of Engineers on 23 July 1958.

3.2.4.9 Part I, Supplement 23 (Revised), Design Memorandum, Resubmitted 16 July 1958 Superseded Part I, Supplement 23 Dated 20 June 1955

Part I, Supplement 23 (Revised), DM, resubmitted 16 July 1958 superseded Part I, Supplement 23 dated 20 June 1955. The Revised DM recommended L-39 and S-10, three spillway units capable of storing floodwaters within WCA-1 up to elevation 17.3 feet, NGVD under Standard Project Flood (SPF) conditions; withstand normal steady wind-produced tides and waves and provide a reasonable degree of erosion resistance against overtopping and wave action caused by hurricane forces; and provide adequate spillway capacity to prevent the peak ponding stage from exceeding elevation 17.3 feet, NGVD in WCA-1. The Revised DM was approved by the Chief of Engineers on 8 April 1959.

3.2.4.10 Part I, Supplement 31-Detailed Design Memorandum, Dated 13 October 1959

Part I, Supplement 31-DDM, dated 13 October 1959 presented several changes to the approved plan contained in the (Part I, Supplement 27) GDM (see Section 3.2.4.2 below). These changes were the relocation of L-38 (Section 3) approximately 100 feet west to allow for future expansion of U.S. Highway 27; the reduction of L-35B berm from 40 feet to 30 feet, NGVD in order to reduce excavation quantities; steepening of the side slopes of the L-35B borrow canal to one vertical on one horizontal; reducing the gated culvert in the North New River Canal through L-35B from four 72-inch barrels to two 72-inch barrels; and changing the structure in L-38E from two gated 72-inch pipe culverts to a steel sheet pile spillway. The Division Engineer approved the plan in the 5th Endorsement on 13 January 1960.

3.2.5 Water Conservation Area 2

The Flood Control Act 1948 envisioned a series of levee-encircled pools for the conservation of floodwaters. WCA-2 levees include LL-6, L-35, L-36 and L-39. S-11 would serve as outlet for passage of floodwaters from WCA-2 to WCA-3. Inflow would be contributed from the Hillsborough Canal and rainfall over WCA-2.

3.2.5.1 Partial Definite Report, Part I, Dated 10 July 1951

The plan of improvement for WCA-2 was presented in the Partial Definite Report, Part I, dated 10 July 1951. It included an authorized area where excess water could be stored to supply irrigation needs in developed areas south and east of the pool and as a floodway to release excess water into WCA-3.

3.2.5.2 Part I, Supplement 27-General Design Memorandum, Dated 28 February 1958

Part I, Supplement 27-GDM, dated 28 February 1958 recommended no change to the existing grade of L-6, L-35, L-35A and L-36, except a change in slope on the landward side of L-36; construction of L-35B with culverts from S-11A to L-36; construction of a reach of L-38 on the

existing spoil bank elevation and placing two 72-inch gated culverts to allow regulation of the pool in WCA-2B; construction of a reach of L-38 east of the highway with a grade varying from 18 feet, NGVD at S-11C to 19 feet, NGVD at S-7; raising U.S. Highway 27 to an elevation of 17.5 feet, NGVD between S-11A and S-11C; construction of a reach of L-38 west of the highway with an elevation of 16.7 feet, NGVD and with two 72-inch gated culverts in the levee; construction of S-38 in L-36 near C-14; and a provision retained in the cost estimate for deferred construction of additional facilities which may be required if marsh vegetation does not prevent wind tides and waves from attacking the levee. The Part I, Supplement 27-GDM also recommended deletion of S-35. This GDM was approved in the 9th endorsement from the Chief of Engineers dated 16 April 1959.

3.2.5.3 Part I, Supplement 21-DM, Dated 1 November 1954

Part I, Supplement 21-DM, dated 1 November 1954 recommended increasing the crown width of L-5 to 15 feet, NGVD to permit access to S-8; constructing the levees in two stages, with construction of the first stage to the intermediate grade established in the interim report (Part V1 Section 7 of the DM for the C&SF Project, dated 2 April 1954) and the second stage to the final grade when S-7 and S-8 were constructed and the lower agricultural areas developed. A levee grade of four feet above average ground elevation was adopted as minimum intermediate grade. The Part I, Supplement 21-DM, dated 1 November 1954 was approved by the Chief of Engineers in a letter dated 3 March 1955. In the fourth endorsement dated 30 June 1955, the USACE revised the levee design and the excavated peat material was mixed with rock to provide a suitable base material. This was approved by the Division Engineer on 9 August 1955.

3.2.5.4 Part I, Supplement 42-Detailed Design Memorandum (DDM), Dated 11 February 1965

Part I, Supplement 42-DDM, dated 11 February 1965 presented a plan similar to the plan in Part I, Supplement 21 – DM, except it proposed the relocation of the levee 350 feet from the centerline of U.S. Highway 27 to allow for widening of the highway; and the two 72-inch gated culverts located under the levee was reduced to a single gated culvert. These changes were approved by the Division Engineer in a letter dated 23 March 1965.

3.2.5.5 Part I, Supplement 49-GDM and DDM, Dated 31 August 1972

Part I, Supplement 49-GDM and DDM, dated 31 August 1972 presented a modified plan of improvement for WCA-1 and WCA-2 and a proposed plan in lieu of improving conveyance across WCA-2A. C-302 across WCA-2A was proposed in the 1968 Water Resources Report for C&SF Project as part of the general concept to reduce wastage of flood control releases down the St. Lucie Canal. Instead of giving priority to flood control releases down the St. Lucie Canal, priority was given to pumping as much of the excess Lake Okeechobee water as practicable to the WCAs and ENP for beneficial use. The modified plan was approved by the Chief of Engineers on 20 April 1973.

3.2.6 Water Conservation Area 3

3.2.6.1 Phase I Comprehensive Plan (H.D. No. 643)

The Phase I Comprehensive Plan (H.D. No. 643) provided for encircling WCA-3 with levees so that floodwaters from adjacent areas could be put into the area and stored for beneficial uses or released into ENP. S-8 and S-9 were to release into WCA-3 from adjacent agricultural areas and S-7 was to release into either WCA-2 or WCA-3 depending on relative water levels. The Comprehensive Plan also called for a gated spillway (S-11) to release water into WCA-3 from WCA-2 and another gated spillway S-12 was to release water from WCA-3 into the undeveloped Everglades south of Tamiami Trail. S-31 in the eastern levee at Miami Canal was to allow irrigation releases and release for control of saltwater intrusion. Levees along the east coast (L-30, L-33, and L-37), gated spillways (S-11 and S-12), S-9, and S-31 were included in the Flood Control Act of 1948 while the remaining works in WCA-3 were authorized in the Flood Control Act of 1954.

3.2.6.2 Subsequent to Approval of the Comprehensive Plan

Subsequent to approval of the Comprehensive Plan, several minor changes were approved. L-4 and L-5 and S-8 were moved about three miles south to the Palm Beach-Broward County line. The alignment for L-28 was moved from one to four miles east of the original plan along the Collier County line. S-12s were moved from the vicinity of L-30 to the western end of the area in order to release directly into ENP. S-7 was designed to release only into WCA-2.

3.2.6.3 Part I, Supplement 33-GDM, Dated 22 June 1960

Part I, Supplement 33-GDM, dated 22 June 1960 presented the facilities needed to regulate water levels in WCA-3 during a SPF and prevent water in the Everglades from aggravating flood problems on adjacent lands. Part I, Supplement 33-GDM added Levees L-67, L-67 Extension, L-68, and L-28 Extension; S-12E, S-24B, S-150, and S-151. All recommended additions to the C&SF Project were approved in the second endorsement, dated 25 August 1960, to the Chief of Engineers except L-67 Extension and L-28 Extension which were deferred until further study and coordination with the Park Service. The 25 August 1960 report was approved in the fifth endorsement from the Chief of Engineers dated 13 January 1961.

3.2.6.4 District Engineer Letter, Dated 15 August 1960

A letter from the District Engineer, dated 15 August 1960 recommended the deletion of the S-147 pump. However, the Chief of Engineers, in the 2nd endorsement dated 13 September 1960, elected to put it in a deferred status.

3.2.6.5 Part I, Supplement 34-Detailed Design Memorandum, Dated 30 September 1960 Supplements the General Detailed Memorandum-Part I, Supplement 33

Part I, Supplement 34-DDM, dated 30 September 1960 supplements the Part I, Supplement 33 GDM, and presents in detail the design criteria and construction methods for L-67A and L-29, Section 3, S-151, and a gated culvert in L-29, Section 3. L-67A was designed to reduce seepage

under the existing east side levees, L-30 and L-33 of the WCA-3B. Section 3 of L-29 provides protection for U.S. Highway 41 (Tamiami Trail) and forms the south boundary of WCA-3B. S-151 provides releases from WCA-3A as needed to maintain desired water levels in WCA-3B, and provides capacity needed for low water releases through S-31 to the east coast agricultural area. Gated culvert in L-29, Section 3, was designed for water releases to the south during dry periods. Approval was made by the Chief of Engineers on 17 November 1960.

3.2.6.6 Part I, Supplement 35-DDM, Dated 7 November 1960 Supplements the General Design Memorandum-Part I, Supplement 33

Part I, Supplement 35-DDM, dated 7 November 1960 supplements the GDM-Part I, Supplement 33 GDM, and presents in detail the design criteria and methods for constructing L-29, Sections 1 and 2, and S-12A, S-12B, S-12C, S-12D, S-12E, and 14. Section 1 of L-29 extends from the south end of L-28 to 40-mile bend on the Tamiami Trail where it joins Section 2, which continues eastward to its junction with Section 3 and L-67A. The existing Tamiami Trail (U.S. Highway 41) was to be abandoned when the roadway is relocated to the top of Section 2 of the levee. S-12 (A-D) were required to provide the major releases for regulating WCA-3A by release into the ENP. S-12E was required to allow regulation of WCA-3B by release into the ENP. Control Section 14 provided gravity drainage from the lower reaches of L-28 borrow pit, via L-29, Section 2, borrow pit, through the Tamiami Trail into the ENP. Approval was made by the Chief of Engineers on 27 December 1960.

In response to a 6 December 1960 request from the District Engineer to construct a berm for wildlife enhancement along L-67A, an evaluation was made to determine whether additional Congressional authorization would be required for construction. However, in a letter dated 19 January 1961, the District Engineer withdrew his proposal for adding the berm due to construction costs. Instead a 12-inch peat layer above elevation 11.0 feet, NGVD that would support a lush growth of grass was proposed that would be suitable for deer grazing. The Division Engineer gave his approval to this modification on 7 February 1961.

3.2.6.7 Part I, Supplement 30-GDM, Dated 15 September 1959

Part I, Supplement 30-GDM, dated 15 September 1959 proposed adding S-139 and S-140; a diffusion canal from L-4(W) borrow canal to WCA-3; inlet structures at points of local inflow; enlargement of Levee tieback and L-4 (W) borrow canals; and two new canals (Big Cypress Canal and L-28 [Section 2] borrow canal). The report also recommended the deletion of S-16. In a letter dated 1 October 1959 the Division Engineer returned the DM for revision contending that S-140 would be one of the largest in the world. The pump station had a very high initial cost, very high maintenance and depreciation cost, and was not considered a very good engineering or economic solution to the drainage problem. The Division Engineer recommended that a gravity canal extending from the upper end of Big Cypress Canal to the vicinity of S-140 be investigated; an alternate alignment to L-28 (Section 2) that would provide storage for the drainage area; the deletion of Big Cypress Canal and S-139; and sizing S-140 to handle a larger area. In a letter dated 20 October 1959, the District Engineer addressed the Division Engineers recommendation. Ultimately a conference was held on 24 November 1959 with representatives

from USACE, SAD, Office of the Chief Engineer (OCE), and the USACE in attendance to discuss the proposed changes. Ultimately, approval was only given to extend L-28 approximately five miles by Chief of Engineers.

3.2.6.8 Addendum 1, Part I, Supplement 30, Dated 15 September 1959

Addendum 1, to Part I, Supplement 30 recommended the removal of runoff from the 110-year storm without appreciable damages. The plan would also add the Interceptor Canal; Big Cypress Canal; enlargement of L-4 (W) borrow canal and L-3 tieback borrow canal; S-139, S-140 and S-147; culverts in L-28; and inlet structures along L-28 borrow canal. S-16 and S-17 would be deleted and S-14 would remain in the plan. The Division Engineer recommended approval of this plan in a letter dated 21 June 1960, however the Chief of Engineers stated in a letter dated 31 August 1960 that no action would be taken until the views of the Flood Control District were furnished.

3.2.6.9 Addendum 2, Part I, Supplement 30, Dated 13 June 1961

Addendum 2, dated 13 June 1961, presented a new plan which incorporated the views of the Flood Control District. This addendum provided a single pump station (S-140) instead of two pump stations (S-139 and S-140); extended the interceptor canal to the northern and western extremities of the Seminole Indian Reservation to provide an outlet for excess water; placed Pump Station S-147 in deferred status; and left an 11-mile gap in L-28 immediately south of the interceptor canal with filling the gap in deferred status until the development of eastern Collier County. In summary the additions were Pump Station S-140 and S-147; the interceptor canal, including two feeder canals, each with a headwater (HW) control structure; two culverts in L-28-south of the interceptor canal; L-3 tieback borrow canal enlargement; and the necessary lateral inflow culverts. The plan also recommended the deletion of S-16 and S-17. The addendum was approved by the Chief of Engineers on 28 August 1961.

3.2.6.10 Part I, Supplement 32-DDM, Dated 2 March 1962

Part I, Supplement 32-DDM, dated 2 March 1962 recommended that the previously approved Addendum 2, Part I, Supplement 30, be modified to tieback to higher ground. The tieback would block any release from WCA-3 through the 11-mile gap in L-28 and would eliminate the possibility that water would be released south along the west side of L-28. The addition of the tieback was approved in a letter from the Chief of Engineers on 11 April 1962.

3.2.6.11 Part I, Supplement 36-DDM, Dated 31 May 1961

Part I, Supplement 36-DDM, dated 31 May 1961 presented a program for the establishment of comprehensive permanent networks of hydrologic and meteorological stations considered necessary for the operation of the project works in WCA-3 and adjoining areas. It also presented a temporary program which would provide sufficient data to determine the approximate seepage rate under interior levees in WCA-3 and the total number of levees required to reduce seepage out of the pool to acceptable rates. Approval was made by the Chief of Engineers on 9 August 1961.

3.2.6.12 Part I, Supplement 37-DDM, Dated 27 April 1962

Part I, Supplement 37-DDM, dated 27 April 1962 presented the same basic plan as Part I, Supplement 33-GDM except S-31 and S-150 were changed from concrete box culverts to corrugated metal pipe culverts. These changes were made to arrive at the most economical structures. They were approved by the Chief of Engineers on 8 June 1962.

3.2.6.13 Part I, Supplement 38-DDM, Dated 22 March 1962

Part I, Supplement 38-DDM, dated 22 March 1962 provided supplemental information to Part I, Supplement 33 –GDM and presented detailed information on the design criteria and methods for the construction of L-68A.

3.2.6.14 Part I, Supplement 41-DDM, Dated 19 June 1964

Part I, Supplement 41-DDM, dated 19 June 1964 presented the design criteria for S-140 and supplemented Part 1, Supplement 30, including addendums 1 and 2. S-140 was designed to serve 110 square miles north and east of the interceptor canal and west of L-28. The plan was approved by the Chief of Engineers on 19 February 1965.

3.2.6.15 Part I, Supplement 42-DDM, Dated 11 February 1965

Part I, Supplement 42-DDM, dated 11 February 1965 supplemented both Part I, Supplement 33 and 27 by providing design criteria for the west levee (L-38) only.

3.2.6.16 Part I, Supplement 53-GDM, and DDM, Dated September 1977

Part I, Supplement 53-GDM and DDM, dated September 1977 presented a supplemental plan of the hydrologic and hydraulic design data necessary to determine the physical features for construction of two canal water control structures S-339 and S-340 located on C-123 (Miami Canal). These structures would prevent over drainage by holding upstream water levels at, or near, ground level. The plan was approved by Chief of Engineers on 3 May 1978.

3.2.6.17 Part I, Supplement 54- GDM and EIS, Dated June 1990

Part I, Supplement 54-GDM and EIS, dated June 1990 proposed changes to the method of operation and changes to the canals and structures that would if implemented, as nearly as possible, return the hydrology of ENP to historic conditions. The plan proposed major modifications at S-345 and S-349, construction of S-355A and S-355B; removal of L-67 Extension and filling the borrow canal and construction of a levee around a residential area.

3.2.6.18 Letter Report on S-343A, S-343B, S-344, and Modification of L-28 and L-67 Extension, Dated 13 April 1983

Letter Report on S-343A, S-343B, S-344, and Modification of L-28 and L-67 Extension, dated 13 April 1983 proposed structural modifications to the C&SF Project, as requested by ENP, which would improve the capability of the project to provide water supply to ENP in a more beneficial manner. The proposed modifications would also benefit the eastern portion of BCNP

by restoring overland flow to an area just south of L-28 Tieback; prevent over drainage of the eastern BCNP under dry conditions; and provide a means of making regulatory releases from WCA-3A into Big Cypress Preserve. The letter report was approved by the Deputy Division Commander on 20 May 1983.

3.2.6.19 Letter Report on S-346 and S-347 in the L-67 Extension and Borrow Canal, Dated 23 August 1983

Letter Report on S-346 and S-347 in the L-67 Extension and Borrow Canal, dated 23 August 1983 presented design criteria for two controlled culvert structures in the L-67 Extension borrow canal. These two structures were to reduce the rate of S-12 release flowing into ENP down the L-67 Extension borrow canal and to enable the release of minimum water deliveries to the park down the borrow canal only when such deliveries would not otherwise be possible. The report was approved by the Deputy Division Commander on 26 August 1983.

3.2.6.20 Part I, Supplement 55-Feature Design Memorandum No. 1, Dated September 1993

Part I, Supplement 55-Feature DM No. 1, dated September 1993 presented design and cost estimates for modifications to the C&SF Project water management features required for improved water deliveries to ENP. These features include the construction of S-345A, S-345B, and S-345C; S-349A, S-349B, and S-349C; S-355A and S-355B; and the modification of S-334.

3.2.6.21 Central and Southern Florida Ecosystem, Critical Restoration Project, Western C-11 Basin Phase 2 Spillway 381 – DDR, Dated April 2003

The Central and Southern Florida Ecosystem, Critical Restoration Project, Western Canal C-11 (Western C-11) Basin Phase 2 Spillway 381 – DDR, dated April 2003 consists of the construction of a pump station (S-9A) and a gated spillway (S-381) located in Broward County, Florida east of WCA-3A near Weston Florida. S-9A is a four-bay pump station and S-381 is a gated spillway. DDM contains pertinent information for the construction of S-381. The purpose of this project is to improve the quality and timing of stormwater release from C-11 drainage basin to WCA-3A and WCA-3B by pumping seepage at S-9A back into WCA-3A at the same rate it enters the 7,800 feet of C-11 from the S-9A pumps to the S-381 gates. S-381 acts as a canal divide to separate the urban area to the east of the structure from the mainly natural area to the west.

3.2.7 Everglades National Park-South Dade Conveyance System (ENP-SDCS)

The first overall plan for flood control and protection for southern Miami-Dade County was presented by the USACE in the Survey Review Report on the C&SF Project, South Dade County in 1961. Additional features such as the L-31W Canal system and structures S-174 and S-175 were added by memorandum to the initial plan. Structures S-173, S-176, and S-177 were added to control flows into C-111 canal. The Flood Control Act of 1968 authorized the construction of the ENP-SDCS. The system of canals, structures and pump stations was superimposed on those that already existed above the C-111 system. The purpose of the C&SF Project with the region

was to improve sheetflow of freshwater to ENP and Florida Bay. The southern bank of the C-111 project consisted of 54 spoil mounds (the rock dredged to make the canal). However, these spoil mounds impeded overbank flow from the canal to the wetlands.

3.2.7.1 Part V, Supplement 30, GDM, Dated 6 November 1959

Part V, Supplement 30-GDM added Structures S-20F and S-20G by the Chief of Engineers in the Sixth Endorsement dated 4 May 1960.

3.2.7.2 Part V, Supplement 37- GDM, Dated 12 September 1963

Part V, Supplement 37-GDM, added Canals C-102N, C-103N, C-103S, Structure S-179 and deleted S-20D, S-20E and a portion of C-103S within Florida City. These changes were approved by the Chief of Engineers in its Second Endorsement dated 29 November 1963.

3.2.7.3 Part V, Supplement 37- GDM, Addendum 1, 5 October 1967

Part V, Supplement 37-GDM, Addendum 1 added S-198. The addition of S-198 was approved by the Chief of Engineers in its Second Endorsement dated 27 February 1968. S-199 was added by the Chief of Engineers in its Seventh Endorsement dated 5 October 1967.

3.2.7.4 Part V, Supplement 39-DDM, Dated 19 November 1964

Part V, Supplement 39-DDM, dated 19 November 1964 added S-194 and S-195 to the project. These changes were approved by the Division Engineer in its Third Endorsement dated 15 February 1965.

3.2.7.5 Part V, Supplement 40-DDM, Dated 22 January 1965

Part V, Supplement 40-DDM, dated 22 January 1965 added S-196 in Canal 103, which was required to hold the HW in C-103 to elevation 6.5 feet, NGVD. The change was approved by the Division Engineer in the Third Endorsement dated 23 March 1965.

3.2.7.6 Report No. 1768 on the Public Works Appropriations Bill

The Senate Appropriations Committee, in Report No. 1768 on the Public Works Appropriations Bill, determined that the extension of C-l to the northwest was within the scope of the C&SF Project. This extension includes the continuation of the main canal westward to L-31 (C-1, Section 2, or C-1W or C-l Ext.) and the addition of a spur canal north of the main canal. C-1 Ext., C-1N, S-148 and S-149 were added to the project by letter to the Chief of Engineers to the Chairman of the House Committee on Appropriations dated 7 September 1960.

3.2.7.7 Letter Report Entitled "Control Structure 197 in Canal 111," Dated September 1967

A letter report titled "Control Structure 197 in Canal 111," dated September 1967, provided information about S-197. The structure enables overland flow across C-111 and thence southward to the ENP and also serves as a barrier against saltwater intrusion. The letter report

was approved by the Chief of Engineers on 18 October 1967. In March 1990 the SFWMD received a Department of the Army permit to modify S-197 by adding ten barrels to the three barrels in the original design of the culvert structure.

3.2.7.8 Memorandum of Understanding, April 1973

Memorandum of Understanding (MOU) between NPS and Chief of Engineers dated April 1973 revised the water conveyance system for south Dade County and endorsed the eastern alignment of the canal instead of the western alignment. Subsequent economic, environmental and engineering investigations showed that the eastern alignment was the most advantageous route because it required no new canals; precluded further development near the park boundary; delivered the water nearer the problem areas; and was less costly.

3.2.7.9 Part V, Supplement 52-GDM, Dated 27 June 1973

Part V, Supplement 52-GDM, dated 27 June 1973 contained the authorized plan of improvement of the conveyance canals, which included Pump Station 331 and enlargement of reaches of Levee 31N Borrow Canal, C-1 and C-103. These improvements provided supplemental water demands projected to the year 2025 to both the ENP and urban and agricultural users of South Dade County. The GDM was approved by the Chief of Engineers in its Second Endorsement dated 23 November 1973.

3.2.7.10 Part V, Supplement 52- GDM, Addendum 1, Dated 30 June 1978

Part V, Supplement 52-GDM, Addendum 1, dated 30 June 1978 presented a modified plan of improvement of the conveyance canals system as presented in the main report (Part V, Supplement 52 see section 3.2.6.9, above). This addendum covered the design consideration of enlarging the existing C-304 reach of the Miami Canal and S-151 to provide for concurrent deliveries to the coastal tributary reach of Miami Canal (C-6) including the Miami Well Field area, ENP and south Dade County.

3.2.7.11 Part V, Supplement 56-DDM, Dated March 1976

Part V, Supplement 56-DDM, dated March 1976 supplements Part V, Supplement 52-GDM and presents detail designs and costs for a conveyance canal (L-30 Borrow Canal), and two control structures S-32A and S-337 that are part of a strategy to increase flows to ENP and South Dade County.

3.2.7.12 C&SF Project for Flood Control and Other Purposed, Part 1 Supplement 54 GDM and EIS Modified Water Deliveries (MWD) to ENP June 1992

This GDM addresses the Shark River Slough (SRS) portion of water deliveries from the C&SF Project to ENP. Water deliveries to Taylor Slough and to the eastern panhandle area of the Park were to be addressed in other studies. Also, land acquisition for ENP expansion were to be addressed under the guidelines contained in PL 101-229. The purposes of this report were as follows: Follows: (1) develop a plan for an improved water delivery system for ENP; (2) provide designs and cost estimates for all structural and operational modifications necessary for

implementation of the improved delivery system; (3) identify the most cost effective alternative means of mitigating potential adverse impacts to developed areas in the East Everglades, either flood protection or acquisition of real estate interests; (4) describe potential environmental benefits to be obtained as a result of hydrologic changes produced by the improved water delivery system.

3.2.7.13 C&SF Project, Final Integrated GRR and Environmental Impact Statement (EIS), C-111 South Dade County, Florida May 1994

This report covers the Canal 111 (C-111) basin and other parts of the Central and Southern Florida Project which affect flows to and through the basin including the borrow canal to L-3IN and the borrow canal to L-31W. The purpose of this GRR was restoration of the ecosystem in Taylor Slough and the eastern panhandle of ENP that were affected by construction of the flood control project in the C-111 Basin. The study also focused on preserving the current level of flood protection for the agricultural activities in the C-111 basin. In early 1995, the SFWMD and the USACE signed a Project Cooperation Agreement to modify the C-111 canal to help the Everglades ecology, while maintaining urban and agricultural flood control benefits. Project components included detailed design, land acquisition, coordination among government agencies, and structural modifications. In 1996, water quality certification was issued for C-111 Spoil Mounds Degrading Project, allowing the removal of 750,000 cubic yards of dredged material along the southern side of the C-111 canal. And construction contract was awarded for removal of spoil mounds along southern C-111. The work was conducted in 1996 and 1997 between structures S-18C and S-197. The material was trucked to the Frog Pond area for use in construction of the C-111 project levees.

3.2.7.14 C&SF Project, Modified Water Deliveries (MWD) to Everglades National Park, Florida 8.5 Square Mile Area (SMA), General Reevaluation Report (8.5 SMA GRR) July 2000

The 8.5 SMA GRR authorized the construction of the 8.5 SMA levees, canals and the S-357 pump station. The goal of the 8.5 SMA GRR was to facilitate selection of a plan that provides a technical solution for the hydrological and ecological restoration of the Everglades National Park and mitigation for additional flooding impacts in the 8.5 SMA that would result from implementing the MWD project, both as specified in the 1989 Act, while maintaining compatibility with CERP objectives consistent with the WRDA 2000 authorization.

3.2.7.15 C&SF Project, Final Revised GRR/Second Supplemental EIS (GRR/EIS) for the Tamiami Trail Modifications, MWD to ENP, November 2005

This document is a Revised General Reevaluation Report into which a Second Supplemental Environmental Impact Statement has been integrated (RGRR/SEIS). It revises the previous 2003 GRR/SEIS to update the alternative analysis and serves to incorporate and evaluate all features necessary for project implementation.

3.2.7.16 Canal 111 (C-111), South Dade County, Florida Final Limited Reevaluation Report (LRR), November 2016

The C-111 SD LRR was prepared to ensure a complete administrative record and that all necessary approvals were documented. Numerous design changes have been needed on the C-111SD project since construction from 1996 through 2016. the This LRR describes refinements and design changes associated with all construction of the C-111 South Dade project, comparing each design change to the features authorized in the 1994 General Reevaluation Report (USACE 1994). The LRR consolidates and documents previously approved post authorization change reports (PACR) and their associated NEPA documents, encompassing numerous design changes were needed on the C-111 South Dade project during construction from 1996 through 2018.

3.3 CONSTRUCTION

Construction on the structures in the WCAs, ENP, ENP-SDCS areas began after authorization in 1948. The first structures were completed in 1951. **Table 3-1** shows a list of spillways, levees, pump stations, culverts and other associated structures with dates of construction and dates when completed facilities were transferred to the SFWMD.

TABLE 3-1: DATES OF CONSTRUCTION AND TRANSFER TO SFWMD WITHIN THE WCAS, ENP, ENP-SDCS REGION

Structure	Type	Construction Initiated	Construction Completed	Transferred to SFWMD	Modifications
S-5A	Pump Station	20 Mar 53	26 Aug 55	2 May 55	
S-5A(E)	Culvert	8 Jul 52	7 Dec 53	15 Apr 54	
S-5A(S)	Spillway	8 Jul 52	7 Dec 53	15 Apr 54	
S-5A(W)	Culvert	8 Jul 52	7 Dec 53	15 Apr 54	
S-6	Pump Station	21 Feb 55	30 Mar 57	30 Apr 57	
S-7	Pump Station	12 Sep 57	11 Dec 59	10 Feb 61	
S-8	Pump Station	12 Apr 59	16 Jan 62	9 Feb 62	
S-9	Pump Station	25 Nov 53	8 Apr 57	9 Aug 57	
S-9A	Pump Station				
S-10A, C&D	Spillways	2 Nov 58	28 Jun 60	Retained	
S-10E	Culvert			Retained	

Structure	Type	Construction Initiated	Construction Completed	Transferred to SFWMD	Modifications
S-11A, B&C	Spillways	13 May 52	12 Mar 54	Retained	
S-11A, B&C*	Spillways	11 Feb 57	11 Dec 57	Retained	
S-12A,B,C&D	Spillways	24 Apr 61	20 Jan 63	Retained	
S-12E	Culvert	24 Apr 61	20 Jan 63	Note (1)	
S-12F	Culvert		13 Dec 67	Note (1)	
S-14	Culvert	24 Apr 61	20 Jan 63	31 Jan 63	
S-18	Spillway	26 Jun 70	16 Dec 71		
S-18C	Spillway	21 May 64	9 Mar 66	15 Apr 66	
S-24	Culvert	20 May 52	24 Sep 52	15 Oct 52	
S-24A	Culvert	20 May 52	24 Sep 52	15 Oct 52	
S-31	Culvert	2 Jul 62	15 May 63	12 Jul 63	
S-32	Culvert	15 Mar 51	2 Feb 52	15 Sep 52	
S-32A	Culvert	10 May 51	3 Jul 52	15 Sep 52	
S-34**	Culvert	15 Mar 51	2 Feb 52	15 Sep 52	
S-34***	Culvert	23 Mar 54	29 Oct 54	13 Aug 54	
S-38	Culvert	17 Feb 60	15 Jun 61	3 Jul 61	
S-38A	Culvert				
S-38B	Culvert	10 May 62	29 May 62	18 Jun 62	
S-39	Spillway	8 Aug 51	15 Oct 52	15 Sep 52	
S-39A	Culvert				
S-124	Culvert	12 Dec 65	6 May 66	21 Jun 66	
S-140	Pump Station	16 May 66	14 Jan 70	15 May 70	
S-141	Spillway	22 Jan 60	15 Jun 61	3 Jul 61	
S-142	Culvert	22 Jan 60	15 Jun 61	3 Jul 61	
S-143	Culvert	22 Jan 60	15 Jun 61	3 Jul 61	
S-144	Culvert	22 Jan 60	15 Jun 61	3 Jul 61	
S-145	Culvert	22 Jan 60	15 Jun 61	3 Jul 61	
S-146	Culvert	22 Jan 60	15 Jun 61	3 Jul 61	
S-150	Culvert	26 Oct 65	18 Mar 66	8 Mar 68	
S-151	Culvert	9 Jan 61	12 Jul 62	27 Jul 62	
S-155A					
S-155B					

Structure	Type	Construction Initiated	Construction Completed	Transferred to SFWMD	Modifications
S-173	Culvert	5 May 66	8 Jul 67	15 Aug 67	
S-174	Spillway	17 Jul 68	28 Oct 70	29 Nov 71	
S-175	Culvert	17 Jul 68	28 Oct 70	29 Nov 71	
S-176	Spillway	16 May 66	8 Jul 67	15 Aug 67	
S-177	Spillway	2 May 66	16 Jul 67	15 Aug 67	
S-178	Culvert	2 May 66	16 Jul 67	15 Aug 67	
S-190	Spillway	19 Feb 65	24 May 67	12 Jul 67	
S-194	Culvert	21 Apr 65	15 Jul 66	15 Sep 66	
S-196	Culvert	13 Dec 65	23 Jul 66	25 Aug 67	
S-197	Culvert	27 May 68	12 Feb 69	8 Jul 69	
S-199 New	Pump Station				
S-199	Spillway	Aug 70	18 Dec 71	28 Jul 72	
S-200	Pump Station				
S-319	Pump Station				
S-328	Culvert	1999	2003		
S-331	Pump Station	13 Feb 79	1 Feb 83	13 Jun 83	
S-332	Pump Station	14 Dec 78	Aug 80	18 Aug 80	
S-332B	Pump Station	29 Jan 00	12 Apr 00	2010	
S-332C	Pump Station	2002	2003	2010	
S-332D	Pump Station		Dec 1997	1997	
S-333	Spillway	Feb 76	11 Oct 78	15 Dec 78	
S-332DX1	Culvert			21 Feb 2017	
S-334	Spillway	Feb 76	11 Oct 78	15 Dec 78	
S-335	Spillway	30 Mar 77	15 Feb 79	8 Sep 78	
S-336	Culvert	Feb 76	11 Oct 78	15 Dec 78	
S-337	Culvert	26 Jan 77	3 Jan 79	8 Sep 78	
S-338	Culvert	26 Aug 77	13 Feb 79	Apr 79	
S-339	Spillway	13 Feb 79	8 Aug 80	20 May 81	
S-340	Spillway	13 Feb 79	20 Nov 80	20 May 81	

Structure	Type	Construction Initiated	Construction Completed	Transferred to SFWMD	Modifications
S-343A	Culvert	18Jul 83	23 Jun 86	14 Jun 91	
S-343B	Culvert	18Jul 83	23 Jun 86	14 Jun 91	
S-344	Culvert	18 Jul 83	23 Jun 86	14 Jun 91	
S-346	Culvert	18 Jul 83	23 Jun 86	14 Jun 91	
S-347	Culvert				
S-355A	Spillway	31 Aug 96	1998	Retained	
S-355B	Spillway	31 Aug 96	1998	Retained	
S-356	Pump Station	1 May 02	31 Jul 2002	03 Aug 2017	
S-357	Pump Station		22 Oct 2009	04 Oct 2012	
S-357N	Culvert	2017	Feb 2018	May 2018	
S-362	Pump Station				
L-4	Levee	16 Jan 56	10 May 57	24 May 57	
L-5	Levee	18 Sep 56	21 Nov 57	16 Dec 57	
L-6	Levee	24 Jan 56	12 Aug 57	30 Aug 57	
L-7	Levee	24 Nov 52	22 Jun 55	1 Jul 55	
L-28 (Sec. 1)	Levee	16 Jan 56	10 May 57	24 May 57	
L-28 (Sec. 2)	Levee	29 Mar 60	15 Jun 61	20 Mar 61	
L-28 (Sec. 2 Rem. & Sec. 3)	Levee	22 Aug 62	28 Jun 63	22 Jul 63	
L-28 (Sec.5 & Sec. 5 Tieback)	Levee	25 May 62	12 May 63	1 Sep 65	
L-29	Levee	9 Jan 61	12 Jul 62	27 Jul 62	
L-30	Levee	10 May 51	3 Jul 52	15 Sep 52	
L-31N	Levee	16 May 66	8 Jul 67	15 Aug 67	
L-31W	Levee	17 Jul 68	28 Oct 70	30 Apr 71	
L-33	Levee	15 Mar 51	6 Feb 62	15 Sep 52	
L-35	Levee	11 Mar 50	18 Aug 50	1 Jan 52	
L-35A	Levee	3 Jan 50	22 Jul 50	1 Jan 52	
L-35B	Levee	17 Feb 60	15 Jun 61	3 Jul 61	
L-36	Levee	7 Mar 50	17 May 51	1 Jan 52	

Structure	Type	Construction Initiated	Construction Completed	Transferred to SFWMD	Modifications
L-38	Levee	13 Apr 59	15 Jun 61	3 Jul 61	
L-38E (Sec. 1)	Levee	13 Apr 59	28 Feb 60	18 Mar 60	
L-38E (Sec. 2 & 3)	Levee	17 Feb 60	15 Jun 61	14 Jul 61	
L-38W	Levee	26 Oct 65	18 Mar 66	8 Mar 68	
L-39	Levee	2 Nov 58	28 Jun 60	19 Jul 60	
L-40	Levee	11 Nov 50	29 Dec 52	15 May 53	
L-67A & B	Levee	9 Jan 61	12 Jul 62	27 Jul 62	
L-67 EXT	Levee	6 Jun 66	9 Nov 67	26 Jul 68 Note (2)	
L-68A	Levee	9 Oct 62	19 Aug 63	12 Sep 63	

Note (1): Removed in 1990
Note (2): Four miles degraded in 2002.
* Second Phase
** Main Structure
*** Secondary Structure

3.4 RELATED PROJECTS

This section covers additional Federal and non-Federal projects and/or infrastructure which are hydrologically connected or interact with the WCA, ENP, ENPD-SDCS component of the C&SF Project.

3.4.1 Everglades Construction Project (ECP) and Everglades Nutrient Removal (ENR) Project

The State of Florida, as a result of the Everglades Forever Act (Ch. 373.4592, F.S.) and the Everglades Settlement Agreement, began the construction of the non-Federal Everglades Construction Project (ECP). The ECP consists primarily of five large constructed wetlands, referred to as Stormwater Treatment Areas (STAs) designed to reduce the levels of phosphorus from waters entering the Everglades Protection Area. The ENR Project was a pilot project for testing and refining treatment design and operation of the full-scale constructed wetlands and was approximately 10 percent (4,000 acres) of the planned STAs.

3.4.2 Stormwater Treatment Areas (STAs)

The STAs which consist of the Federal STA-1E, and non-Federal STA-1W, STA-2, STA-3/4, and STA-5/6 replaced the ENR project. The STAs are adjacent to and release directly into WCA-1, WCA-2A and WCA-3A. The STAs will be discussed in detail in the Volume 3 of the SOM. See **Figure 3.1**.

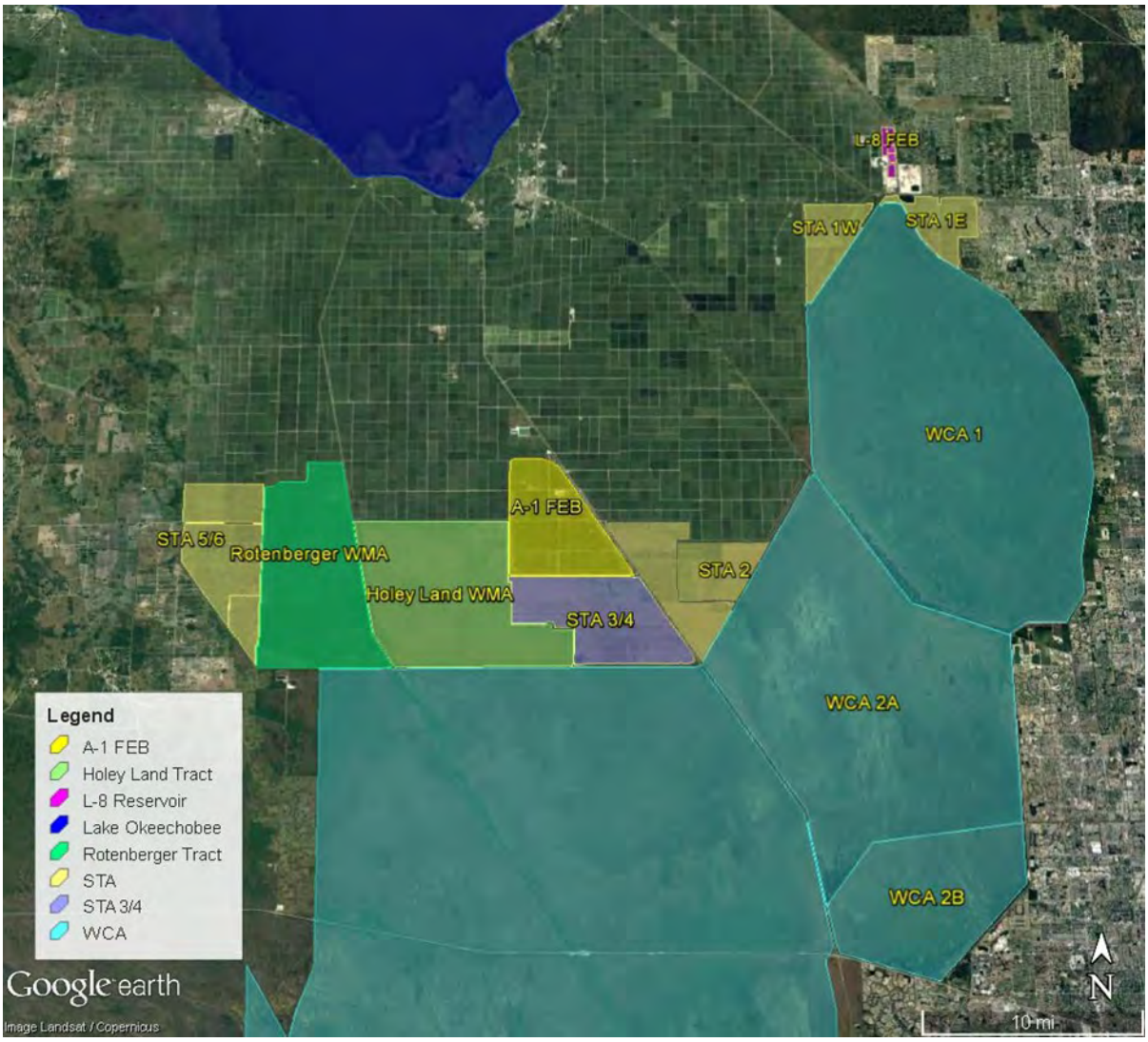


FIGURE 3-1: STORMWATER TREATMENT AREAS AND WATER CONSERVATION AREAS

3.4.2.1 Stormwater Treatment Area 1 West (STA-1W)

The ENR was modified and expanded to create the STA-1W project. The ENR Project is a "constructed," or man-made, wetland designed to biologically remove phosphorous from agricultural runoff before it enters the Everglades. The project encompasses nearly 4,000 acres and is located adjacent to L-7 which borders the Arthur R. Marshall Loxahatchee Wildlife Refuge (WCA-1). The project is located near a major pump station, S-5A, which drains a 230-square-mile section of the EAA. Construction of STA-1W began in 1997 and included modifications to the ENR internal levees and water control structures to provide additional peak flow capacity through Cells 1 through 4 (Engineer of Record, Hutcheon Engineers). Operation of Cells 1 through 4 (i.e., the Eastern and Western flow-ways) continued during the construction modifications. Cells 5A and 5B (Northern Flow-way) were completed in March 1999. Flow through operation of the Northern Flow-way commenced in July 2000. Full operation of STA-

1W commenced in October 2000 when the G-310 outflow pump station was completed. The total effective treatment area is approximately 11,000 acres. STA-1W releases are through the G-310 and G251 pump stations into the WCA-1 L-7 canal which borders the western perimeter of the WCA. For additional information, refer to the SFWMD Operation Plan for Stormwater Treatment Area 1 West in the SOM Volume 3.

3.4.2.1.1 Pump Station G-251

The G-251 Pump Station is located on the western boundary of the L-7 Canal approximately 8.6 miles north of S-6 and is an outflow pumping station for STA-1W. This pumping station consists of six 75 cfs electric motor driven pumps, with a combined capacity of 450 cfs. G-251 is used in concert with G-310 to pump treated agricultural runoff water from STA-1W to WCA-1.

3.4.2.1.2 Pump Station G-310

The G-310 Pump Station is located at the south corner of STA-1W approximately 0.25 miles west of G-251. This pumping station consists of two (2) 100 cfs pumps, two (2) 470 cfs pumps, and two (2) 950 cfs pumps with a maximum combined capacity of 3,040 cfs. Pump station G-310 serves as the primary outflow pump station for STA-1W. G-310 is used in concert with G-251 to pump treated agricultural runoff water from STA-1W to WCA-1.

3.4.2.2 Stormwater Treatment Area 1 East (STA-1E)

STA-1E (federal) is located approximately 20 miles west of West Palm Beach, Florida, south of State Road 80 and C-51, adjacent to the northeast boundary of WCA-1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge). STA-1E features include levees, water management structures, and pump stations. STA-1E consists of three parallel treatment paths, or flow-ways, with eight treatment cells flowing from north to south. This created wetland marsh system will provide an effective treatment area of 5,132 acres within the eight treatment cells, and an additional 1,046 acres in the distribution cells upstream of the eight cells. For additional information, refer to the SFWMD Interim Operation Plan for Stormwater Treatment Area 1 East of the SOM Volume 3.

3.4.2.2.1 Pump Station S-362

S-362 is a seven-unit pump station located in the south corner of STA-1E. It is comprised of five (5) diesel engine-driven pumps (three (3) 960 cfs pumps and two (2) 550 cfs pumps) and two (2) additional 110 cfs electric motor driven pumps, with a combined nominal capacity of 4,200 cfs. S-362 is the outlet from STA-1E to WCA-1 via L-40 borrow canal.

3.4.2.3 Stormwater Treatment Area 2 (STA-2)

STA-2 (non-federal) is a critical component of the ECP that is located immediately west of WCA-2 and consists of four parallel treatment paths, or flow-ways, flowing from north to south. STA-2 is situated generally on and surrounding the former Brown's Farm Wildlife Management Area, Woerner Farm and the Okeelanta Farm. The original STA-2 consisted of three treatment

cells (1, 2 and 3) with 6,338 acres of effective treatment area and began operation in 2000. However the treatment area was expanded with the addition of the Compartment B Build-out for a total STA-2 treatment area of 15,057 acres. Water is sent to STA-2 from a variety of sources, including agricultural runoff and releases from the S-6/S-2 Basin, a portion of the runoff from the S-5A Basin via the Ocean and Hillsboro Canals, runoff from Chapter 298 drainage districts situated on the easterly shore of Lake Okeechobee, and several others. STA-2 releases are through the G-335 gated spillway and G-436 pump station into the western WCA-2A. For additional information, refer to the SFWMD Operation Plan for STA- 2 in the SOM Volume 3.

3.4.2.3.1 Pump Station G-335

G-335 (non-federal) is a six-unit pump station located in the southeast corner of STA-2. It is comprised of two (2) 950 cfs diesel engine driven pumps, two (2) 470 cfs diesel engine driven pumps and two (2) 100 cfs electric motor driven pumps for a nominal discharge capacity of 3,040 cfs and includes six pumps with a combined capacity of approximately 3,040 cfs (design capacity 3,370 cfs). G-335 is the primary outlet from STA-2 to WCA-2. G-335 along with G-436 serves as one of the primary outflow pumping stations for STA 2 (cells 1 through 3). The structure moves treated agricultural runoff into WCA-2 via L-6 canal.

3.4.2.3.2 Pump Station G-436

G-436 (non-federal) is a five-unit pump station located adjacent to and south of G-335. G-436 is located adjacent to and south of S-335. The station is comprised of three 533 cfs diesel engine driven pumps and two 100 cfs electric motor driven pumps for a nominal discharge capacity of 1,600 cfs. The 100 cfs electric motor driven pumps allow for remote operation during low flow conditions. All pumps are vertical axial flow pumps.G-436 is a diesel powered 533 cfs pump and two electric powered 100 cfs pumps that are used under low flow conditions. G-436 along with G-335 serves as one of the primary outflow pumping stations for STA 2 (cells 4 through 8). The structure moves treated agricultural runoff into WCA-2 via L-6 canal. This pumping station releases into the L-6 canal and ultimately into WCA-2A.

3.4.2.4 Stormwater Treatment Area 3/4 (STA-3/4)

STA-3/4 (non-federal) is part of the ECP and is positioned immediately east and north of the Holey Land Wildlife Management Area, north of WCA-3A and west of U.S. Highway 27. It provides a total effective treatment area of 16,327 acres with six treatment cells to treat stormwater runoff originating within the S-2/S-7, S-3/S-8, S-236 and C-139 Basins as well as Lake Okeechobee, all located generally north of the project. For additional information, refer to the SFWMD Operation Plan for STA-3/4 in the SOM Volume 3.

3.4.2.4.1 S-7

S-7 is a three-unit pump station located in the North New River Canal at the western corner of WCA-2A, about 30 miles southeast of the town of Belle Glade and immediately east of U.S. Highway 27. This pump station is comprised of three (3) 830 cfs diesel engine driven pumps for a total discharge capacity of 2,490 cfs. Pump Station S-7 is used to provide a hydraulic gradient

for discharges from STA-3/4. The station also has an adjacent gated spillway that allows water to enter WCA-2A via gravity when downstream stages are low. In addition to moving water from STA-3/4, S-7 may also be used (when G-371 is open) to divert North New River Canal flows around STA-3/4, either for water supply deliveries to the Lower East Coast or in the event of extended durations of excessively high water depths in STA3/4 during extreme events.

3.4.2.4.2 S-8

S-8 is a four-unit pump station located in the Miami Canal at the northern boundary of WCA-3A, about 30 miles southwest of the town of Belle Glade and 15 miles west of U.S. Highway 27. This pump station is comprised of four (4) 1,040 cfs diesel engine driven pumps for a total discharge capacity of 4,160 cfs. The operational purpose of S-8 is to discharge waters from STA-3/4 and STA-5 to the Miami Canal in WCA-3A.

3.4.2.4.3 G-404

G-404 (non-federal) is a three-unit pump station located in Broward County in the L-4 Canal at the confluence of the Miami Canal and the L-4 Canal. G-404 is located just north of Pump Station S8, adjacent to and south of Structure G-357, and adjacent to the southeastern corner of the Rotenberger Wildlife Management Area. This pump station is comprised of three (3) 200 cfs diesel engine driven pumps for a total discharge capacity of 600 cfs.

The two operational objectives for G-404 are as follows, (1) To supply the northwest corner of WCA-3A with treated discharges from STA-3/4 and STA-5; (2) To provide supplemental irrigation water supply to the Big Cypress Seminole Indian Reservation (G-404 will be operated in conjunction with G-409 in this scenario).

3.4.2.4.4 Structure S-150

Structure S-150 is located on the L-5 Canal west of the confluence with the North New River Canal This structure is located adjacent to U.S. Highway 27, just west of Pump Station S-7, and adjacent to the northeastern corner of the Water Conservation Area 3A. This structure has historically been used to pass S-2/S-7 basin waters into WCA-3A, and to provide regulatory discharge from Lake Okeechobee so long as not to affect the water supply to WCA-2A via Pump Station S-7.

3.4.2.5 Stormwater Treatment Areas 5 / 6 (STA 5/6)

STA-5 and STA-6 were components of the ECP, located immediately west of the Rotenberger Wildlife Management Area. The original STA-5 facility consisted of 4,110 acres of effective treatment area and began operation in 2000. In 2006, a third flow-way was added to STA-5 (i.e., the initial expansion on land referred to as Compartment C”), yielding a total of approximately 6,095 acres of effective treatment area. The original STA-6 facility consisted of 870 acres of effective treatment area and began operation in 1997. STA-6 was expanded by 1,387 acres in 2006 with the addition of Section 2, yielding a total of approximately 2,257 acres of effective treatment area for STA-6. In 2010, STA-5 and STA-6 were expanded by about 5,000 acres

(referred to as the "Compartment C Build-out") resulting in a combined STA-5/6 (non-federal) facility with a total of approximately 13,685 acres of effective treatment area.

3.4.2.5.1 G-407

G-407 (non-federal) is located in the L-3 Canal west of the southern part of STA-5/6 Cells 6-3 and immediately northwest of the Oil Well Bridge. G-407 consists of two 10 feet wide by 9 feet high reinforced concrete box culverts approximately 40 feet long. Both manual and remote operation of this structure are possible. G-407 has a design release capacity of 2,000 cfs and serves as the diversion structure for STA-5/6. Under most circumstances, G-407 will remain closed and runoff from the C-139 Basin is directed to STA-5/6 for treatment. When opened, G-407 will route runoff to the L-3 Canal after which it can be conveyed to the northwest corner of WCA-3A.

3.4.2.5.2 G-409

G-409 (non-federal) is located in Hendry County south of STA-6 in the L-3 Borrow Canal at the point commonly referred to as "Confusion Corner." G-409 has three 30-inch diameter vertical axial flow pumps with a total release capacity of 190 cfs. The objective of G-409 is to supply irrigation water to the Seminole Big Cypress Reservation from the Miami Canal. Waters are then delivered to various locations within the eastern portion of the Seminole Big Cypress Reservation for irrigation and also to the North L-28 Feeder Canal and West L-28 Feeder Canal.

3.4.3 C-139 Annex Restoration Project (C-139 Annex)

The C-139 Annex Restoration Project (non-federal) is located immediately south of the C-139 basin and adjacent to STA-5/6. The major water management features associated with the C-139 Annex are a network of internal canals and a structure [(U.S. Sugar Outlet Structure (USSO)] whose main functions are to remove excess water from the basin when needed. The USSO structure is a gated culvert that controls releases from the C-139 Annex allowing excess water to flow from the C-139 Annex south into to the North L-28 Feeder Canal.

3.4.4 Rotenberger Wildlife Management Area (RWMA)

RWMA (non-federal) encompasses approximately 35,000 acres. It is located in southwest Palm Beach County, immediately west of the Miami Canal, north of the L-4 borrow canal, and east of STA-5/6. It consists of sawgrass prairies, maidencane, cattails, shrubs and isolated tree islands. Historical landscape patterns and reports indicate that the northern portion of Rotenberger was a sawgrass-dominated community while the southern portion was a ridge and slough community (C. McVoy, personal communication, 2003). Beginning in the 1950s, Rotenberger was cut off from surface water inflows and only received direct rainfall (SFWMD, 2004). As a result, it experienced marked ecological disturbances related to increased drainage, decreased hydroperiod, drought, and fire severity. These changes led to a transition in the vegetation community including an expansion of species that are characteristic of high nutrient, impacted soil conditions as well as repeated invasions by plant species indicative of upland communities (Garrett and Ferree, 2010; Leeds et al., 2009).

Project components include an inflow pump station (G-410) with associated spreader canal, and four outlet structures (G-402A/B/C/D) with associated upstream collection canals. During normal operations, the source of water for restoration of the RWMA will be treated from STA-5/6. Inflow pump station G-410 is located at the south end of the STA-5/6 release canal, and release into a 3.5-mile distribution canal inside the RWMA. For additional information, refer to the SFWMD Operation Plan for RWMA in the SOM Volume 3.

3.4.4.1 G-402A/B/C/D

The G-402 A-C structures act as outflows from RWMA into the Miami Canal. They are 54 inch diameter corrugated metal pipe culverts with slide gates, located on the eastern perimeter levee of the WMA, immediately west of the Miami Canal (L-23). The G-402D structure is a 42 inch diameter corrugated metal pipe culvert with slide gates also located on the eastern perimeter levee of RWMA, immediately west of the Miami Canal (L-23). The structures have a combined design release capacity of 240 cfs. These structures serve as the primary outflow control structures from the RWMA to the Miami Canal.

3.4.5 Holey Land Wildlife Management Area

The Holey Land (non-federal) is a 35,336 acre impoundment located in the southwest corner of Palm Beach County, Florida. During World War II and Korean War, the southern portion of the area was used as a bombing range, hence the name “Holey”. Currently, no physical evidence of this disturbance is discernable from viewing the surface or topography of the area. However, the area had been degraded by decades (1940s – 1980s) of over drainage, and invasion by upland plant species. Over drainage also caused much of the topography of Holey Land to change due to oxidation and the resulting subsidence of organic peat soils. The unnaturally dry conditions increased muck fires that further changed the topography by causing localized areas of even lower elevation.

FWC is primarily responsible for managing the flora and fauna of the area and works closely with the SFWMD whose responsibilities include overall hydrological operations, as well as construction and maintenance of inflow and outflow structures. The FWC goal for management of the Holey Land is to promote historical vegetation communities. Important components of this goal are to create conditions that support the functional integrity of tree islands, maintain or reduce extent of cattail coverage, increase potential for wading bird, snail kite and alligator usage and maintain the terrestrial wildlife populations near or at high-water carrying capacity.

To restore the natural Everglades habitat of the Holey Land, a restoration project consisting of a levee system, culverts, and pumps was constructed and completed in late 1989. FWC and SFWMD entered into an agreement for an “Initial Operational Plan” with a water regulation schedule from 11.5 feet, NGVD to 13.5 feet, NGVD. The range of the schedule was lowered in 1993 to 11.0 feet, NGVD to 13.0 feet, NGVD. An explosive growth of cattail and negative impacts to deer herds occurred when water levels exceeded 12feet, NGVD. In 1995 the water regulation schedule was once again lowered to between 10.5 feet, NGVD to 12 feet, NGVD.

In 1997 the FWC developed a Holey Land Wildlife Management Area Conceptual Management Plan, which emphasized restoring the vegetation of the Holey Land. This initial document was modified in 2003 and became a draft Memorandum of Understanding (MOU). The draft MOU prompted discussion about water levels and water quality issues that needed to be addressed to bring about a successful restoration effort. In 2005, the G-200A inflow pump to Holey Land was decommissioned, which limited the SFWMDs ability to implement the management strategies in the Draft MOU.

During the 2007/2008 droughts water supply storage and operational alternatives were investigated, which included exploring water storage options within the Holey Land. Several options were considered and documented in a SFWMD "Engineering White Paper", which concluded that the Holey Land, even under best case scenarios, would make a poor temporary reservoir because seepage from this area is relatively high.

With the Holey Land WMA being a rainfall driven system with no real capacity for getting water into or out of the system. The only operational criteria being implemented is during the dry season when water levels are kept at minimum levels between 10.3 feet, NGVD to 10.7 feet, NGVD to prevent potential muck fires from igniting in the area. This is done by sending water via gravity from the Miami Canal through the manually operated G-372HL box culvert. The temporary trade-off of having untreated water conveyed into the Holey Land was thought to have less impact than having potential muck fires ignite, which are very difficult to extinguish. In addition, during periods of excess water, the three outflow culverts G-204, G-205, and G-206 have very limited capacity for releasing water because the water stages in the receiving L-5 canal are typically at or above the Holey Land when STA-3/4 is operating.

Beginning in 2008, SFWMD and FWC scientists began to meet with the objective of developing a new operational schedule and suggested infrastructure for improving hydroperiods and hydro patterns for ecosystem restoration and maintenance for the Holey Land. This effort resulted in agreement on a new 10.75 feet, NGVD to 12.00 feet, NGVD regulation schedule with proposed infrastructure improvements for the Holey Land and was presented to the SFWMD Everglades Restoration Design and Engineering staff. As a follow-up an interagency meeting was conducted on October 20, 2008, with representatives from DEP, FWC, and the SFWMD attending. An overview of the project and a proposal for moving things forward was presented with overall comments from the agencies being supportive.

3.4.6 Site 1 Impoundment

The Site 1 Impoundment Project is part of the CERP and will be located just southeast of WCA-1. The purpose of the Site 1 Impoundment Project is to capture and store local runoff during wet periods and then use that water to supplement water deliveries to the Hillsboro Canal during dry periods thus reducing demands for releases from Lake Okeechobee and the LNWR (WCA-1). Constructing and operating the impoundment will reduce the need for releases from LNWR during the dry season to meet local water demands and will facilitate the maintenance of more natural, desirable, and consistent water levels within the LNWR. The impoundment is meant to reduce groundwater seepage from LNWR. Phase 1 (modifications to the L-40 and miscellaneous

features) of the project is currently under construction by SFWMD (2020), with Phase 2 (impoundment) is not yet authorized.

3.4.7 Seminole Big Cypress Reservation Water Conservation Plan Critical Project (SBC Project)

The Seminole Big Cypress Basin is located in the northwest corner of the Seminole Big Cypress Reservation. It is bound by the West Feeder Canal to the south, the Reservations western boundary to the west, and the existing field ditch system to the east and north. The Federal SBC Project features in this area provide water quality improvements, ecosystem restoration, water storage capacity, and flood control. Features include Water Resource Areas (WRAs), Irrigation Storage Cells (ISCs), levees, water management structures, and pump stations. The non-Federal water management features related to the SBC Project are listed below. SBC Project features are further detailed in the SBC Project WCPs which are an Annex to the WCAs, ENP, ENP-SDCS WCP (Chapter 7).

3.4.7.1 Levees

There are no non-Federal levees related to the SBC Project.

3.4.7.2 Structures

3.4.7.2.1 Structure PC-17

SFWMD operates and maintains PC-17, which is located adjacent to the L-28 North Feeder Canal approximately 2.0 miles upstream of S-190. PC-17 is a single barrel steel culvert 72-inches in diameter and 88 feet long through the west levee of L-28-I. The flashboard risers are located on the canal side of the levee and the release end is on the land side of the levee. The riser width is 94 inches, riser height is 12 feet, and board length is 47 inches. PC-17 releases water from the Water Resource Area 4 East in Basin 4 into the North Feeder Canal.

3.4.7.2.2 G-357

SFWMD operates and maintains G-357, which is located in the Miami Canal at the confluence with the L-4 Borrow Canal, adjacent to the G-404 pump station, north of S-8. G-357 has two 10 feet by 10 feet concrete box culverts fitted with motorized lift gates. G-357 can be utilized to control the flow of water between the L-4 Borrow Canal and the Miami Canal.

3.4.8 Pump Stations

3.4.8.1 Pump Station G-404

G-404 (non-federal) is located in Broward County in the Miami Canal at the confluence with the L-4 Borrow Canal. G-404 is located adjacent to G-357, north of S-8, and adjacent to the southeastern corner of the RWMA. G-404 provides supplemental irrigation water supply to the Seminole Big Cypress Reservation and to US Sugar Southern Divisions Unit 2 farm. G-404 has

three 60-inch diameter vertical axial flow pumps with a total erelease capacity of approximately 1,800 cfs. G-404 also provides water from STA-5/6 and STA-3/4 to northwest WCA-3A.

3.4.8.2 Pump Station G-409

G-409 (non-federal) is located in Hendry County south of STA-6 in the L-3 Borrow Canal at the point commonly referred to as "Confusion Corner." G-409 has three 30-inch diameter vertical axial flow pumps with a total release capacity of 190 cfs. The objective of G-409 is to supply irrigation water to the Seminole Big Cypress Reservation from the Miami Canal. Waters are then delivered to various locations within the eastern portion of the Seminole Big Cypress Reservation for irrigation and also to the North L-28 Feeder Canal and West L-28 Feeder Canal.

3.4.9 North Springs Improvement District (NSID)

The NSID owns and operates a pump station located adjacent to S-38B on the L-36 borrow canal. NSID is permitted to release into WCA-2A only when pumping to the L-36 borrow canal would cause flooding in the Hillsboro Canal or C-14 basins.

3.4.10 Water Conservation Area 1

3.4.10.1 G-94A, G-94C, G-94D (S-4, S-2, S-1)

G-94A, G-94C, and G-94D (non-federal) located in L-40 are identical gated culverts. G-94A and G-94C are used for water supply to the Lake Worth Drainage District (LWDD). G-94D is used to provide water supply to the AID. These structures were constructed and are maintained by SFWMD. AID operates G-94D under a permit from SFWMD. G-94A and G-94C are operated by LWDD under a permit from SFWMD. The volume of water that flows through these structures constitutes a small percentage of the total water budget of WCA-1. G-94A, G-94C, and G-94D each contain two 72-inch diameter corrugated metal pipes with manually operated sluice gates.

3.4.10.2 G-338

G-338 (non-federal) is located in the Supply Canal of STA-2, approximately 400 feet downstream of S-6 and is connected to the Hillsboro Canal via a short spur canal. G-338 may provide water supply to downstream users, transfer water from WCA-1 (LNWR)to STA-2 or divert flows from S-6. G-338 is a 12 feet by 14 feet concrete box culvert with a manually operated gate that has a design release of 975 cfs.

3.4.10.3 G-300

G-300 (non-FederalSTA-1 Diversion Structure) is located in the L-40 Borrow Canal approximately 0.5 miles southeast of S-5A and adjacent to the west side of the STA-1E. G-300 is a concrete spillway with two 20 feet by 8.4 feet vertical lift gates that can be manually or remotely operated. G-300 may divert untreated stormwater into WCA-1 (LNWR) should the inflow capacity of STA-1E and/or STA-1W be exceeded. G-300 can be operated with G-301 to divert the entire capacity of S-5A in the event of an extreme rainfall.

3.4.10.4 G-301

G-301 (non-Federal STA-1 Diversion Structure) is located in the L-7 Borrow Canal approximately 0.5 miles southwest of S-5A and adjacent to the west side of the STA-1W. G-301 is a concrete spillway with three 11.7 feet by 22 feet vertical lift gates that can be manually or remotely operated. G-301 may divert untreated stormwater into WCA-1 (LNWR) should the inflow capacity of STA-1E and/or STA-1W be exceeded. G-301 can be operated with G-300 to divert the entire capacity of S-5A in the event of an extreme rainfall.

3.4.11 Water Conservation Area 2

3.4.11.1 G-335

G-335 (non-federal) is a six-unit pump station is located in the southeast corner of STA-2. It is comprised of two (2) 950 cfs diesel engine driven pumps, two (2) 470 cfs diesel engine driven pumps and two (2) 100 cfs electric motor driven pumps for a nominal discharge capacity of 3,040 cfs. and includes six pumps with a combined capacity of approximately 3,040 cfs (design capacity 3,370 cfs). G-335 is the primary outlet from STA-2 to WCA-2. G-335 along with G-436 serves as one of the primary outflow pumping stations for STA 2 (cells 1 through 3). The structure moves treated agricultural runoff into WCA-2 via L-6 canal.

3.4.11.2 G-436

G-436 (non-federal) is a five-unit pump station located adjacent to and south of G-335. G-436 is located adjacent to and south of S-335. The station is comprised of three 533 cfs diesel engine driven pumps and two 100 cfs electric motor driven pumps for a nominal discharge capacity of 1,600 cfs. The 100 cfs electric motor driven pumps allow for remote operation during low flow conditions. All pumps are vertical axial flow pumps.G-436 is a diesel powered 533 cfs pumps and two electric powered 100 cfs pumps that are used under low flow conditions. G-436 along with G-335 serves as one of the primary outflow pumping stations for STA 2 (cells 4 through 8). The structure moves treated agricultural runoff into WCA-2 via L-6 canal. This pumping station releases into the L-6 canal and ultimately into WCA-2A.

3.4.12 Water Conservation Area 3

3.4.12.1 G-89

G-89 (non-federal) is a three-barrel, CMP culvert, located at the northwest corner of WCA-3A. G-89 is controlled by stop logs in a CMP riser pipe which may be opened for irrigation demands west of WCA-3A.

3.4.12.2 G-204

G-204 (non-federal) is located north of WCA-3A under L-5. G-204 has five 66-inch corrugated metal pipe culverts. G-204 is used to release water from Holey Land WMA to WCA-3A via the L-5 Canal.

3.4.12.3 G-205

G-205 (non-federal) is located north of WCA-3A under L-5. G-205 has six 72-inch corrugated metal pipe culverts. G-205 is used to release water from Holey Land WMA to WCA-3A via the L-5 Canal.

3.4.12.4 G-206

G-206 (non-federal) is located north of WCA-3A under L-5. G-206 has five 66-inch corrugated metal pipe culverts. G-206 is used to release water from Holey Land WMA to WCA-3A via the L-5 Canal.

3.4.13 ENP-South Dade Conveyance System (ENP-SDCS)

3.4.13.1 G-211

G-211 (non-federal) is located south of the L-31N Borrow Canal and C-1W intersection, south of S-335 and north of S-331. G-211 has six 72-inch corrugated metal pipe culverts with a design release of approximately 1,100 cfs. G-211 serves as a divide structure in the L-31N Borrow Canal that facilitates drainage of areas between S-331 and G-211 without lowering the L-31N Borrow Canal between G-211 and S-335.

3.4.13.2 G-737

G-737 (non-federal) is located in the L-31W Levee (South Dade Frog Pond), approximately 1.8 miles downstream and south of S-200. G-737 has three 71-inch by 47-inch pipe arch culvert Flow is controlled by with manually operated slide gates. G-737 releases water from the South Dade Frog Pond to the L-31W Borrow Canal to Florida Bay via Taylor Slough.

3.5 DAM SAFETY HISTORY/ISSUES

A brief summary of the WCA-3A high water concerns, the ERTP interim risk reduction

measures, and an update on the status of further ongoing investigations by the USACE, is provided within the remainder of this section; for a more comprehensive discussion, the reader should refer to the 2011 ERTP Final EIS (USACE 2011c). During 2010-2011, concurrent with the formulation of the ERTP, the USACE conducted a preliminary review of the original WCA-3A design documents and has analyzed historical hydrologic data and U.S. Geological Survey (USGS) rating curve measurements in the area. Based on this review, documented in Appendix A-5 of the November 2011 Final EIS for the ERTP, SAJ concluded the S-12s may not be capable of achieving their original design release of 32,000 cfs and that the current configuration of WCA-3A would result in a predicted increase in the Standard Project Flood (SPF) stage for WCA-3A of between 1.3 and 1.4 feet, compared to the WCA-3A design assumptions. Based on the hydrologic insights gained from the preliminary analysis, the significant change to the original design assumptions, and the diminished extent of emergent vegetation within WCA-3A, the USACE, Jacksonville District recommended the lowering of Zone A of the WCA-3A Regulation Schedule (compared to IOP) as an interim risk reduction measure under ERTP. With

the the ERTP Record of Decision (ROD) in October 2012, the correlating WCP implemented the 1960 WCA-3A 9.5 to 10.5 feet, NGVD Regulation Schedule as a required component for the interim water management criteria for WCA-3A Zone A. Prior to implementation of ERTP in October 2012, Zone A of the IOP Regulation Schedule for WCA-3A ranged seasonally from 10.0-10.75 feet, NGVD.

In addition to the interim risk reduction measure implemented under ERTP, the USACE recommended completion of a detailed engineering assessment to evaluate the combined effects of the potential S-12s release limitations and the WCA-3A Regulation Schedule modifications on the frequency and duration of high water events. The detailed engineering assessment was to include a rigorous evaluation of SPF conditions within WCA-3A/WCA-3B and the upstream WCA-1 and WCA-2 within the context of the regional C&SF Project system infrastructure and operations. As the initial step towards the recommended detailed engineering assessment, the USACE initiated efforts to develop a comprehensive flood routing model of the C&SF Project WCA system in 2014 as part of the USACE' C&SF System Baseline and Modification Modeling (BAMM) Project. The purpose of the BAMM analysis is to determine if cumulative system wide alterations to the C&SF Flood Control Project have altered peak SPF stages within each of the WCAs.

Within the ERTP Final EIS, the Jacksonville District originally proposed a two-phased analysis approach for the WCA-3A high water events. Phase 1 was completed with implementation of the ERTP in October 2012 and included the interim water management criteria for WCA-3A. The Phase 1 effort was limited to a water budget spreadsheet hydrologic and hydraulic assessment. Phase 2 includes the BAMM effort, which will include the need to integrate the results of the BAMM modeling analysis as part of a broader engineering assessment of the public health and safety aspects associated with the levees and structures of the WCAs. Phase 2 also includes a more comprehensive evaluation of the hydraulic, geotechnical and structural engineering effects of the system alterations; incorporation of current USACE risk analysis requirements, focusing on potential human health and safety concerns resulting from increased WCA stages; and evaluation of potential water management operating criteria and/or infrastructure modification options to mitigate adverse changes to the high-water performance of the WCAs.

3.6 PRINCIPAL REGULATION ISSUES

3.6.1 Difficulty in Achieving Design Release Downstream of S-12s

Experience has shown that actual releases from S-12A, S-12B, S-12C and S-12D have been approximately 40 percent less than the design rating curves. However, this has been validated only up to a headwater stage of 10.1 feet, NGVD. The BAMM analysis takes this into account.

3.6.2 Problems with Water Storage in Water Conservation Area 2B and 3B

WCAs-2B and WCA-3B overlie the Biscayne Aquifer. Regulation schedules are not utilized for WCAs-2B and WCA-3B due to high rates of seepage from these areas.

3.6.3 Water Supply Releases from Water Conservation Areas During Low Water Conditions

During low water conditions it is difficult to draw water out of the interior of the WCAs. The regulation schedules for WCA-1, WCA-2A, and WCA-3A include a minimum canal level below which water releases are not permitted unless water is supplied from another source (see Chapter 7 for current minimum canal levels/floor).

3.6.4 Maintenance of Marsh Vegetation in Water Conservation Areas to Prevent Wind Tides

A major factor in the selection of limits for the regulation schedule governing WCA-3A was the maintenance of marsh vegetation. If large areas of open water develop as a result of a loss of vegetation, the increased size of potential hurricane-induced wind tides would necessitate the construction of prohibitively costly levees.

3.6.5 Regulatory Outlet Water Conservation Area 3B

The regulatory outlet for WCA-3B was originally S-12E, which was located along the L-29 Canal immediately east of S-333. However, S-12E never functioned as intended due to tailwater conditions which were higher than designed. Subsequent construction of the ENP-SDCS made S-12E a non-functional structure. Currently, regulatory releases from WCA-3B are made on a secondary basis through S-31 or S-337 to the East Coast. Some flow may also be released through S-355A and S-355B into the L-29 Borrow Canal. However, these structures are rarely used due to tailwater conditions limiting the head differential across the structures.

3.6.6 Competing Needs for Water

WCA-3A was designed to provide flood control, municipal and agricultural water supply, prevention of saltwater intrusion, preservation of a wetlands environment for Everglades' plant and wildlife species, and fresh water supply for ENP. Unfortunately, these project functions require different water management practices to achieve their optimum benefits. High water problems have caused stress on the deer population due to the deer being forced to congregate on restricted areas of high ground. When these conditions last beyond six weeks, severe competition for forage results in decline in the physical condition of the deer herd and an increase in the susceptibility to parasites and disease. High water can also destroy alligator and turtle nests and tree islands, which are critical habitat for many plants and animals in the WCAs. Low water levels can cause effects such as saltwater intrusion; municipal and agricultural water shortages; muck fires; disruption of food availability for wading birds, alligators and other aquatic organisms; and loss of fish and wildlife habitat. Low water has an overall impact on the delicate ecosystem of the ENP.

3.6.7 Everglades Ecosystem

The Everglades system has evolved over many years of climatic fluctuations, including extreme events such as hurricanes, floods, and droughts. Natural stochastic variations within this system

are necessary for its continued health and survival, but are difficult to mimic within the limits of the man-made C&SF Project. Construction of the three WCAs, with attendant internal canal systems, created two pronounced impacts on hydroperiods (1) water tends to pond in the southern portions of each WCA, sometimes at depths that have adverse effects on some Everglades plant communities such as wet prairies and tree islands; and (2) the northern portion of each WCA dries too quickly, too often causing loss of wading bird habitat, increasing the frequency of fires which cause the subsidence of peat soils and damage to tree islands and wet prairie communities. Areas which have experienced shortened hydroperiods have experienced vegetation shifts to woody vegetation (willow and wax myrtle) while the lower elevations have experienced shifts to more aquatic flora. Some attempts to correct hydroperiod impacts in the past include the construction of S-339 and S-340 in WCA-3A to disperse canal flow from the Miami Canal into the northern marsh in wet periods, and to stop over drainage of these northern marshes in dry seasons. These alterations tend to slightly reduce the depth of water in the southern, ponded area. Northern WCA-3A is largely dominated by sawgrass and lacks the natural structural diversity of plant communities seen in southern WCA-3A. The Combined Operational Plan (COP) defines operations for the constructed features of the Modified Water Deliveries (MWD) to Everglades National Park (ENP) and Canal 111 (C-111) South Dade project components. The COP was developed by the MWD and C-111 South Dade project objectives and constraints, and lessons learned from a series of MWD Incremental Field Tests conducted under the authority of the MWD project (i.e. Increment 1, Increment 1.1 and 1.2, and Increment 2) to raise the L-29 canal maximum operating limit for the purpose of increasing flows to Northeast Shark River Slough (NESRS) in ENP. The COP developed Tamiami Trail Flow Formula (TTFF) determines releases from WCA-3A to ENP to achieve; surface water flow deliveries that resemble more natural processes, gradual rate changes to deliver surface water flows, surface water flow distributed across the entire slough.

3.7 MODIFICATIONS TO REGULATIONS

3.7.1 Interim Action Plan

Florida DEP and the SFWMD instituted the Interim Action Plan (IAP) in 1979 as a means of reducing back-pumping of nutrient-enriched water into Lake-Okeechobee from EAA. Under this plan, pump stations S-2 and S-3 were no longer routinely operated to move water north into the lake, but only operated under emergency conditions for flood control or water supply purposes. Runoff from the EAA produced by normal rainfall is released into the WCAs. Based on the operational premises of the IAP, implementation of Level I Best Management Practices (BMPs) in the Taylor Creek/Nubbin Slough Basins and establishment of nutrient loading criteria for the lake and its tributaries, the FDEP issued a Temporary Operating Permit to the SFWMD in 1980 and a Lake Okeechobee Operating Permit (LOOP) in 1983 for the water control structures around Lake Okeechobee. Operation of the IAP has increased the amount of water that is released to the WCAs and decreased the amount of water entering the Lake from the EAA. It is estimated that phosphorus loading released to the WCAs through pump stations S-6, S-7, and S-8 have increased approximately ten percent on an annual average basis since the implementations of the IAP in 1979.

3.7.2 Water Conservation Area 1

3.7.2.1 Initial Interim Regulation

The Basic Report 1951 studied two WCPs for WCA-1. The first plan consisted of providing the minimum requirements for flood control, using the conservation area as a floodway for passing water through the area as quickly as the vegetation, terrain, and outlet capacity would allow. The second plan included provisions for storage of water for agricultural use in addition to the flood protection specified in the first plan. The second plan called for a maximum conservation elevation of 17.0 feet, NGVD. Part I, Supplement 25 recommended a schedule which ranged from elevation 14 to 17 feet, NGVD. Regulation of water levels began July 1960 when the gates of the S-10s were first closed. From July 1960 to May 1969 WCA-1 was regulated according to the second plan. Under this schedule extreme fluctuations in water levels occurred nearly every other year.

3.7.2.2 1969 Revised Interim Regulation

In 1969, the USACE recommended a new schedule that revised the interim regulation raising the lower elevation from 14 to 15 feet, NGVD. This schedule was designed to reduce the frequency of occurrence of low stages and provide additional storage for water supply. WCA-1 followed this schedule from May 1969 to June 1975 on an interim basis. The FWS conducted a study of the effects of water levels in WCA-1 on fish and wildlife resources. The FWS report dated May 1972 recommended returning the previous regulation range of 14 to 17 feet, NGVD. Implementation of the schedule did not begin until February 1974, and only for a few days. It was discontinued at the request of the LNWR manager because of fear of upsetting the established nests of endangered Everglade snail kites, and the 1969 Revised Interim regulation schedule (15 to 17 feet, NGVD) was reinstated.

3.7.2.3 1975 Revised Interim Regulation

In March 1975 the FWS submitted another report and again requested a 14 to 17 feet, NGVD schedule. A flexible schedule was developed in an April 1975 workshop which weighed the various water management objectives and system capabilities. The resulting schedule was implemented in July 1975.

3.7.2.4 1995 Regulation Schedule

In March 1995, a FONSI was signed changing the WCA-1 Regulation Schedule. This action was a result of the USACE consultation with the SFWMD at the request of FWS. This change in the Regulation Schedule ranges from 15.75 to 17.5 feet, NGVD and was based on the changing conditions of demand, supply, and public interests. The objective was to maximize benefits for the various, often competing interests in water use by allowing the water levels to drop during the dry season through consumption and evapotranspiration.

3.7.3 Water Conservation Area 2

3.7.3.1 Initial Regulation

The Basic Report 1951 called for WCA-2 to be a 204-square mile reservoir for storage of excess water from WCA-1 and from the agricultural areas. The flood control storage would protect the adjacent developed areas along the east coast and provide storage for agricultural use and water supply in the Deerfield and Fort Lauderdale areas. In general, Part I of the Basic Report proposed to maintain the conservation pool at elevation 15.9 feet, NGVD. Under this schedule, much of the vegetation would have been eliminated by maintaining higher water levels causing large open water areas to develop. These open water areas would allow major wind tide and large waves to be generated during hurricanes, thus requiring a high and costly levee system.

3.7.3.2 Early Regulation

Part I, Supplement 27-GDM indicated from studies analyzing the available water supplies, flood volumes, irrigation requirements, and the desires of fish and wildlife interests that a seasonal regulation schedule would be desirable for WCA-2. This supplement also studied the feasibility of constructing an interior levee, creating two pools (WCA-2A and WCA-2B) in lieu of raising existing levees to the grade required to provide protection against wind tides and wave run-up. The report recommended that the interior levee be constructed and that WCA-2A be regulated between 12 and 14.5 feet, NGVD and WCA-2B between 8 and 10 feet, NGVD. Regulation of WCA-2A began in July 1961 when the S-11s were closed and continued until May 1970.

3.7.3.3 1969 Regulation

In 1969, the USACE performed a study of alternative schedules that would provide the most benefits without increasing flood hazards in the area. This 1969 study recommended raising the lower limit for WCA-2A from 12.0 to 13.0 feet, NGVD. Benefits from this change were: an increase in pool stages during the spring recession period; the capability to store an increment of water early in the wet season which would otherwise have to be released; and a reduction in the frequency of release at the S-11s which would then reduce the adverse effects of stage drawdown under the existing schedule.

3.7.3.4 1970s Observed Changes

WCA-2A schedule was modified in 1970 and ranged from 13.0 to 14.5 feet, NGVD. However, observed changes in the ecology of WCA-2A prompted SFWMD scientists in the early 1970s to initiate efforts to lower the water schedule and provide for annual drying of the interior marsh. Extended high water killed significant stands of trees, eroded islands, and caused other undesirable vegetation changes in the area. During 1973, an extreme drawdown of WCA-2A was undertaken.

3.7.3.5 1980 Regulation Update

In 1980, the regulation schedule was revised at the request of SFWMD to an interim plan of 9.5 to 12.5 feet, NGVD for reasons stated in paragraph 3.7.3.4. This was an extreme drawdown that

was in place for eight years. In 1989, the USACE adopted an official schedule of 11 to 13 feet, NGVD that is currently in effect.

3.7.4 Water Conservation Area 3

3.7.4.1 Initial Regulation

The Basic Report 1951, Part I had two WCPs for WCA-3. The first plan developed the minimum works required for flood control within the area, considered as a floodway. The water would pass through the area as fast as vegetation, terrain, and outlet capacity would permit, with only incidental storage in the natural basin north of Tamiami Trail. The second plan studied the feasibility of providing agricultural-water use storage in addition to flood protection. Four WCA-3A upper pool levels, 7.5, 10.0, 13.5, and 14.0 feet, NGVD were studied to determine the comparative desirability of the four levels for creating additional storage. The Basic Report recommended that WCA-3 be utilized as a floodway (no upper pool limit) until the need developed for additional water supply.

3.7.4.2 Part I, Supplement 33-GDM, dated 22 June 1960

Part I, Supplement 33-GDM recommended the construction of an interior levee (L-67) to divide the WCA into WCA-3A and WCA-3B. L-67 would be designed to reduce seepage losses for WCA-3A. The report also proposed a regulation range of 9.5 to 10.5 feet, NGVD. This schedule went into effect in 1963. Seepage losses would make it impractical to store water in WCA-3B; therefore, no regulation schedule was proposed for this area.

Review of the Regulation Schedule for WCA-3A, dated October 1980, discussed the review of the regulation schedule; gave a summary of the findings, and statements of positions of all concerned Federal, State, and local agencies; and presented the conclusions and recommendations for the operation of WCA-3A and how the project functions require different water management practices to achieve their optimum benefits. High water caused problems to the area's deer population, low water caused a number of environmental and economic effects, and flood release caused problems to ENP. After reviewing the regulation schedule, it was recommended not to change the schedule at that time.

In 1985, SFWMD developed and was granted permission to experiment with water releases based on rainfall and evaporation over the Everglades. The Rainfall Plan distributed water over a broader area than the original operating schedule whenever possible. The schedule ranges 9.5 to 10.5 feet, NGVD, but included five zones to modify release to ENP when water levels are above or below the optimum target.

3.7.4.3 Everglades Restoration Transition Plan (ERTP)

In March 2012, the WCA-3A Interim Regulation Schedule and ranges from 8.75 to 10.5 feet, NGVD. This regulation schedule removed Zone B and Zone C and added Zone E1. The Zones D, E and E1 of the remaining zones allow release to ENP to be modified when water levels are above or below the optimum target. Parts A, B, and C were also approved as part of the ERTP.

3.7.4.4 Combined Operational Plan (COP)

COP developed a proposed Regulation Schedule, which includes only Zone A and Zone B for WCA-3A and eliminates Zones D, E and E1. The regulation schedule ranges from 9.5 to 10.5 feet, NGVD. Releases are up to maximum when in Zone A (subject to seasonal closures and downstream constraints) and calculated by the new Tamiami Trail Flow Formula (TTFF) when in Zone B. The proposed regulation schedule also includes an Extreme High Water Line designed to allow water managers to consider additional water management actions to lower WCA-3A. The WCA-3A regulation schedule "floor" elevation was changed from 7.0 feet, NGVD measured at S-333 headwater to 7.5 feet, NGVD measured at Site 69W gage. Further details on the TTFF and the WCA-3A regulation schedule are in the WCP (Chapter 7).

3.7.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS)

3.7.5.1 Minimum Delivery Schedule

Two studies in the 1960s allowed development of interim Shark River Slough (SRS) water delivery schedules. A minimum SRS delivery schedule was adopted by Congress in 1970 through the River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970 (P.L. 91-282; see Section 3.1.7). A median annual flow of 260,000 acre-feet was adopted as the minimum annual delivery requirement for the slough based on a rough average by the NPS of the two studies. The median release value of 37,000 acre-feet was recommended for Taylor Slough as the minimum annual requirement. The minimum delivery schedule for the ENP's eastern panhandle designated at S-18C in P.L. 91-282 the 1970 Act was 18,000 acre-feet.

3.7.5.2 Seven Point Plan

By 1983, there was a significant deterioration in the park's ecological conditions. Also, the IAP implemented by the SFWMD and FDEP called for the maximum volume of water to be pumped from the EAA into the WCAs. At that time the ENP requested that the SFWMD and the USACE institute seven protective measures that have subsequently been termed the Seven Point Plan (**Table 3-2**).

TABLE 3-2: EVERGLADES NATIONAL PARK SEVEN POINT PLAN

1	Fill in L-28 Canal and Remove Levee Segments. L-28 Canal was over-draining the eastern Big Cypress during the dry season, and the levee prevented high water from moving into Big Cypress as it traditionally did. Removal of the levee would provide some flood relief to ENP and restore high-water flow through several historical drainage channels.
2	Fill in L-67 Extended Canal and Remove Levee. Water deliveries to the ENP through this canal at times caused abnormal flooding of the ENP during the dry season, and the levee prevented historical hydrological connection with deep-water areas in NESRS.
3	Restore WCA-3B to the Everglades System. Divert as much flow as is environmentally acceptable into WCA-3B.
4	Distribute Water Deliveries Along the Tamiami Canal. Distribute water deliveries from WCA-3A along the full length of the Tamiami Canal from L-28 to L-30. The prevention of flow to NESRS from WCA-3A has stressed aquatic communities within ENP.
5	Establish a Water Quality Monitoring Program. Establish a water quality monitoring program to provide methods to detect degradation of delivery waters to ENP.
6	Defer Implementation of New Drainage Districts. Defer implementation of new drainage districts such as proposed for the East Everglades, until the full impact of any potential flood releases to ENP are thoroughly addressed and all possible mitigation of impacts to the ENP is considered.
7	Field Test a New Water Delivery System to ENP. The present water delivery system to the Park is not working. The proposed new delivery schedule based upon a reference station in the BCNP that predicted water deliveries to SRS based upon current rainfall and normal runoff, rather than upon upstream water management. Any quantities above that predicted would be considered flood releases and all efforts should be made to divert these excess flows.

3.7.5.3 Experimental Delivery Plan

In March 1983, the ENP requested action that would reduce untimely and spatially restricted flood releases of water from WCA-3A into the ENP. With the passage of the Supplemental Appropriations Act of 1984 (P.L. 98-181; see Section 3.1.8), Congress authorized the USACE in December 1983, in P.L. 98-181, with the concurrence of the NPS and the SFWMD, to conduct an experimental program of water deliveries from the C&SF Project to the ENP. The Experimental Delivery Plan field tested water delivery methods to assess potential impacts on the ENP and other parts of the Everglades ecosystem, as well as on the authorized C&SF Project functions of flood control and water supply. The objectives of the plan were:

- Reduce water releases to the Park's SRS Basin through the S-12 structures, especially during normal dry season recession periods.
- Restore flow distribution across the entire width of SRS, the natural flowway into the Park. This would not only contribute significantly to objective 1, but would also help restore hydroperiods in the eastern portion of the historic SRS Basin (Northeast Shark River Slough [NESRS]).
- Allow volume and timing of deliveries to fluctuate as they did historically in response to rainfall and antecedent water conditions in the southern Everglades.
- Maintain downstream SRS water levels at pre-project levels.
- Maintain water quality so that resource degradation does not occur.

3.7.5.3.1 30-day Test at S-12C and S-333

A 30-day test at S-12C and S-333 was conducted during the dry season from 19 April 1984 to 18 May 1984. Results, of the test showed that large volumes of water could be released to NESRS through S-333 and the L-29 Borrow Canal, and that for dry-season conditions, releases of water to NESRS posed no threat of flooding to nearby residential and agricultural areas.

3.7.5.3.2 Wet Season 90-day Test

A 90-day test was conducted during the wet season from 1 August 1984 to 30 November 1984.

3.7.5.3.3 Taylor Slough Demonstration Project (Test 6)

On July 1, 1993, the USACE, SFWMD and the ENP began the sixth iteration of the Experimental Water Delivery Program. This iteration was also known as the Taylor Slough Demonstration Project and included the elements contained in the previous five tests for water deliveries to NESRS. Two new components were added in the south end of the system. First, the stage in the L-31N Borrow Canal was raised from elevation 4.5 to 5.0 feet, NGVD, during the wet season. Prior to initiation of the test, the approved optimum level of the L-31N Borrow Canal was 5.5 feet, NGVD. The approved optimum level was lowered during the program as part of the test mitigation Raising the operating level partially back to the pre-test level was being done at the request of the ENP staff to prevent back seepage from water pumped at S-331 and S-332. ENP hydrologists showed that lower stages in the L-31N Borrow Canal caused large volumes of water to seep from ENP back into the L-31N Borrow Canal. In addition, three portable pumps were placed at S-332 to pump additional flow into the Taylor Slough area of ENP.

3.7.5.3.4 Test Iteration 7-Experimental Program of Water Deliveries to Everglades National Park

In October 1995, a concurrency agreement amongst the USACE, NPS/ENP, and the SFWMD was signed for the Operating Criteria for Test 7 as contained in the Preliminary Environmental Assessment and Finding of No Significant Impact for Test Iteration 7, Experimental Program of

Water Deliveries to ENP, for the Central and Southern Florida Project and for Flood Control and Other Purposes, dated August 1995. The test objectives were to "evaluate methods to restore a more natural hydroperiod to ecosystems within ENP including NESRS and Taylor Slough, enhance flow to Florida Bay via Taylor Slough, as well as reduce large freshwater releases through S-197 into Manatee Bay and Barnes Sound." The test goals were to deliver water to NESRS and Taylor Slough in consonance with rainfall to the degree possible without compromising the flood control function and try to maintain desirable canal stages and pass as much excess water as possible westward into the L-31W Borrow Canal and Taylor Slough. During storm events, the flood control criteria would override normal operations. Test 7 was divided into two distinct phases. Phase I will consist of operations during construction of Phase II components. Phase II would include operation of new components. These components included the additional pumping capacities at structures S-331 and S-174, and flood protection to the L 31N Basin.

3.7.5.4 General Design Memorandum-Modified Water Deliveries to Everglades National Park (MWD to ENP)

In June 1992, the USACE proposed changes to the method of operation and changes to the canals and structures that would, if implemented, as nearly as possible, return the hydrology of ENP to historic conditions. The four major modifications were:

- Construction of structures S-345 and S-349 in L-67A to allow water to be passed from WCA-3A to WCA-3B.
- Construction of structures S-355A and S-355B in L-29 to allow water to be passed from WCA-3B to NESRS.
- Removal of L-67 Extension and filling of the borrow canal.
- Construction of a levee around a residential area in the East Everglades west of L 31N to mitigate for additional flow into NESRS.

3.7.5.5 Interim Structural and Operational Plan (ISOP) for Hydrologic Compliance with the Cape Sable Seaside Sparrow Biological Opinion for the Year 2000

On February 19, 1999, the FWS issued a Final Biological Opinion (BO) on the Cape Sable seaside sparrow (CSSS) under provisions of the ESA. The CSSS is listed as an endangered species under the ESA. FWS concluded that continuation of the water management operations under Test 7, Phase 1 of the Experimental Program of Water Deliveries to ENP would jeopardize the continued existence of the CSSS. In each of the preceding two years, there has been a need to take emergency actions to protect the CSSS, which had been focused on the western population (Habitat A). The BO included a Reasonable and Prudent Alternative (RPA) to avoid jeopardizing the species - additional water management targets for the eastern populations (Habitats C, D, E and F). Factors concerning hydrologic conditions and water management operations are described in the RPA. The proposed Interim Structural and Operational Plan (ISOP) was designed to maintain the level of protection in the western habitat while beginning protective

actions for the eastern habitats for the year 2000. This plan was superseded by the Interim Operational Plan (IOP).

3.7.5.6 Habitat West of Shark River Slough

Because of high regional water levels going into the dry season in November 1999, there was concern that year, as in past years, that the operation of the S-12 structures as specified in the Test 7 criteria would result in water levels too high to allow successful nesting of the CSSS in its habitat west of SRS (**Figure 3-2**). This could lead to the loss of population A and an unacceptable risk of extinction of the entire species. The FWS advised that to avoid this risk, for the year 2000 water management operations should be adjusted so that there would be at least 60 continuous days of sufficiently dry conditions on the habitat during the breeding season, March 1 to July 15. This would be evidenced by water levels at or below 6.0 feet, NGVD, measured at a nearby indicator gage, NP-205.

3.7.5.7 Habitat on the Eastern Flank of Shark River Slough (RPA)

Water levels in CSSS Habitat E (**Figure 3-2**) are characterized by the FWS as too low, leading to higher than normal fire frequencies and invasion of woody vegetation, which adversely affected the CSSS. To re-hydrate this area, the reasonable and prudent alternative (RPA) calls for at least 30 percent of the regulatory water releases occasionally required from WCA-3A to be re-routed into NESRS instead of released through the S-12 structures, beginning on March 1, 2000. This rose to 45 and 60 percent in March 1, 2001 and March 1, 2002 respectively.

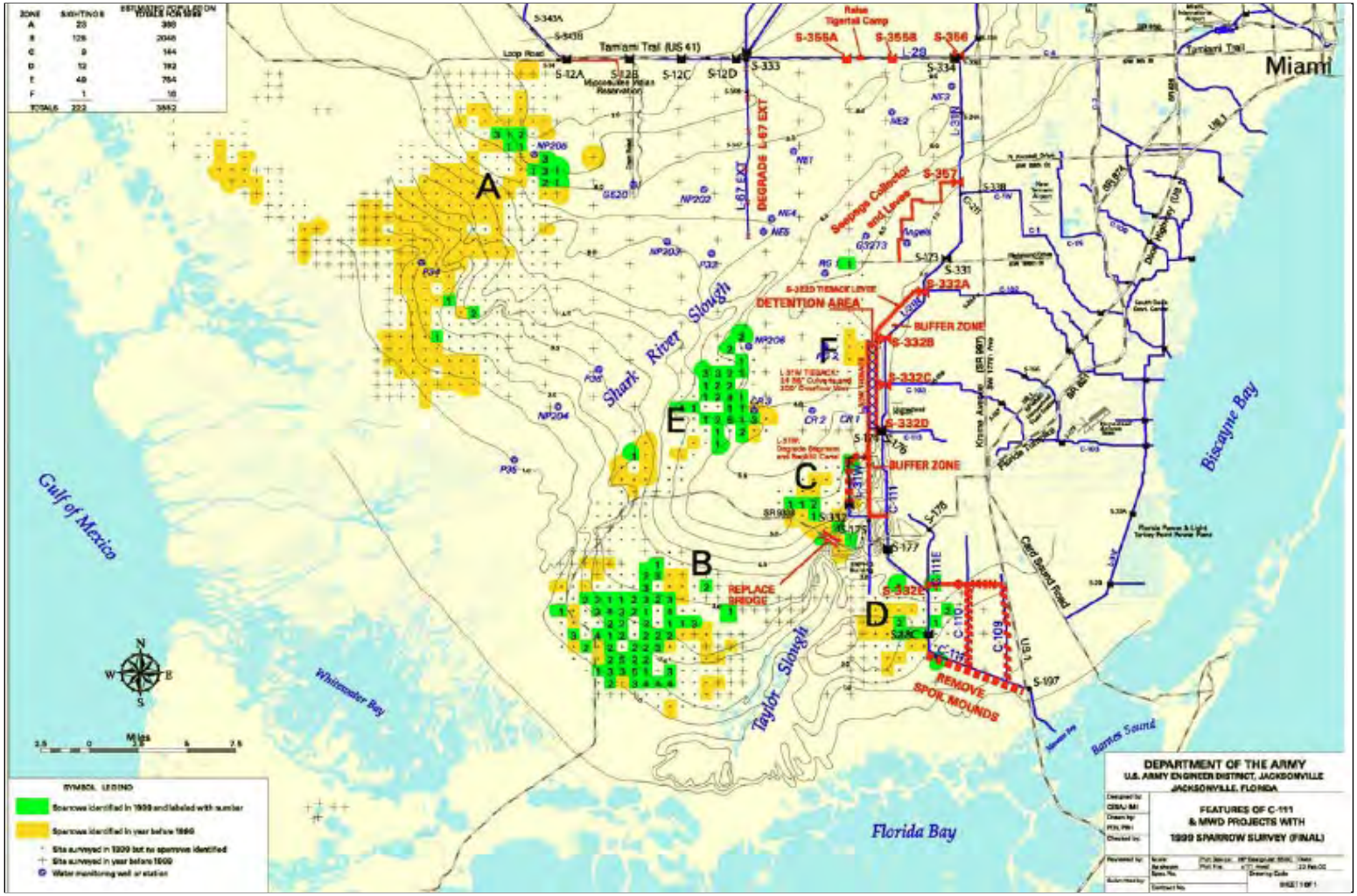


FIGURE 3-2: CSSS HABITAT MAP

3.7.5.8 Eastern Habitats

Sparrow habitats C, D, and F (**Figure 3-2**) lie on the eastern edge of the Everglades near the L-31N Borrow Canal and C-111. Water levels in Habitats C and F are characterized by the FWS as too low and Habitat D as too high as a result of water management operations of the adjacent canals. The RPA recommends raising the canal levels or otherwise producing similar hydrologic conditions to those that would have resulted from implementation of Test 7, Phase II of the Experimental Program. The FWS concludes that Test 7, Phase II hydrologic conditions would establish and maintain favorable habitat for the sparrow.

3.7.5.9 Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow-May 2002

On February 19, 1999, the FWS issued a Final BO under provisions of the ESA for actions required to assure the survival of the endangered CSSS, related to operation of components of the C&SF Project in Miami-Dade County. The BO referenced specifically rapid implementation of structural and operational changes under the MMWD Project, to existing operations under Test 7 of the Experimental Program of Water Deliveries, and to the C-111 Canal Project. The BO concluded that continuation of Test 7, Phase I operations would cause adverse modification of CSSS critical habitat and would jeopardize the continued existence of the CSSS. The BO presented RPAs to the then existing operations that would avoid jeopardizing the CSSS. The RPA recommended that the following hydrological conditions be met for protection of the CSSS: 1) a minimum of 60 consecutive days of water levels at or below 6.0 feet, NGVD at the NP 205 gage between March 1 and July 15; 2) ensure that 30, 45, and 60 percent of required regulatory releases crossing Tamiami Trail enter ENP east of L-67 extension in 2000, 2001, and 2002, respectively, or produce hydroperiods and water levels in the vicinity of subpopulations C, E, and F that meet or exceed those produced by the 30, 45, and 60 percent targets; and 3) produce hydroperiods and water levels in the vicinity of subpopulations C, E, and F that equal or exceed conditions that would be produced by implementing the exact provisions of Test 7, Phase II operations (USACE 1995); and implement the entire MWD project no later than December, 2003. Emergency deviations from Test 7 were authorized in 1998, 1999, 2000, and 2001 by Council on Environmental Quality (CEQ) to allow the USACE to conduct water control operations to protect the CSSS (USACE 1999b; USACE 1999c; USACE 2000). These ISOP operations enabled the USACE to maintain water levels, particularly in the western CSSS populations, that would maximize breeding seasons for the sparrow. During implementation of the ISOP, the USACE received confirmation from the FWS that producing the hydrologic equivalent of the 30, 45, and 60 percent conditions, as opposed to the actual release percentages, would also meet the FWS RPA conditions until the implementation of MWD. The proposed actions under this IOP would allow the USACE to meet or provide the hydrologic equivalent of the FWS RPA conditions, while managing the system for purposes authorized under the C&SF Project.

3.7.5.10 Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow-December 2006

The USACE was required to issue a supplement to its 2002 FEIS by an order issued in March 2006 by the U.S. District Court for the Southern District of Florida, Miami Division, resolving a lawsuit by the Miccosukee Tribe regarding the NEPA compliance and other matters related to IOP. This FSEIS discussed IOP Alternative 7R model output, structural features of Alternative 7R, and actual operations since IOP began in 2002. Structural features unique to Alternative 7R include pump stations S-356 and S-332C, degrading four miles of L-67 levee extension, and three new impoundment basins at S-332B, S-332C, and S-332D. Construction features of Alternative 7R were first authorized under the MWD Project as described in the 1992 GDM and EIS, and under the C-111 Project as described in the 1994 Integrated GRR/EIS. Construction features differed somewhat from the conceptual designs in the referenced reports. New pump stations were built as interim structures for use in protecting sparrow habitat during the wet seasons, subject to further design in conjunction with associated seepage reservoirs that are being constructed. Alternative 7R incorporated the system operations of Alternative 7 and the WCP for WCA-3A, providing for emergency operations in anticipation of high rainfall events. In conjunction with the FSEIS, the USACE re-initiated consultation under Section 7 of the ESA with the FWS for endangered species, including the snail kite and CSSS and received an updated BO November 17, 2006. In the updated BO, the FWS concluded that continued operation of IOP Alternative 7R was not likely to jeopardize the continued existence of the CSSS, Everglade snail kite, or wood stork and was not likely to destroy or adversely modify designated critical habitat for the CSSS or Everglade snail kite.

3.7.5.11 Everglades Restoration Transition Plan (ERTP) December 2011

In early 2009, USACE and FWS identified the need for reexamination of IOP water management operations. In June 2009, due to endangered species concerns within WCA-3A and the fact that the 2006 FWS IOP BO was set to expire on November 17, 2010, USACE and FWS began informal consultation on the Everglades Restoration Transition Plan (ERTP). IOP was determined to no longer be a viable option for water management within WCA-3A and SDCS based upon the current status of endangered species within WCA-3A.

The purpose of ERTP was to define water management operating criteria for C&SF Project features and the constructed features of the MWD and C-111 South Dade Projects until a COP was implemented. ERTP objectives included improving conditions in WCA-3A for the endangered Everglades snail kite, wood stork and wading bird species while maintaining protection for the CSSS and congressionally authorized purposes of the C&SF Project. The proposed action was a modification of IOP with operational flexibilities to provide further hydrological improvements amenable to multiple listed species. Results of modeling efforts were evaluated in relation to the ERTP performance measures (PMs) and ecological targets (ETs) to select the alternative which best met the ERTP objectives, PMs and ETs. ERTP incorporated more flexible operating criteria to better manage WCA-3A for the benefit of multiple species and represented a positive step towards balancing the competing needs of a complex system. ERTP also integrated consideration of new information consisting of current

meteorological, hydrological and species conditions, project specific PMs and Periodic Scientists Calls that serve as a forum to provide input to the USACE decision making process for WCA-3A water management operations.

ERTP represented a paradigm shift in water management within the WCA-3, ENP and SDCS system. Under IOP, there were hard and fast structural closure dates designed to protect nesting season requirements of CSSS-A. The structures will open or close on the specified dates independent of WCA-3A water levels, CSSS nesting or other endangered species requirements. Under ERTP, the needs of multiple species, including other endangered bird species, and their habitats are considered along with current hydrological and climatological conditions. ERTP incorporates protective measures for CSSS-A (most structures retain existing IOP closure dates), but also includes a lowered regulation schedule to meet both the WCA-3A interim high water management criteria and endangered species needs. The WCA-3A Regulation Schedule proposed under ERTP contains extended regulation zones that allow for "up to maximum" releases, providing for management of recession rates and seasonal water levels, which are important for snail kite, wood stork and wading bird nest success. As with any change, there is resistance to flexibility in water management operations. Therefore, USACE committed to conducting Periodic Scientists Calls (PSCs) to provide a forum for stakeholders to provide input to be considered in the USACE decision making process for WCA-3A water management operations. The USACE will consider all input based upon, but not limited to, hydro-meteorological conditions, forecasted conditions, species needs and the often competing multiple C&SF project purposes.

ERTP represented a bridge between IOP and COP, which will supersede ERTP and define water management for the completed MWD and C-111 Projects. Formal consultation on the Cape Sable seaside sparrow, Everglade snail kite and wood stork resulted in a Biological Opinion from the USFWS in November 2010 and a supplemental BO in March 2012 concluding that implementation of the ERTP recommended plan is not likely to jeopardize the continued existence of these species.

3.7.5.12 G-3273 Constraint Relaxation/S-356 Field Test and S-357N Operational Strategy

The G-3273 Constraint Relaxation/S-356 Field Test and S-357N Operational Strategy was the first in a planned series of three related, incremental efforts that were to result in a Comprehensive Operating Plan (COP) to be incorporated into a revised WCAs, ENP, ENP-SDCS WCP. Two field tests (Increment 1 and Increment 2) were to be conducted to assist future development of the COP. COP (Increment 3) was planned to fully realize the natural system benefits that were used to justify the considerable Federal and State expenditures associated with the MWD and C-111 South Dade Projects. Concurrent with construction efforts to complete the flood mitigation and seepage management features envisioned in the MWD and C-111 South Dade Projects, the incremental approach to the development of COP will: (1) allow interim benefits towards restoration of the natural systems; (2) reduce uncertainty of operating the components of the MWD and C-111 South Dade Projects; and (3) provide information to complete COP efficiently.

3.7.5.13 Increment 1

The USACE initiated the Increment 1 under the authority of the MWD Project, to evaluate raising or removing the existing G-3273 stage constraint for inflow into NESRS and operated the S-356 pump station for control of seepage into the L-31N Borrow Canal in October 2015. Increment 1 was a planned deviation from the 2012 WCP (ERTP). The 2012 WCP, which includes the WCA-3A Regulation Schedule, Rainfall Plan and the Interim Operating Criteria for the 8.5 SMA Project continued to govern water management operations during Increment 1, with the exception of operating criteria for S-333, S-334, S-356, S-197, and S-357N . Increment 1 maintained the L-29 Borrow Canal maximum operating limit of 7.5 feet, NGVD while relaxing the G-3273 stage constraint and utilized S-356 for the management of seepage to the L-31N Borrow Canal. During Increment 1, it was anticipated that the combined flows to NESRS through S-333 and S-356 would be more than what would have otherwise been released through S-333 under the 2012 WCP. Additionally, it was anticipated that during implementation of water management operations associated with the Increment 1, under typical hydrometeorological conditions, the combined flows through S-173 and S-331 to the C-111 Basin would be less than what would have been released through these features under the 2012 WCP. Increment 1 also included a testing protocol to assist in defining operating criteria for the new 8.5 SMA S-357N water management structure.

3.7.5.14 Increment 1 Plus (Increment 1.1 and 1.2)

Through several extensions, the latest of which extended the expiration date until July 22, 2016, the USFWS and USACE were able to continue work on revising the ERTP while retaining the ESA coverage afforded by the 2010 ERTP BO. USFWS issued a new BO for ERTP on July 22, 2016, developed in formal ESA consultation with the USACE. As a result of this consultation, it has been determined that current conditions within CSSS habitat, threaten the survival of the sparrow, and as a result, USFWS issued a “jeopardy” opinion, which explains that unless alternatives to current water operational practices are explored and implemented, continued implementation of ERTP is likely to jeopardize the continued existence of the CSSS. The revised BO, issued July 22, 2016 presented a RPA that would avoid jeopardizing the CSSS. The RPA identifies operational modifications and expediting restoration initiatives for some of the structures in the southern portion of the Everglades ecosystem to provide suitable nesting habitat for the endangered CSSS. Main elements of the RPA are: habitat performance targets; actions to move water east; surveys and studies; and adaptive management. These RPA actions include additional seasonal closures to outlet structures within WCA 3A (S-12A, S-12B, S-343A, S-343B, S-344), with the flexibility to open under high water conditions between October and November, and adjustments in operations in the SDCS that will enable additional flows to Biscayne Bay during the dry season and increased flows toward eastern ENP to extend hydroperiods during the early dry season. In response to the BO, the USACE committed to taking specific actions to comply with the BO terms and conditions and implementing the RPA.

Upon review of monitoring data associated with Increment 1 and the 2016 Temporary Emergency Deviation, it became apparent that modifications were necessary to Increment 1 to maintain the congressionally authorized flood mitigation requirements within the 8.5 SMA,to

facilitate completion of ongoing construction of the MWD and C-111 South Dade Projects, and to address the requirements of the 2016 USFWS BO. During Increment 1 and the 2016 Temporary Emergency Deviation, the USACE learned how 8.5 SMA and the ENP-SDCS responded to increased water levels in NESRS prior to the full build out of MWD and C-111 South Dade Project features.

The USACE included additional operational flexibility within the revised Increment 1.1 and 1.2 to operate the L-29 Borrow Canal to a maximum operating limit of 7.8 feet, NGVD subject to downstream constraints. Increment 1.1 and 1.2 also addressed the mandated terms and conditions of the 2016 ERTP BO, which included expanded closure periods for S-12A, S-12B, S-343A, S-343B, and S-344 as mandated by the RPA. NEPA documentation for Increment 1.1 and 1.2 was completed on February 16, 2017 with signing of a FONSI incorporating an EA. During implementation of Increment 1.1 and 1.2, the 2012 WCP, which includes the WCA-3A Regulation Schedule, and Rainfall Plan continued to govern water management operations with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S-355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177 and S-197. Similar to Increment 1, the water level constraint at G-3273 was not a predetermined constraint under Increment 1.1 and 1.2, allowing NESRS to receive more water, relative to the 2012 WCP. S-356 was also utilized for control of seepage to the L-30 Canal. Under Increment 1.1 and 1.2, the ability to raise the L-29 Borrow Canal maximum operating limit from 7.5 feet, NGVD (Increment 1.1) up to 7.8 feet, NGVD (Increment 1.2), was contingent upon compliance with downstream constraints including: (1) acquisition of required real estate interest and any associated improvements for the private ownership along Tamiami Trail and receipt of Tamiami Trail Bridge and roadway channel and flowage easements from the Florida Department of Transportation (FDOT); (2) completion of the C-358 Canal (Richmond Drive Seepage Collection Canal) and installation of S-357N (C-358 control structure); and (3) completion of sufficient portions of Contract 8 (construction of the C-111 NDAL-315 western levee, the L-357W Extension Levee between Richmond Drive and the 8.5 SMA Detention Cell) and completion of the Contract 8A berms inside the 8.5 SMA Detention Cell. Prior to construction completion and operation of the NDA , these constructed features of the MWD and C-111 South Dade Projects were deemed necessary to raise the L-29 Borrow Canal maximum operating limit up to 7.8 feet, NGVD while maintaining required water levels in the residential and agricultural areas in southeastern Miami-Dade County.

3.7.5.15 Increment 2

The USACE proposed to modify the Operational Strategy currently defined in the February 2017 Increment 1.1 and 1.2 EA and FONSI and evaluated the increased restoration flows to NESRS by way of raising the maximum operating limit in the L-29 Borrow Canal up to 8.5 feet, NGVD while ensuring continued flood mitigation within 8.5 SMA. The USACE evaluated further relaxation or potential removal of the G-3273 stage constraint, and modifications to structural operations that direct more flow to ENP. This allows for increased deliveries from WCA-3A into NESRS for the benefit of natural resources and further reductions to the frequency and duration of Column 2 operations implemented under the 2012 WCP. Additionally, operational

flexibility is necessary to facilitate completion of construction of the MWD and C-111 South Dade Project features in a similar manner to Increment 1.1 and 1.2. Increment 2 seeks to increase flow to NESRS while providing operational flexibility needed to: (1) maintain operating limits in the L-29 Borrow Canal that ensure the stability and safety of the Tamiami Trail (U.S. 41 Highway) between S-333 and S-334; (2) support MWD Project construction for the installation of S-357N, if needed; (3) facilitate the remaining Southern Detention Area (SDA) construction of C-111 South Dade Contract 8A and any remaining construction components of the NDA Contract 8; (4) maintain authorized flood mitigation for 8.5 SMA; (5) maintain pre-existing flood protection along the L-31N and C-111 Canals; (6) provide supplemental flows to Taylor Slough; and (7) provide operational flexibilities for prescribed extreme high water conditions in WCA-3A.

3.7.5.16 Combined Operational Plan (COP)

The Experimental Delivery Program as identified in the Supplemental Appropriations Act of 1984, Public Law 98-118) ends with the implementation of COP. The COP is an integrated operational plan for MWD to ENP and the C-111 SD projects. The COP operations do not call for continuation of minimum deliveries as identified in Public Law 91-282 but will convey more natural deliveries to ENP based on environmental conditions tied to rainfall and stages in ENP and WCA-3A. The COP operations improve water deliveries (timing, location, volume) into ENP and take steps to restore natural hydrologic conditions in NESRS, Taylor Slough, Rocky Glades, and the eastern Panhandle of ENP. Information and water management operating criteria identified from Increment 1, Increment 1.1, Increment 1.2, and Increment 2 were used to develop the COP. COP developed a revised WCP (Chapter 7) which is supported by appropriate NEPA documentation.

This page intentionally left blank

4 WATERSHED CHARACTERISTICS

4.1 GENERAL CHARACTERISTICS

The area is a vast, nearly flat, expanse of wetlands with permeable limestone in the northern half but highly impermeable limestone in the southeastern part. The watershed drainage pattern is influenced by the management of WCAs, canals, levees and structures to provide water supply, flood risk management and environmental benefits to the basin. The three general regions covered here are: 1) the WCAs, which represent northern Everglades habitat and includes the majority of intact natural Everglades; 2) the southern Everglades habitat, which occurs in ENP and the southern third of WCA-3; and 3) the East Everglades, which includes the NESRS and a developed area along the slough's eastern boundary. The EAA and Hendry County to the north and BCNP to the west have an impact on these regions; therefore, they are also briefly characterized below. As a whole, the Everglades represents one of the most striking freshwater ecosystems in the country.

4.1.1 Seminole Big Cypress (SBC) Basin

The SBC Basin includes the SBC Project located within the Big Cypress Seminole Indian Reservation in southeastern Hendry County; north of the BCNP, southwest of the EAA, and west of the northwest corner of WCA-3A. The SBC Project features are located in the northwest portion of the Big Cypress Seminole Indian Reservation in Basins 1, 2, and 4.

4.1.2 Water Conservation Areas (WCAs)

The WCAs contain approximately 1,346 square miles which encompass and preserve a large part of the Everglades. A series of levees encircles each of the WCAs and forms their boundaries. The WCAs encompass and preserve approximately 40 percent of the Everglades. The Everglades is a vast shallow depression of organic soil, a product of living plants. The WCAsare principally a large sawgrass plain that includes sloughs, prairies and open water areas, interspersed with hammocks and myrtle and bay heads. The vegetation, when undisturbed by fire or prolonged flooding, effectively covers the ground to heights of 3 to 6 feet, NGVD. The flat slope of the land and the thick vegetation restrict water flow.

4.1.2.1 Water Conservation Area 1 (WCA-1)

WCA-1, with an area of 221 square miles, is approximately 21 miles long from north to south. Ground elevations slope approximately 5 feet in 10 miles both to the north and to the south from the west center of the area. With elevations varying from greater than 16 feet, NGVD, in the northwest to less than 12 feet, NGVD, in the south.

4.1.2.2 Water Conservation Area 2 (WCA-2)

WCA-2, just south of WCA 1, encloses 210 square miles and is subdivided by L-35B into WCA-2A and WCA-2B. WCA-2 measures approximately 21 miles long from north to south. Ground elevations slope southward at 2 to 3 feet in 10 miles, ranging in elevation from greater than 13

feet, NGVD in the northwest to less than 7 feet, NGVD, in the south. Hillsboro Canal separates WCA-1 from WCA-2 and North New River Canal separates WCA-2 from WCA-3.

4.1.2.3 Water Conservation Area 3 (WCA-3)

WCA-3, the largest of the three conservation areas, is approximately 40 miles long from north to south and includes 915 square miles. Ground elevation slopes southeasterly 1 to 3 feet in a ten mile range from greater than 13 feet, NGVD, in the northwest to 6 feet, NGVD, in the southeast. WCA-3 is subdivided into WCA-3A and WCA-3B by parallel levees, L-67A and L-67C in the southeastern corner of WCA-3 which reduces seepage out of WCA-3. Pump Stations S-9 and S-9A, located in L-37 at C-11, convey water from the Western C-11 Basin into WCA-3A. The Miami Canal traverses both WCA-3A and WCA-3B from northwest to southeast and conveys water to the LEC. L-28, located along the BCNP-WCA-3A boundary, contains a gap, to allow for natural drainage from BCNP to WCA-3A. The L-29 Borrow Canal is located on the southern end of WCA-3A and WCA-3B and receives water from WCA-3A and WCA-3B. The Tamiami Trail (U.S. Highway 41), on the south side of the L-29 Borrow Canal, has numerous culverts that transfer water into ENP. Additionally, the physical roadway of Tamiami Trail (U.S. Highway 41) is undergoing a series of construction phases to enable increased flow to pass under the eastern 10 miles of road adjacent to the L-29 Borrow Canal between S-333 and S-334. Over three miles of bridges have been installed, with a 1-mile stretch on the eastern side and a 2.3-mile stretch on the western side that allow unimpeded flow from the L-29 Borrow Canal to ENP.

4.1.3 Everglades National Park (ENP)

ENP is in the southwestern tip of the state, extending from the southern boundary of WCA-3 to Florida Bay and the Gulf of Mexico. ENP comprises approximately 2,300 square miles, including the associated islands and gulf waters; the mainland area is approximately 1,500 square miles with most of the area below elevation 4 feet, NGVD. The highest elevation is approximately 6 to 7 feet, NGVD near the Tamiami Trail. Shark River flows through ENP to Whitewater Bay. Taylor Slough flows southwesterly through ENP to the coast. The coastal areas of ENP are highly susceptible to the influence of salinity from tidal action. Eight different vegetative associations are located in the area: sawgrass Everglades, mangrove forest, salt marsh, cypress forest, pine forest, mixed West Indian hardwood hammock forest, bayhead, and Cape Sable saw palmetto salt prairie.

4.1.4 Las Palmas Community (8.5 Square Mile Area)

The 8.5 Square Mile Area (8.5 SMA), also referred to as the Las Palmas Community, is an inhabited area bounded on the west by ENP and separated from intensively developed urban lands to the east by the L-31N Borrow Canal. The 8.5 SMA has comparatively low ground surface elevations and a surficial aquifer system with high transmissivity. The lowest ground surface elevations are below 7 feet, NGVD along the ENP/8.5 SMA boundary.

4.1.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS)

The ENP-SDCS area is bounded on the north by L-29, on the east by L-31N, on the south by ENP, and on the west by ENP. ENP-SDCS includes; NESRS, a developed area (residential,

agriculture, and industrial) adjacent to the L-31N Borrow Canal, C-111, and Taylor Slough. The ENP-SDCS receives water from upstream WCAs, local runoff, and groundwater seepage. Water in the SDCS can be conveyed to tide via the ECC, pumped to the C-111 detention areas (NDA and SDA), or utilized to meet agricultural water supply demands. The topography of ENP-SDCS sloping from 7 feet NGVD at U.S. Highway 41 (Tamiami Trail) to the tide at the coast.

4.1.6 CONTRIBUTING DRAINAGE AREAS

4.1.6.1 Everglades Agricultural Areas (EAA)

The lands located north of the WCAs and directly south of Lake Okeechobee are considered the EAA. This area of approximately 1,130 square miles is lower than surrounding land and is encircled by levees. To protect against floodwater; a network of Federal and non-Federal (local drainage districts, agriculture) infrastructure which includes canals, structures, and levees to provide for removal of excess water to WCA-1, WCA-2 and WCA-3 by way of STAs 1E, 1W, 2, 3/4 and 5/6. Ground elevations are generally between 13 and 15 feet, NGVD; however, Univesity of Florida Institute of Food and Agricultural Studies efforts indicate ongoing subsidence within the EAA. The EAA contains the most highly developed agricultural land in the C&SF Project area. The crops grown are sugarcane, sod, and truck crops. A large portion of the area is devoted to beef-cattle production on improved pasture.

4.1.6.2 Big Cypress National Preserve (BCNP)

The terrain in the eastern half of the BCNP slopes southeast toward WCA-3A and ENP (aproximately 17 feet, NGVD, to approximately 8 feet, NGVD). BCNP water drains into WCA-3A through a gap in L-28 along the central boundary between the two areas. S-343A, S-343B, and S-344, located on the L-28, also transfer water between BCNP and WCA-3A (usually from WCA-3A to BCNP). BCNP water also drains to ENP through culverts under U.S. Highway 41 (Tamiami Trail).

4.1.6.3 Southeast Hendry County

The terrain in southeastern Hendry County slopes southeast toward BCNP and WCA-3A. Hendry County water is conveyed to WCA-3A by the L-28 Interceptor Canal.

4.2 TOPOGRAPHY

The topography of the WCAs range from 17 feet, NGVD in the northern part of WCA-1 to near 7 feet, NGVD in the southern end of WCA-3A. This gives an average slope of approximately 3 inches per mile for that entire area. The topography of ENP and the East Everglades is nearly flat, sloping from 7 feet, NGVD at U.S. Highway 41 (Tamiami Trail) to the tide at the coast which results in relatively slow overland flow.

4.3 GEOLOGY AND SOILS

The Florida peninsula is the emerged part of a wider projection of the continental land mass called the Floridan Plateau. Southern Florida occupies the southeastern corner of the plateau.

The overburden deposits encountered in the region consist of peat, muck, and organic sand, marl, and clay ranging in age from late Pleistocene to Recent. Those materials were deposited on Everglades Basin floor consisting of the Anastasia formation along the northeastern border, the Fort Thompson formation in the north-central, northwestern, and southwestern areas, and the Miami oolite in the south and southeastern areas. The Tamiami formation of the earlier Miocene period can be found in the Monroe County section of ENP.

The primary geological feature that controls regional hydrology is the permeability of underlying rock. Groundwater, surface water, and water management are all affected. In areas of high permeability, rainfall easily seeps into the underlying rock, but it also may return quickly to canals and streams during dry periods. In some rock strata, water may travel considerable distances before re-emerging at the surface as springs or as seepage to canals or streams. Seepage losses through and under the C&SF Project levees, as determined by detailed field investigations during the course of project design studies, have been found to range from four to over 100 cfs per foot of head per mile of levee. The higher seepage losses occur along the exterior levees bordering WCA-3B. Estimated annual seepage losses from the three WCAs total approximately one-half million acre-feet during normal years. Some benefits accrue from this seepage, especially to the east coast agricultural and urban interests and to ENP, in making up part of the supply to those areas. However, the seepage in excess of the area's water needs is lost to the aquifer and to coastal discharge and cannot be stored for later use. So, if the seepage-loss could be reduced, this would result in a considerable potential supply. Various seepage-reduction measures have been used in western arid regions but are neither suitable nor cost efficient for this area. Until new cost efficient materials or techniques are developed, seepage-loss reduction will continue to be limited to the use of multiple levees to reduce head, avoidance of high-seepage-loss area for use as storage areas, and use of a muck and sand mixture for levee base and cover material.

4.3.1 Seminole Big Cypress (SBC) Basin

Soils throughout the SBC Project area generally consist of loose dry sands. In addition, rock outcroppings or “caprock” is throughout the site extending above the existing ground surface, generally consisting of weathered to competent limestone.

4.3.2 Water Conservation Area 1 (WCA-1)

Soils throughout WCA-1 are generally Loxahatchee peat. The peat varies greatly in depth which is subject to large volumetric changes when drained and is unsuited for long-term productive use. The Anastasia surface formation underlies all of WCA-1. The Anastasia sediments consist of fine, clean quartz sand, and marl and shelly sands with local sandstone concretions and thin interbedded calcareous sandstones.

4.3.3 Water Conservation Area 2 (WCA-2)

WCA-2 contains three surface formations of the Floridan Plateau. In the northern most area Anastasia is the underlying surface formation. There is a gradual change from the soft, sandy limestones to medium-hard sandstones in a southwesterly direction as the Anastasia sand, from

the northern section, mingle with the Fort Thompson formation found to the southwest in WCA-3A. The eastern side of WCA-2 contains permeable sands and oolite limestones because the Miami Oolite formation overlaps the Anastasia formation. Soils are dominantly Peat and Mucks.

4.3.4 Water Conservation Area 3 (WCA-3)

The overburden in WCA-3 consists of peat and sandy peat which ranges generally from one to six feet thick. Underlying the peat are discontinuous beds of calcareous silt, up to 3 feet thick. The hard to medium-hard, sandy, porous limestone found in the Fort Thompson formation underlies the northern half of WCA-3A. The limestone found in the southeastern part of WCA 3A and all of WCA-3B is highly porous and permeable as the Miami Oolite formation is the underlying formation because it overlaps the Fort Thompson formation.

4.3.5 Everglades National Park-South Dade Conveyance System (ENP-SDCS)

Tamiami limestone and Miami oolite underlie most of the ENP; both have a high vertical permeability and subject to extensive solution. The Tamiami is the underlying formation in the north western tip of ENP (the teapot spout section found in Monroe County), while the Miami oolite underlies the rest of ENP area and the area to the east which includes the ENP-SDCS. Although rock outcrops occur, the greater portion of these areas are at least thinly covered by peat or marl or mixed layers of these soil types, produced by organisms.

4.4 VEGETATION

Sediment erosion and production is not a significant issue in the WCAs, ENP, ENP-SDCS, or adjacent areas. Due to the favorable climate in south Florida, vegetation (aquatic and terrestrial plants) grows rapidly. In addition, freezing temperatures that kill vegetation are rare. These conditions result in the expansion of vegetation into undesireable locations. Ocasionally, floating aquatic vegetation or tussocks are moved by wind or current and have the potential to impede flow through water management structures within the C&SF Project area. Terrestrial plants can also impede releases to downstream areas.

4.5 CLIMATE

The climate of south Florida is broadly classified as humid sub-tropical because it has two definite seasons; a dry season and a wet season. The warm rainy season typically extends from May through October, characterized by high humidity, intense solar radiation, and unstable atmospheric conditions that cause frequent local thunderstorms. The dry season normally lasts from November through April with frontal storms bringing cool temperatures, and moderate rainfall of low intensity. Some fronts are accompanied by severe weather producing thunderstorms, tornadoes, and large amounts of rainfall. Although the fronts can sometimes bring freezing temperature, damaging frosts rarely occur. Usually, an adequate blanket of water prevents excessive frost damage and oxidation of the peat soils.

Climate change in the project area could result in higher average ambient temperatures and increased evapotranspiration. Rainfall events may become less frequent and larger in magnitude.

Regional surface water storage systems (i.e. canals) will most likely experience more rapid water loss when compared to current water levels, ultimately impacting availability of water supplies. Sea level change is one of the more certain consequences of climate change, and because it affects the land/ocean interface. Future rates of sea level change are expected to result in significant impacts on coastal canals and communities, with loss of flood risk management levels and increased saltwater intrusion being the primary effects.

4.5.1 Temperature

The monthly average temperatures recorded at National Oceanic and Atmospheric Administration (NOAA) stations in the region for the period from 2000 through 2019 are provided in Table 4-1 at the end of this chapter. The temperatures are moderately high from June through September and pleasantly cool from November through April. Frequent afternoon thundershowers tend to lower temperatures in the summer, and nights are usually cool. January is the coldest month; July and August are the hottest months, with many days above 90°F. Additional climate information may be found at the following website: https://sercc.com/climateinfo/historical/historical_fl.html.

4.5.2 Precipitation

Florida generally experiences large amounts of rainfall. The monthly total precipitation for the period of 2000 through 2019 for selected stations in the project area is shown in Table 4-2 at the end of this chapter. Seasonal rainfall patterns in south Florida resemble the wet and dry season patterns of the humid tropics more than the winter and summer patterns of temperate latitudes. In the wet season, convective showers occur almost daily. Typically, 75% the average annual rainfall occurs during the wet season months of May through October. Tropical storms and hurricanes also provide major contributions to wet season rainfall and the heavier and more prolonged rainfall generally occurs from August through October due to tropical systems. During the dry season (November through April), rainfall is governed by large-scale winter weather fronts that pass through the region approximately weekly. However, due to the variability of climate patterns (La Niña and El Niño), dry periods may occur during the wet season and wet periods may occur during the dry season. Prolonged periods of deficient rainfall are occasionally experienced even during the time of the expected rainy season. Several such dry periods, over the course of one to two years can lead to significantly lowered water tables and lake levels, which in turn may cause serious water shortages for communities in the area of the project. Eight typical rainfall patterns have been identified over Florida:

(1) **Isolated Air Mass**: Local, convective showers are due to daytime heating. Generally, if rain occurs it is limited to a small area and short duration.

(2) **Sea Breeze**: Sea breeze generally occurs on undisturbed days during warm months. Associated showers form along the coast and move inland during the day. There are many types of disturbances including cold air aloft and weak cyclonic flow.

(3) **Sea Breeze and Disturbances**: If sea breeze is associated with a larger scale disturbed pattern, more widespread rain is possible.

(4) **Mesoscale Thunderstorms and Showers**: These systems are often perturbations along old frontal troughs. Mesoscale shower and thunderstorms are quite common over Florida in summer months, usually due to cold air aloft.

(5) **Squall Lines**: Not common in Florida. Lines of thunderstorms are sometimes along a cold front and act like a squall line

(6) **Warm and Cold Fronts**: Frontal passages normally occur in the winter months. Frontal passages do not guarantee rain. During the summer months it is more common to have weak frontal zones that act as convergence zones and have few of the characteristics of winter fronts.

(7) **Tropical and Subtropical Cyclones**: A significant portion of wet season rainfall is associated with tropical systems. The amount of rainfall is not necessarily related to the strength or classical structure of the system. Tropical cyclones consist of tropical waves, tropical depressions, tropical storms, and hurricanes.

(8) **Stationary Upper Level Low Pressure Systems**: Truly stationary upper level low-pressure systems are rare. Over Florida, these systems are usually found in June, September, or early October. Upper level low-pressure systems combined with a front can produce heavy, sustained rain over a wide area. Large rainfalls in the dry season are usually due to these systems.

4.5.3 Evapotranspiration (ET)

ET, which is the loss of water from soil and water surfaces and by transpiration from plants, is a major element of south Florida's hydrologic cycle. Average ET within the Everglades ranges from 70 to 95 percent of rainfall and in dry years can exceed rainfall in volume. Although ET is affected by many factors, temperature is considered the most important. Minimum ET rates occur during the winter months (January and December) and increase to maximum rates during the spring months (April and May). Pan evaporation is used to determine the amount of ET for an area. Pan evaporation is evaporation observed at a standard National Weather Service (NWS) Class A pan installation by observers following standard techniques. Monthly, seasonal, and annual pan evaporation values for selected stations in the C&SF Project area is shown in **Table 4-1**.

TABLE 4-1: PAN EVAPORATION IN INCHES AT SELECTED STATIONS

	Belle Glade Exp Station	Fort Lauderdale Exp Station	Hialeah	Tamiami Trail 40 Mile Bend
January	3.35	3.83	3.81	3.36
February	3.99	4.33	4.42	3.85
March	5.70	6.24	6.12	5.41
April	6.45	7.54	7.26	6.31
May	7.07	7.83	7.80	6.83
June	6.29	6.92	7.12	6.15

	Belle Glade Exp Station	Fort Lauderdale Exp Station	Hialeah	Tamiami Trail 40 Mile Bend
July	6.33	7.15	7.36	6.87
August	6.15	6.97	7.22	6.57
September	5.30	5.94	5.91	5.36
October	4.73	5.52	5.81	5.53
November	3.66	4.31	4.79	3.81
December	3.14	3.81	3.80	3.20
May-Oct	35.87	40.33	41.22	37.31
Nov-Apr	26.29	30.06	30.20	25.94
Annual	62.16	70.39	71.42	63.25
Period of Record	**(03/1940-12/1979)**	**(11/1953-06/1979)**	**(1/1941-12/1979)**	**(2/1941-11/1979)**

4.5.4 Winds

Winds are persistent year round, but on average, are strongest in the late winter or early spring (March). During the wet season, the prevailing winds are easterly. In the dry season wind direction is variable. ET rates increase with wind speed and therefore wind has an effect on regional hydrology. Wind action during the winter intensifies the drying of marshes and causes increased water demands for agricultural irrigation. Very strong winds associated with hurricanes probably do not affect ET losses, but they are an important physical process shaping the Everglades and Florida Bay. High winds and associated wave actions can redistribute such physical features as barrier islands, inlets, channels, and sand shoals and disrupt established plant and animal communities such as coral reefs, seagrass beds, and mangroves.

4.5.4.1 Tropical Disturbance, Tropical Deptression, Tropical Storm, Hurricane

The occurrence of tropical storms of varying intensities is a critical factor in regulatory planning. The necessary regulation schedule must maintain water levels that would be safe even with the occurrence of hurricane wind tides and wave action and at the same time have enough storage to control storm runoff and store enough water for dry-season irrigation requirements. Total storm rainfall is difficult to anticipate. Storm rainfall has little direct relation to the size or intensity of the storm, although the so-called Cape Verde hurricanes which originate far out in the Atlantic tend to produce more rainfall than others originating near shore. Stationary low-pressure systems combined with fronts, and tropical and subtropical cyclones are systems capable of producing large amounts of rain over widespread areas. The region is subject to tropical cyclones from June through November. NOAA classifies tropical cyclones as follows:

(1) **Tropical Disturbance**: Rotary circulation slight or absent at surface but sometimes better developed aloft; no closed isobars and no strong winds; also known as tropical wave or easterly wave.

(2) **Tropical Depression**: One or more closed isobars and some rotary circulation at the surface, highest wind speed 39 miles per hour (mph).

(3) **Tropical Storm**: Closed isobars, distinct rotary circulation, wind speed 39 to 73 mph.

(4) **Hurricane**: Closed isobars, strong and very pronounced rotary circulation, wind speed 74 mph or greater. However, more often than not hurricanes produce at least six to eight inches of rainfall. Hurricanes strike most frequently during August, September, and October with a return frequency of approximately every three years. Numerous tropical disturbances have affected the Florida peninsula between 1885 and 2018, and many of these have reached hurricane intensity. The most notable hurricanes that affected the C&SF Project were: Hurricane of October 1906, Great Hurricane of September 1926, Great Hurricane of Labor Day 1935, Hurricane "Yankee" in November 1935, Great Hurricane of September 1945, Great Hurricane of September 1947, Hurricane Donna in 1960, Hurricane Betsy in 1965, Hurricane Andrew in 1992, Hurricane Irene in 1999, the October 2000 storm (unnamed), and Hurricanes Charley, Frances, Ivan and Jeanne in 2004, Katrina and Wilma in 2005, and Irma in 2017. Additional hurricane information may be found at the following website: **https://www.nhc.noaa.gov/**.

4.6 STORMS AND FLOODS

Although intense rainfalls amounting to four inches or more are common in Florida, serious flooding usually is the result of prolonged heavy seasonal rainfall (August through October) aggravated by tropical disturbances. This seasonal rainfall occurs in thunderstorms which vary greatly in intensity and may occur in an extended squall line or form in locally unstable air. They rarely occur during the winter season, but may occur as often as two days out of three during the summer months. For the agricultural and Everglades area, the available rainfall records show the greatest rainy season amounts occurred in 1947, 1953, 1960, 1981, 1982, 1985, 1991, 1999, 2000, 2004, 2005, 2008, 2012, 2014, 2015, and 2017.

4.6.1 Flood of 1947

The 1947 flood was very severe and was a major consideration for the authorization of the C&SF Project. Nearly 2,500,000 acres were flooded, some of the flooding lasted six months, and damages totaled near $55,000,000. In 1960, one of the wettest summers was followed in September by a severe hurricane and a tropical disturbance. Approximately 1,330,000 acres were flooded, resulting in damages of over $10,000,000. The partially completed C&SF Project prevented almost $25,000,000 damages.

4.6.2 Flood of 1960

September 1960 was one of the wettest months within the history of the C&SF Project. The major causes were rainfalls resulting from Hurricane Donna and the effects of Tropical Storm Florence. This rainfall created extensive flooding throughout much of the area. Rainfalls averaging from 20 to 40 inches occurred over the greater portion of central and southern Florida for the period July 21 to September 30. Damages to agriculture and urban land in the area were estimated at more than $14 million, with agricultural damage alone over $11 million.

4.6.3 Hurricane Betsy — September 7-9, 1965

A tropical storm formed in the southwestern Atlantic and reached extreme southern Florida as Hurricane Betsy on September 8. Rainfall amounts were generally approximately 5 inches in the Miami area and were as much as eight inches over ENP. Flooding was of little consequence and actually brought water levels to normal since the area was experiencing an acute water shortage for wildlife. Completed project works in the project area affected by Hurricane Betsy functioned as designed. Flood stages that occurred in the South Miami-Dade area resulted from overland tidal inundation and overflow of the completed portion of L-31E. However, had this levee been completed, the extent, depth, and duration of flooding during the storm would have been reduced somewhat.

4.6.4 Storm Event — April 24-25, 1979

The areas of highest rainfall intensity for April 24 and 25 occurred in the eastern areas of Miami-Dade, Broward and southern Palm Beach Counties. The "Preliminary Report on The Severe Storm of April 24-25, 1979," prepared by SFWMD, indicates that the highest rainfall was 18.83 inches which occurred several miles west of Delray Beach. S-9, adjacent to WCA-3, received 9.10 inches of rain and portions of WCA-1 and WCA-2 received over 6 inches. Persistent flooding occurred in areas adjacent to the project area such as the C-11 and C-9 basins and releases from the Conservation Areas to the ECC were closed on the night of April 25.

4.6.5 Tropical Storm Dennis — August 16-18, 1981

The passage of Tropical Storm Dennis brought local relief to a prolonged rainfall deficiency, but resulted in the most extensive flooding in South Miami-Dade since 1960. The area of highest rainfall intensity during Tropical Storm Dennis as indicated in the document entitled "Report on Tropical Storm Dennis, August 16-18, 1981" which was prepared by SFWMD, occurred in a 15 to 20 miles wide strip parallel to L-31N and L-30. The area from Florida City to the Tamiami Canal reported 18 or more inches of rainfall within the storm period. Water levels in the WCAs increased from nearly dry to the regulation schedules as a result of rainfall associated with Tropical Storm Dennis. S-18C was opened full at noon on August 17. The peak S-18C headwater stage occurred approximately 18 hours later. A peak release of 2,170 cfs at S 18C exceeded the design discharge of 2,100 cfs.

4.6.6 Rainstorm — April 23-26, 1982

The SFWMD report entitled "Preliminary Report on Rainstorm of April 23-26, 1982" indicates that between 9 and 15 inches of rain occurred in the greater Miami area over the period of April 23 to April 24. Most flooding that occurred was in areas along the east coast and very little rainfall occurred in the WCAs.

4.6.7 Tropical Storm Bob — July 22-24, 1985

Tropical Storm Bob formed as a tropical depression in the southeast Gulf of Mexico on July 21 and moved eastward reaching maximum intensity of 50 mph, with gusts up to 70 mph and made landfall near Fort Myers. Tropical Storm Bob was rather unusual for the fact that no storm, in

over 100 years of data, had moved eastward across southern Florida in late July. The heaviest amounts of rainfall were experienced on the southwest coast of Florida with 2-day amounts exceeding 20 inches near Everglades City. Parts of Monroe and Collier Counties exceeded the 100-year event. However, rainfall amounts in the other portions of the project area averaged approximately 4 to 6 inches for the 2-day period. Pumping was terminated at S-331 and structures S-174, S-176, S-177, S-18C and the culvert at S-197 were opened fully. S-338, located in C-1, was also opened full in an attempt to remove some of the water from L 31N Borrow Canal north of S-331. The earthen plug at the lower end of C-111, near S 197, was removed and pumping resumed at S 331.

4.6.8 Storm Event — January 15-17, 1991

When the storm of January 15-17 occurred, south Florida was more than 2 months into the dry season and there was consideration of imposing water restrictions. The decline in the level of the WCAs was a cause for concern for water supply and represented a threat to wildlife. Information discussed in the document "Storm Event of January 15-17, 1991" prepared by the SFWMD, indicates that the major part of the storm was concentrated along a narrow strip from the west coast of Florida in Collier County to the east coast of Florida in Palm Beach County, with rainfall amounts averaging approximately 8 inches. Fifteen rainfall stations in south Florida set new records for the month of January. During the storm, floodwaters were pumped from the EAA into the WCAs which helped to replenish the storage in the WCAs.

4.6.9 Storm Event — October 8-10, 1991

The intense rainfall of October 8-10 was concentrated over eastern Broward and Miami-Dade counties. The magnitude of the storm may be best represented from the 1-day maximum rainfall amounts, which ranged from 13.5 inches in Hollywood to 2 inches in the Tamiami area of Miami-Dade County. The document "Storm Event of October 8-10, 1991" prepared by the SFWMD shows that the 1-day rainfall at Hollywood had a return period of greater than 100 years. In other areas, the return period was approximately 1-in-10 years. Rainfall in the area of the SDCS ranged from 4 to 8 inches for the entire storm. While rainfall in the WCAs and ENP was less than 2 inches, there were releases for water deliveries to the ENP at the S-12s and S-333 mandated by the Rainfall Plan. S-5A and S-6 pumped water to the EAA and S-140 pumped to WCA-3.

4.6.10 Hurricane Andrew - August 16-28, 1992

Hurricane Andrew crossed the northern tip of Elliot Key, Florida on August 24, then made landfall in mainland Florida at Fender Point in Biscayne National Park (located at approximately SW 280 Street, ENE of Homestead Air Force Base). The tropical cyclone struck southern Miami-Dade County, Florida as a Category 5 hurricane. On the southeast Florida coast, peak storm surge arrived near the time of high astronomical tide. The height of the storm tide (the sum of the storm surge and astronomical tide, referenced to mean sea level) ranged from 4 to 6 feet in northern Biscayne Bay increasing to a maximum value of 16.9 feet at the Burger King International Headquarters, located on the western shoreline in the center of the Bay. Hurricane Andrew resulted in sufficient rainfall to cause local floods even though the hurricane was

relatively small and generally moved rather fast. The 1993 NHC Report on Hurricane Andrew included event rainfall totals of approximately 7.8 inches in Broward County (S-124) and 7.4 inches in Miami-Dade County (S-21A). After striking Florida, Andrew moved northwest across the Gulf of Mexico to make a second landfall in south-central Louisiana.

4.6.11 Hurricane Irene — October 13-17, 1999

Hurricane Irene moved across southeast Florida parallel to the coast, dropping torrential rains with tropical storm and Category 1 hurricane force winds. The center of Hurricane Irene moved offshore near Jupiter later on the morning of October 16, 1999. Between October 13 and 17, many sites in Broward, Miami-Dade, Martin and Palm Beach counties received more than 10 inches of rainfall. The maximum rainfall at a site was 17.46 inches near S-41 near the coast of Boynton Beach in Palm Beach County. The maximum rainfall at a site in Broward County was 14.15 inches at the rain gage station: FTL at the Fort Lauderdale Airport. Sites in Broward, Miami-Dade and Palm Beach counties received the 24-, 48- and 72-hour maximum rainfall that would occur once in 100 years. Flows through water control structures and water levels in Lake Okeechobee, the WCAs, and canals showed significant increase due to the hurricane. The SFWMD pumped 646,654 acre feet of water in October with 466,388 acre-feet being pumped from October 13 to October 31, 1999. The pumping for October 1999 was greater than the combined sum of pumping volumes for October in the previous 3 years. Seventy seven percent of the pumping volume was pumped into the WCAs through G-251, S-5A, S-6, S-7, S-8 and S-9. A few pump stations and several structures achieved record high daily average release rates. The total inflow and outflow for Lake Okeechobee for October was 565,136 acre-feet and 179,346 acre-feet, respectively. From October 13 to 31, the inflow to Lake Okeechobee was 381,065 acre-feet and the outflow was 173,175 acre-feet. Outflow through coastal structures was 1,108,107 acre-feet for October with 976,757 acre-feet released from October 13 to 31. Releases into the ENP were 365,785 acre-feet with 276,672 acre-feet occurring between October 13 and 31. Inflow and outflow to STAs generally increased. There were many instances where historical high water levels were attained. S-332 had a record maximum pumping rate of 539 cfs on October 17, 1999.

4.6.12 Unnamed Storm — October 3-4, 2000

This storm dropped 15.3 inches at the Miami International Airport. The combined effect of this storm and Hurricane Irene one year earlier resulted in locally sponsored flood protection improvements in C-3, C-4 and C-6 Basins.

4.6.13 Hurricanes Charley, Frances, Ivan and Jeanne — August - September, 2004

Hurricanes Charley, Frances, Ivan, and Jeanne made landfall in South Florida in 2004. A similar series of events had not been observed since 1871. High rainfall, high surface water flows, and a rise in lake water levels were experienced. Most of the rainfall occurred on the Upper and Lower Kissimmee River Basins, the headwaters of Lake Okeechobee, which is the central component of the south Florida water management system. In these basins, the 100-year return period of monthly rainfall was observed for September 2004. The resulting surface water flow raised the

water level in Lake Okeechobee, a 433,000 acre lake, by 5.38 feet between August 12 and October 13, 2004, resulting in a storage increase of 2.37 million acre-feet.

Hurricane Charley made landfall on the southwest coast of Florida near Cayo Costa on the evening of August 13, 2004, with a maximum sustained wind of 145 mph. The center passed near Kissimmee and Orlando early on August 14 and crossed into the Atlantic Ocean at Daytona Beach. For the purpose of hydrologic impact analysis of the 2004 hurricanes, the five-day cumulative rainfall before, during and after the landfall day of each hurricane is reported as the rainfall amount from the hurricane. For Hurricane Charley, the highest areal rainfall was observed in the Upper Kissimmee rainfall area followed by the east Caloosahatchee and southwest coast rainfall areas and corresponds with the path of the hurricane.

Hurricane Frances made landfall over the southern end of Hutchinson Island on Florida's southeast coast on the evening of September 5, 2004. It traveled west-northwest through central Florida and entered the northeastern Gulf of Mexico on September 6, 2004. The highest areal rainfall was observed in the Palm Beach rainfall area followed by the Martin-St. Lucie and Upper Kissimmee rainfall areas, corresponding with the hurricane's path.

Hurricane Ivan made three U.S. mainland landfalls initially coming ashore west of Gulf Shores, Alabama on September 16, 2004. Ivan gradually weakened while producing heavy rainfall in the southerern Appalachians while it moved to the Mid-Atlantic States. On September 19, Ivan moved over the Delmarva Peninsula (Deleware/Maryland) and entered the western Atlantic Ocean as an extra tropical cyclone. Ivan turned south and southwest toward Florida, moving over the southern Florida peninsula emerging in the Gulf of Mexico, eventually making landfall in southwestern Louisana on September 24. The highest areal rainfall was observed in the Martin-St. Lucie rainfall area, followed by the Palm Beach, east EAA, and WCA-1, which generally corresponds with the path of the storm event over the Florida peninsula.

Hurricane Jeanne made landfall on the southeast coast of Florida at the southern end of Hutchinson Island just east of Stuart early on September 26, 2004. It went west to 30 miles north of Tampa and moved north to central Georgia. The highest areal rainfall was observed in the Upper Kissimmee, Palm Beach, Martin-St. Lucie, and lower Kissimmee rainfall areas, corresponding with the hurricane's path.

In September 2004, several rainfall areas observed extreme rainfall; Martin-St. Lucie (17.86 inches; >50-year return period); and Palm Beach (17.69 inches; >50 year return period).

4.6.14 Hurricanes Dennis, Katrina, Rita, and Wilma — July - October, 2005

Hurricane Dennis (mid-July 2005) did major damage in Cuba but passed west of south Florida on its way north through the Gulf of Mexico drenching Miami-Dade and Broward Counties.

Hurricane Katrina (August 23-26, 2005) developed in the Bahamas and made landfall on the Miami-Dade/Broward line August 25 as a Category 1 hurricane. The hurricane moved slowly west-southwest on a 6-hour trip through the southern tip of Florida. Loss of life and heavy flooding resulted from very high intensity rainfall. Homestead registered 13.24 inches in a 24-hour period. Flooding was reported in the Homestead area and C-1 Basin. L-31N Borrow Canal

and C-111 were seriously impacted. Because the C-4 Storm Detention Reservoir was activated, serious flooding did not occur in the C-4 Basin. Katrina later made landfall near New Orleans causing catastrophic fatalities and property damage.

Hurricane Rita (September 20, 2005) formed in the Turks and Caicos Islands and missed landfall in south Florida to the south as it passed through the Florida Straits, but caused significant rainfall in south Miami-Dade, as well as the Keys and ENP.

Hurricane Wilma (October 24, 2005) caused major damage to Cancun, Mexico, as a Category 4 storm that lingered for several days. It also caused major damage and flooding impacts in south Florida—notably direct impacts on Lake Okeechobee.

4.6.15 Tropical Storm Fay - August 17-23, 2008

According to the National Hurricane Center (NHC), Fay originated as a tropical wave off the coast of Africa on August 6, 2008. On August 15, 2008, a low-pressure area over the Mona Passage became Tropical Storm Fay and moved over eastern Dominican Republic. The next day, the storm passed east of Haiti. On August 17, the storm reached Cuba. By August 18, it had moved northeast of the Florida Keys after a landfall on the Keys. On the morning of August 19, 2008, Tropical Storm Fay landed in southwest Florida, near Cape Romano, moving inland across Lake Okeechobee and moving on to the Atlantic Ocean near Melbourne. The mean Doppler surface wind velocity over Lake Okeechobee was estimated at 69 mph. The SFWMD weather station L005 in Lake Okeechobee observed a 15-minute mean maximum wind speed of 59 mph on August 19, 2009, at 12:45 pm. After lingering for three days off the coast of the Kennedy Space Center, Fay made its third landfall in Florida in Volusia County. The storm moved west and northwest across Florida and crossed into Gulf of Mexico. It made a fourth landfall in the panhandle of Florida. Rainfall from the tropical system affected all of the state, with central and south Florida getting storm-related rainfall from August 17-23, 2008.

4.6.16 Tropical Storm Isaac — August 24-28, 2012

Tropical Storm Isaac moved west-northwest through the Straits of Florida on August 26, with the center passing across the lower Keys late that afternoon. Tropical Storm Isaac continued on a west-northwest track over the southeast Gulf of Mexico making landfall in Port Fourchon, Louisiana on August 29. The NWS Miami-South Florida Weather Forecast Office Tropical Storm Isaac Report described an area of 10 plus inches of rainfall across roughly one-third of Palm Beach County, stretching from Jupiter Farms south to Boca Raton, then into northern metro Broward County from Coral Springs to Lauderhil. In addition, maximum rainfall amounts were both measured and estimated in the 15 to 20 inches range across the Wellington and The Acerage communities.

4.6.17 Heavy Rainfall Event — January 9–10, 2014

At the beginning of 2014, the January 9–10 rainfall event on coastal St. Lucie, Martin, and Palm Beach counties was a rare event, with a frequency higher than 100-year one-day maximum rainfall at several sites. According to the NWS, the storm was caused when a cold front that passed through the area warmed up and moved back north, while from the east and southeast,

warm moist air flow on top of it (The Palm Beach Post, January 13, 2014). The NWS reported more than 22 inches of rainfall in Boynton Beach, which was the hardest hit area (The Palm Beach Post, January 15, 2014). It was also reported that 12 inches of rainfall fell in the first two hours. Rainfall intensity of 2.2 inches in 15 minutes was observed in eastern Palm Beach County in the C-15 Basin, with a maximum of over 7 inches in one hour. In the same basin, radar estimated rainfall of 15.1 inches fell at a site in three and a half hours. Rainfall of 15.75 inches in less than six hours was reported at the LWDD office. In St. Lucie County, 8.68 inches of rainfall fell in 3 hours at a location in the mid-coastal area on January 9 (4:00 p.m. to 7:00 p.m.). In Martin County, 6.23 inches of rainfall fell in four hours at a location in the North Folk area.

The impact of the extreme rainfall resulted in the closing a section of Interstate 95 from Boynton Beach Boulevard to Hypoluxo Road (approximately 3 miles), street flooding that stranded vehicles, and local school closures. As many as 140 homes in Palm Beach County had flooding (Palm Beach Post, January 14, 2014). The District reported that its primary system water control structure gates were fully open. The tertiary (neighborhood) and secondary (LWDD) canal systems were overwhelmed with the high intensity of rainfall and associated flash flood. It was noted that the primary drainage system was helped by the fact that the flooding was close to the ocean, making it a short distance to move the floodwaters that reached the primary canals. St. Lucie, Martin, and Palm Beach counties were affected.

4.6.18 Heavy Rainfall Event — February 2015

As a result of a front that stalled on South Florida, February 28, 2015, there was another 1-inch rainfall day, with high rainfall causing flooding in some locations. According to the NWS, the stalled front drenched eastern and southern Palm Beach and Broward counties. Areas that had high rainfall were Stuart (9.6 inches), Pembroke Pine in Broward (8.84 inches), Jupiter (7.07 inches), Royal Palm Beach (5.92 inches), and Boca Raton (5.66 inches).

4.6.19 Heavy Rainfall Events — December 2015

From December 3 to 6, 2015, south Miami-Dade experienced heavy rainfall causing flooding of farms. The flooding caused crop loss for vegetable farmers of the area. The Miami Herald on December 14, 2015, citing the county agricultural manager, estimated crop losses between 40 and 100 percent. The paper also reported on December 15, 2015, that Federal assistance was asked from the United States Department of Agriculture to declare flooded farm lands a disaster to get relief in the form of loans. Rainfall for the month of December 2015, measured at monitoring sites near the S-177, S-180, and S 20G structures (S-177, S-180, and S-20G monitoring sites, respectively) and a real rainfall average for Miami-Dade rain area, were rare events as shown by the return period in **Table 4-2**.

TABLE 4-2: HEAVY RAINFALL EVENTS - DECEMBER 2015

Recording Date *	Rainfall (inches)			
	Miami-Dade	S-177	S-18C	S-20G
December 3, 2015	0.75	0.55	0.99	0.45

Recording Date *	Rainfall (inches)			
	Miami-Dade	**S-177**	**S-18C**	**S-20G**
December 4, 2015	3.50	3.19	4.53	4.36
December 5, 2015	0.81	0.52	0.63	1.29
December 6, 2015	3.48	4.64	5.18	6.56
Total	**8.54**	**8.9**	**11.33**	**12.66**
* Rainfall observation from 7:00 a.m. previous day to 6:59 a.m. recording day.				

4.6.20 El Niño Event — December 2015 - January 2016

In December 2015 and January 2016, normally the dry season, South Florida experienced an extremely unusual amount of rainfall from El Niño conditions. In fact, January 2016 was the wettest for most of South Florida since records began in 1932. Rainfall over WCA-3A in January 2016 was 9.5 inches, more than 400 percent of average January rainfall. This extraordinary natural phenomenon resulted in WCA-3A extreme water level rise and caused severe impacts to natural resources. The rapid rise, especially since it occurred during a time of year when water levels are historically low, inundated tree islands and other wildlife habitat.

Immediate action beyond what was allowed under existing regulatory criteria was necessary to move significant volumes of water out of WCA-3A. On February 11, 2016, FDEP issued an emergency final order authorizing SFWMD and USACE to lower water levels by moving water out of WCA-3A to ENP through Shark River Slough.

Water levels in WCA-3A crested at elevation 11.50 feet, NGVD in mid-February and returned to below the highest zone (Zone A) of the regulation schedule by May 9, 2016, after the emergency operations. Approximately 700,000 acre-feet of water was released from WCA 3A during the 90-day emergency operations period, February 12–May 11, 2016. ENP received more than one-half million acre-feet of water during the emergency operations period.

USACE and SFWMD implemented emergency operations in a manner that minimized harmful impacts, including flooding and degradation of water quality, to the environment, the public, adjacent properties, and downstream receiving waters. USACE South Florida Operations Office (SFOO) and SFWMD field station staff and crews and contractors constructed numerous temporary features to move more water and to mitigate the effects of higher water levels to wildlife, businesses, and communities.

4.6.21 Extreme Rainfall Event — June 1-8, 2017

The extreme high rainfall of June 1- 8, 2017, averaged 9.27 inches over the whole SFWMD. In comparison, the average SFWMD rainfall for the month of June is 7.85 inches. The rainfall system moved as a continuous band of rainfall from Gulf of Mexico over South Florida crossing into the Atlantic for several days. Both the intensity and duration of rainfall resulted in extreme wet conditions in many parts of South Florida. The main band with the highest rainfall crossed from southwestern Florida to southeastern Florida covering Collier, Hendry, Broward, and Palm

Beach counties with over 22 inches of rainfall at a spot and areal average rainfall of over 15 inches. The extreme rainfall event followed dry conditions in South Florida, which helped mitigate the resulting flooding. Impacts of the event included flooding in Broward and Palm counties, Fort Lauderdale and Miami airports delays, and closing of Sawgrass Mills Mall and Miami Zoo for a time.

4.6.22 Hurricane Irma — September 9–11, 2017

Hurricane Irma moved away from the northern coast of Cuba on September 9 and on September 10, Irma strengthened to a Category 4 hurricane as it accelerated toward the Florida Keys. Hurricane Irma made landfall in Cudjoe Key, Florida on the morning of September 10 as a 130 mph Category 4 hurricane. The center moved into central Florida overnight and into northern Florida later on September 11, as it weakened. The NWS Miami-South Florida Weather Forecast Office Report described the highest rainfall amounts from Hurricane Irma occurring over inland portions of Collier County and western sections of Hendry and Glades counties where the eye of Irma passed. These areas received anywhere from 9 to 15 inches of rainfall, with estimates of up to 20 inches in the Felda, Florida area as well as the Big Cypress National Preserve. Elsewhere, rainfall totals were mainly in the 6 to 10 inch range.

4.7 RUNOFF CHARACTERISTICS

The generally flat topography prevailing throughout the region, its thick vegetation, and the absorptive nature of its soil combine to produce low runoff characteristics. The major canals between Lake Okeechobee and the WCAs serve as collecting sumps for agricultural area runoff to be pumped to the STAs and then released to the WCAs. Under design flood conditions, storage in the 3 WCAs total approximately 963,500 acre-feet but will fluctuate with regulation ranges. Because of the slow movement of water in the densely vegetated areas, rapid removal of flood storage from the interior of those areas via the canals is limited. During periods of high releases from the spillways, canal water levels will often be below ground level in the adjacent marshes while water depths in the densely vegetated marshes are approximately one to two feet. The design discharge for the S-10s, S-11s, and S-12s, is 14,800 cfs, 16,700 cfs, and 32,000 cfs, respectively. The interior canals in WCA-3A, Miami Canal, L-68A, and L 67A Canals, L-67A Extension Canal, also serve as distribution channels for delivery of water to SRS and ENP.

4.8 WATER QUALITY

The water quality in the WCAs, ENP and the East Everglades is influenced by urban and agricultural activities elsewhere in the watershed. The quality of water that leaves the EAA contains higher concentrations of nitrogen and phosphorus and other constituents than is generally found in local rainfall. However, the 2019 South Florida Environmental Report (SFER) by SFWMD documents that Everglades water quality in relation to total phosphorus continues to show improvement: “In Water Year 2018, inflow TP concentrations for the Everglades Protection Area ranged from 8.8 parts per billion (ppb) for ENP to 28.5 ppb for WCA 3. TP concentrations at interior regions ranged from 4.7 ppb in ENP to 10.5 ppb in WCA 2. Individual interior marsh monitoring stations ranged from 2.9 ppb in some unimpacted portions of the marsh to 36.1 ppb at sites that are highly influenced by canal inputs. The investments

made over the last two decades are making a difference, improving the Everglades's water quality with over 90% of the SFWMD EPA at or below 10 ppb TP."

Of particular concern is floodwater released from the EAA into WCA-3A. The Everglades is a nutrient poor system and the introduction of nutrients, particularly phosphorus, from the agricultural areas is thought to have significantly affected sawgrass and wet prairie habitat in the WCAs through which EAA releases pass en route to ENP. Currently, water reaching the ENP has generally been of good quality. As mentioned above, the water quality in relation to total phosphorous is improving. However, the NPS has expressed concern over excessive nutrients in surface water entering ENP from the WCAs. Water is the most critical ecological factor in the ENP. When in 1970, the U.S. Congress guaranteed minimum water deliveries to the ENP, it also required that these waters be of good quality. Regulations for water quality are a function of the State of Florida. As the State representative, it is the responsibility of SFWMD to petition the USACE for changes in flood risk management and navigation regulations where it sees that water quality benefits may be achieved in the WCAs, ENP, ENP-SDCS region without significant loss of benefits for the congressionally authorized project purposes.The USACE monitors the quality of delivery water according to a Memorandum of Agreement (MOA) jointly developed in 1979 with ENP and SFWMD. These monitoring stations and stations for the WCAs are discussed in Chapter 5-Data Collection and Communication Network, and further water quality discussion is provided in Chapter 7-Water Control Plan.

4.9 CHANNEL AND FLOODWAY CHARACTERISTICS

The WCAs are completely contained by levees, except for approximately a 7-mile gap in the levee on the BCNP/WCA-3A boundary. Movement of water through the WCAs and the Everglades is characterized by its low velocity, sheet flow, flat slopes and a high resistance to flow in the marsh areas. The SBC Project, northwest of WCA-3A, releases water to BCNP and WCA-3A. WCA-1 releases water to WCA-2A, which releases water to WCA-2B and WCA-3A. WCA-3A releases water to WCA-3B, ENP, and ENP-SDCS but WCA-3A water may also flow through the gap to BCNP at the BCNP/WCA-3A boundary. WCA-3B releases water to; ENP, which reaches tide through sheetflow, and the ENP-SDCS which releases water to tide.

Water in the WCAs, ENP, ENP-SDCS region is managed with a system of canals, pump stations, and water management structures. The main canals are the: West Palm Beach Canal, Miami Canal, Cross Canal, North New River Canal, South New River Canal, Hillsboro Canal, and Tamiami Canal. In general, for canal design, a velocity of 2.5 feet per second was used for areas with sandy material and 3.5 feet per second for canals in rock. Velocities of up to 5 feet per second were considered permissible for bridges in hard limestone. Side slopes for canals were based on the type of materials encountered. Side slopes of 1 vertical on 2 horizontal were used for sand and clay; 1 on 3 for fine sand; and side slopes of 1 on 1 were used in limestone. Canal sections were based on the most economical section that would carry the design release at the available design water surface and slope, except that bottom elevation in small canals was held to 10 feet below normal water level wherever practicable.

The major outlet structures for the WCAs are the S-10s for WCA-1, the S 11s for WCA-2A and S-333 and the S-12s for WCA-3A. Their design capacities are 14,400 cfs, 16,700 cfs, and 32,000 cfs, respectively. The pump stations associated with the WCAs are S-5A, S-6, S-7, S-8, S-9, S-9A, and S-140. S-140 was designed for a runoff of 7/16 inch-per-day and all the other pump stations except for S-9A, were designed for a runoff of 3/4 inch per-day. S-9A was designed to pump seepage back into WCA-3A. L-31W and L-31N Canals prevent flooding from ENP into the agricultural and urban areas to the east. The ENP-SDCS includes 2 main canals (L-31N and C-111) that convey water to tide or other C&SF Project features within the East Coast Canals (SOM Volume 5) region. S-332B, S 332C, and S-332D pump water from the L-31N Borrow Canal to the NDA and SDA. Due to high transmissivity of the NDA and SDA, the majority of this water eventually enters the groundwater through seepage both to ENP to the west and the L-31N Borrow Canal to the east.

4.10 UPSTREAM STRUCTURES

Lake Okeechobee, the EAA, Lake Istokpoga, and the Kissimmee River include water management structures that are upstream of the WCAs. Within the EAA there are numerous minor pumps operated by Chapter 298, Florida Statutes, drainage districts and individual farms that transfer water to EAA canals. SOM Volume 3-Lake Okeechobee and Everglades Agricultural Area and SOM Volume 2-Kissimmee River-Lake Istokpoga Basin describe upstream structures and regulation responsible parties. The EAA which encompasses approximately 1,158 square miles includes a network of canals, levees, pump stations, and water management structures operated by the SFWMD that allow the transfer of EAA water to STAs which is then released to the WCAs. The major pump stations associated with the transfer of stormwater runoff (which includes the EAA and other sources) to or from the STAs are S-5A, S-6, S-7, and S-8. S-5A transfers water from the EAA and other sources to STA-1E and STA-1W which is released to WCA-1. S-6 transfers water from the EAA and other sources to STA-2 which is released to WCA-2A. S-7 transfers water from the STA-3/4 to WCA-3A. S-8 transfers water from the STA-3/4 and STA-5 to the Miami Canal in WCA-3A. In addition, S-9 and S-9A, operated by SFWMD, transfers water to WCA-3A from C-11 Basin.

4.11 DOWNSTREAM STRUCTURES

The WCAs, ENP, ENP-SDCS features of the C&SF Project release water either to tide or adjacent features within the East Coast Canals Basin of the C&SF Project. The SOM Volume 5-East Coast Canals describes the C&SF Project features operated by SFWMD and the various local drainage district network of canals, levees, pump stations, and/or water management infrastructure downstream of the WCAs, ENP, ENP-SDCS component of the C&SF Project.

4.12 ECONOMIC DATA

4.12.1 Population

The 2010 Census resulted in a total population for the State of Florida of 18,801,310. The population of Florida counties within and adjacent to the WCAs, ENP, ENP-SDCS components of the C&SF Project are shown in **Table 4-3**.

TABLE 4-3: 1990 AND 2010 POPULATION BY COUNTY

County	Population (1990 Census)	Population (2010 Census)
Broward	1,255,488	1,748,066
Collier	152,099	321,520
Hendry	25,773	39,140
Miami-Dade	1,937,094	2,496,435
Monroe	78,024	73,090
Palm Beach	863,518	1,320,134
Total	4,311,996,	5,998,385

4.12.2 Agriculture

In 2017, there was approximately 721,751 acres of farmland within the Palm Beach, Broward, Collier, Miami-Dade, and Monroe Counties. Palm Beach County has the largest total cropland of 487,845 acres of which 275,442 acres was harvested for sugar cane in 2017. Palm Beach County leads the nation in the production of sugar cane, sweet corn and sweet bell peppers 36% of the county's land is dedicated to agriculture. Traditional forms of agriculture that require hundreds of acres of land are no longer viable in Broward County. Landscape nurseries and horse farms are the two main forms of modern agriculture in Broward County. The agriculture within Miami-Dade County is one of the most diverse in the country. The tropical climate provides a year-round growing season and the ability to produce an extremely wide range of crops.

4.12.3 Industry

The main industrial activity in the watershed (WCAs, ENP, ENP-SDCS) and downstream areas is tourism. The Greater Everglades provide opportunities for sightseeing, wildlife viewing, photography, hiking, bicycling, boat touring, boating, kayaking, canoeing, camping, fishing, and hunting at various locations including ENP, EWMA, and LNWR. Visitation at ENP in 2017 was 1,018,557 while LNWR attracts over 432,837 visitors annually (2018). Recreation in these areas increases tourist activity and provides economic benefits to the communities within and surrounding the area.

4.12.4 Flood Damages

Excerpts from the Annual Flood Damage Reduction Report to Congress representing the annual flood damages prevented by the C&SF Project, which includes components of the WCAs, ENP, ENP-SDCS, from fiscal year 1998 through 2018, are shown in **Table 4-4**.

TABLE 4-4: ANNUAL FLOOD DAMAGES PREVENTED BY THE C&SF PROJECT

Fiscal Year	Flood Damages Prevented
FY 1998	$77,628,900
FY 1999	$64,872,600
FY 2000	$52,101,700
FY 2001	$52,594,200
FY 2002	$4,595,800
FY 2003	$35,111,400
FY 2004	$38,578,754
FY 2005	$21,592,313
FY 2006	$9,230,976
FY 2007	$0
FY 2008	$80,318,000
FY 2009	$36,670,000
FY 2010	$6,759,800
FY 2011	$73,706
FY 2012	$20,374,000
FY 2013	$10,083,000
FY 2014	$7,215,900
FY 2015	$1,363,000
FY 2016	$16,743,000
FY 2017	$43,652,000
FY 2018	$1,340,000

TABLE 4-5: MONTHLY MEAN AVERAGE TEMPERATURES

Monthly Mean Avg. Temperatures recorded at West Palm Beach International, AP station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	65.9	69.0	71.5	75.2	79.0	82.0	83.4	83.7	82.3	78.9	73.0	69.6	76.2
Maximum	71.8	75.3	77.0	80.2	81.3	84.4	86.2	85.0	84.1	81.6	78.1	76.3	78.0
Minimum	59.9	60.9	64.1	71.3	76.3	80.3	81.6	82.5	80.1	76.3	69.0	58.8	74.0

Monthly Mean Avg. Temperatures recorded at Fort Lauderdale Area station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	67.9	70.7	73.0	79.6	79.8	82.7	83.8	84.1	82.9	80.0	74.5	71.4	77.3
Maximum	73.0	75.4	77.5	79.8	81.8	85.0	85.2	85.7	84.5	82.6	78.9	77.5	78.9
Minimum	62.2	66.4	66.4	72.9	77.9	80.0	81.7	82.9	81.2	77.6	71.3	60.7	74.9

Monthly Mean Avg. Temperatures recorded at Everglades ARS station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	64.2	66.6	77.2	73.2	77.2	80.1	80.9	82.2	81.2	77.7	71.9	69.1	75.0
Maximum	73.5	74.7	84.9	77.7	84.9	87.1	88.1	93.4	91.2	85.6	80.2	75.0	81.4
Minimum	52.3	37.7	71.3	67.6	71.3	75.5	75.9	76.5	75.9	70.8	65.8	57.9	70.4

TABLE 4-6: MONTHLY TOTAL PRECIPITATION

Monthly Total. Precipitation recorded at West Palm Beach International AP, FL station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	2.44	2.46	3.20	3.70	5.31	8.41	5.65	8.76	8.10	5.00	2.74	3.17	59.02
Maximum	10.42	8.08	10.83	8.05	15.69	20.09	8.97	22.66	29.40	15.02	6.89	11.06	78.72
Minimum	0.11	0.14	0.36	0.660.26	0.40	2.89	1.59	3.03	1.39	0.91	0.75	0.75	42.27

Monthly Total. Precipitation recorded at Fort Lauderdale Area, FL station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	1.92	2.36	2.42	2.87	5.85	8.09	6.46	7.73	7.52	5.46	3.16	2.62	56.59
Maximum	7.41	5.23	5.71	7.29	17.84	17.10	15.49	14.54	14.16	15.52	10.92	10.11	76.45
Minimum	0.04	0.01	-	0.66	0.23	1.09	1.72	2.04	1.33	0.73	0.42	0.13	40.60

Monthly Total. Precipitation recorded at Miami International AP station													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	1.48	1.97	2.32	3.49	6.47	10.79	8.02	9.57	10.02	6.71	2.60	2.40	66.00
Maximum	7.57	4.69	5.24	8.95	16.59	19.62	12.76	15.92	17.99	18.95	7.55	9.82	86.94
Minimum	0.21	0.05	0.19	0.23	1.71	3.60	4.11	4.43	3.25	0.72	0.34	0.28	52.09

This page intentionally left blank.

5 DATA COLLECTION AND COMMUNICATION NETWORKS

Operation and monitoring of the C&SF Project includes a vast network of data collection gages and networks to communicate that data to USACE as well as the non-federal sponsor (SFWMD). The gages span the WCA, ENP, ENP-SDCS basin and the networks are run by USACE, SFWMD, The United States Geologic Survey (USGS), and ENP. Individual CERP projects include their own Water Control Data Acquisition System Plans (WCDASP) and these will be included in the exhibits for this chapter.

5.1 HYDROMETEOROLOGICAL STATIONS

There is a coordinated monitoring effort between the USACE and the SFWMD on all relevant hydrologic and meteorological sites for the purpose of operating and maintaining the functionality of the C&SF Project. The USGS and Everglades National Park (ENP) also play important roles in maintaining and providing data from the hydrologic and meteorological sites.

5.1.1 Facilities

There is a coordinated monitoring effort between the USACE and the SFWMD on all relevant hydrologic and meteorological sites for the purpose of operating and maintaining the functionality of the C&SF Project, including WCAs, ENP, ENP-SDCS Basin. The USGS and ENP also play important roles in maintaining and providing data from the hydrologic and meteorological sites.

ER-1110-2-249, Engineering and Design, Management of Water Control Data Systems, dated 31 August 1994, defines the Water Control Data System (WCDS) as a dedicated special-purpose system of all hardware and software which has been acquired and is being used for acquisition, transmission, processing, display, and dissemination of hydrologic, meteorological, water quality, and project data for the purpose of supporting the water management mission of the USACE. The Jacksonville District Water Management Section and the Operations Division Multi-Project Branch are the WCDS functionaries.

The WCDS mission maintains sufficient resources to perform concurrent real-time hydrometeorological data acquisition and analysis for authorized project purposes. The USACE current WCDS consists of various incoming data streams, a central database, and reporting functions. Gages throughout the system which are included in these data streams are owned, operated and maintained by various partners described in subsequent sub-sections below. The USACE databases consists of both Hydrologic Engineering Center Data Storage System software (HEC DSS or DSS) and custom Oracle databases. Information about hydrologic forecasting can be found in **Chapter 6** of this SOM.

5.1.1.1 United States Geological Survey (USGS)

The USACE collects data throughout the system to assist in the management of the system. The USACE owns many data collection sites which are serviced and maintained through the Cooperative Streamgaging Program with the USGS. The USACE can also access and retrieve data from other publically available USGS gages. These gaging stations transmit data from the

field via Geostationary Operational Environmental Satellite (GOES) in Standard Hydrometeorological Exchange Format (SHEF), and the data is ultimately collected and stored in the USACE WCDS databases. Also, numerous gaging stations are owned and operated by the USGS and monitor surface and groundwater water levels. The USGS water resources database is the National Water Information System (NWIS) and the data is available to the public through NWIS Web (**http://waterdata.usgs.gov/fl/nwis**).

USACE collects the data from USGS via the publicly available GOES system.

A summary of the gages collected by the USGS are shown in **Table 5-1** found at the end of this Chapter. These data are generally available in real time over the internet and through the GOES system; some less critical data are manually collected and are only uploaded intermittently. **Table 5-1** is a snapshot of a dynamic list of sites that are regularly added and removed as the system infrastructure is constructed or removed. This table will be updated as needed.

Data collected by the USACE are transmitted back to the USGS. The data gets transmitted to the USGS in SHEF.

5.1.1.2 South Florida Water Management District (SFWMD)

SFWMD operates a Supervisory Control and Data Acquisition (SCADA) network in the WCAs, ENP, and SDCS Basin which is used for collecting data as well as remote and automated operation of structures. The water management structures are equipped with several types of telemetry recorders, which measure water level, water velocity, gate position, and rainfall. These include on-site and remote recorders. The SFWMD post processes some of the data and calculates flows at many locations.

The SFWMD transmits its data to the USACE database in real-time. This data is reliable for use in making operational decisions in real-time. The SFWMD online database called DBHydro has these datasets in real-time as well, and additionally provides Quality Assurance/Quality Control (QA/QC) and publishes the final data. USACE has access to the data collected by the SFWMD as they become available. The site names and data types are listed in Table 5 2, at the end of this Chapter. Table 5 2 is a snapshot of a dynamic list of sites that are regularly added and removed as the system infrastructure is constructed or removed. This table will be updated as needed.

SFWMD real-time hydrometeorological data is publically available at the SFWMD website which can be found at: **https://www.sfwmd.gov**.

5.1.1.3 Everglades National Park (ENP)

Everglades National Park owns and maintains gages within its borders. The data from these gages is transmitted to USACE and other partners via GOES and the internet. These gages measure surface and groundwater water levels as well as rainfall. Generally this data is reliable and comes into the GOES system in real time, there are some more remote and non-critical (gages which are not necessary for making real time operational decision) which are manually collected and data is only uploaded intermittently. **Table 5-2**, at the end of this chapter, contains

a list of these gages. **Table 5-2** is a snapshot of a dynamic list of sites that are regularly added and removed as infrastructure is constructed or removed. This table will be updated as needed.

5.1.2 Reporting

Reporting is mainly done via website by USACE as well as their partners (SFWMD, USGS, and ENP). Reporting under each agency is described in the following sections.

5.1.2.1 U.S. Army Corps of Engineers (USACE)

The USACE WCDS consists of both HEC-DSS and custom Oracle databases. The WCDS provides a means for storing and maintaining data in a centralized location; providing input to and storing output from application programs; transferring data between application programs; and displaying the data in graphs or tables. The WCDS is utilized to maintain both real-time data acquisition and historical archiving of data.

Data is reported out to stakeholders and partners through the Jacksonville District Water Management webpages. Jacksonville District webpages are updated and maintained regularly and data can be displayed via graphics, plots, tables, text reports, and more. These can be found at

https://www.saj.usace.army.mil/WaterManagement/

Water data for USACE can be found at **https://water.usace.army.mil/**.

5.1.2.2 U.S. Geological Survey (USGS)

Data gathered by the USGS for the USACE through the Cooperative Streamgaging Program is reported in near real-time. Data reported by the USGS in real-time is provisional until finalized by the USGS (as noted by data quality flags). This data can be retrieved from the USGS NWIS web site (**http://waterdata.usgs.gov/fl/nwis**) and is used to prepare daily operation reports, water budgets, and monthly summary of operations.

5.1.2.3 South Florida Water Management District (SFWMD)

The SFWMD provides access to their data via web interface. Data reported by the SFWMD in real-time is provisional until finalized by the SFWMD (as noted by data quality flags). The public and partners can access their website (**https://www.sfwmd.gov**) for all data needs.

5.1.2.4 Everglades National Park (ENP)

ENP does not currently display or report their data via website. Data within the GOES system can be publicly accessed by anyone with the appropriate receivers. Some data is available at the SFWMD webpage. Data that is specifically included in the Adaptive Management Plan (Appendix C of the COP EIS) which is not provided in the data tables within this chapter include gages collected by ENP including: LPG3, LPG5, LPG7, LPG8, LPG16, LPG17, and Tamiami Trail soil moisture monitoring gages. These gages are available over the GOES system but are not currently available online.

5.1.3 Maintenance

Under the Cooperative Streamgaging Program agreement, the USGS maintains the USACE gages. Problems with gages should be reported to the USGS. The SFWMD and ENP also maintain their network of gages within the basin.

5.2 WATER QUALITY STATIONS

The USACE Jacksonville District does not operate or contract for the operation of water quality stations in the WCAs, ENP, or ENP-SDCS Basin at this time. SFWMD has many water quality monitoring gages located throughout the basins. This data is available at SFWMD's website (**https://www.sfwmd.gov**). For more information about water quality monitoring, see Adaptive Management Plan (Appendix C of the COP EIS). The Water Control Data Acquisition System Plan (WCDASP) for Decomp Physical Model (DPM) Phase 2 is a subset of the Water Control Data System and does rely partly on water quality monitoring to determine S-152 operations as discussed in the 2017 DPM Phase 2 Operational Strategy.

5.3 SEDIMENT STATIONS

The USACE Jacksonville District does not operate or contract for the operation of sediment stations in the WCAs, ENP, or ENP-SDCS Basin at this time.

5.3.1 Facilities

Not applicable.

5.3.2 Reporting

Not applicable.

5.3.3 Maintenance

Not applicable.

5.4 RECORDING HYDROLOGIC DATA

The agency responsible for operation and maintenance of the stations is responsible for archiving and maintaining the official station records as well as informing the Corps of structures and/or gages which are out of service. The SFWMD provides a weekly summary of all gages/structures offline via email. USACE operates the S-10s, S-11s, S-12s, and the S-355s within the WCA, ENP, ENP-SDCS Basin. The official recording for these structures is done by the USGS as part of the Cooperative Streamgaging Program. All other gages within the WCA, ENP, ENP-SDCS Basin are officially recorded by the SFWMD, USGS, or ENP. The meteorological data collected by NOAA is published in Climatological Data for Florida, Hourly Precipitation for Florida, and Storm Data. Some near real-time meteorological data and forecasts can be obtained from the NOAA State Forecast Office in Miami (**https://www.weather.gov/mfl/**), or from the Southeast River Forecast Center (SERFC) (**https://www.weather.gov/serfc/**) in Peachtree City, Georgia.

5.5 COMMUNICATION NETWORK

USACE field data collection is transmitted via satellite (GOES) and network connections with remote sites. SFWMD collects and maintains their data and transmits to USACE. USGS and ENP field data collection is transmitted via satellite (GOES) to USACE. The USACE operates and maintains remotely operated equipment to be more efficient. S-10A, S-10C, S-10D, S-12C and S-12D are capable of being remotely controlled. A remotely controlled system is defined in ER-1110-2-1156, Engineering and Design, Safety of Dams – Policy and Procedures as being a water control system that can be operated from an offsite location by offsite personnel without requiring the operator to physically travel to the site for local operation.

5.5.1 Regulating Office with Project Office

The regulation schedules for the WCAs are developed by the USACE in consultation with the SFWMD, and approved by the USACE. The communication between the USACE and the SFWMD is done by phone/teleconference and email. A weekly water management coordination call is setup to ensure continuity of operations and discuss operational decisions between USACE and the SFWMD. Normal day-to-day coordination between USACE and SFWMD are currently handled on an “as needed” basis. During emergencies, communications are more frequent (**Chapter 9** - Water Control Management).

5.5.2 Between South Florida Water Management District and Others

In 1977, SFWMD's real-time water management data acquisition system became fully automated. The telemetry and communications network is controlled from the SFWMD's Communications Center in West Palm Beach. It provides centralized collection of water management data from remote sites and the means to process and display the data for use in the formulation of management decisions. They also carry out remotely controlled and automated operations for many of their structures.

5.6 COMMUNICATION WITH PROJECT

Communication between the Jacksonville District and SFWMD is on a daily basis through phone calls or emails. During storms or other emergencies communication will be more frequently.

5.6.1 Between Regulating Office and Project Office

Communication between the non-federal sponsors (SFWMD and STOF) and the Jacksonville headquarters is done through data transmissions, email, and phone. SFWMD operators and field offices coordinate with their Communications Center in West Palm Beach via data transmissions, email, and phone.

5.6.2 Between Regulating/Project Office and Others

Communications and data transfer related to SFWMD or STOF water management occurs between the Jacksonville District Water Management Section and the SFWMD Office of Operations or the STOF Environmental Resource Management Department, respectively. These offices communicate often with others through several methods including, but not limited to,

press releases/conferences, website, social media, email, and phone. Specific questions should be directed to USACE corporate communications office (PublicMail.CESAJ-CC@usace.army.mil).

5.7 PROJECT REPORTING INSTRUCTIONS

Data will continue to be reported to the USACE in the same manner that has been described previously. The data will be collected by the SFWMD and furnished to the USACE on a real-time basis.

5.8 WARNINGS

A flood warning system is not incorporated into the WCA, ENP, ENP-SDCS component of the C&SF Project. The NWS is the federal agency responsible for developing and disseminating flood forecasts through the Miami Weather Forecast Office.

TABLE 5-1: USGS STATIONS

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
251032080473400	ALLIGATOR CREEK NEAR GARFIELD BIGHT, FL	**Access Data**	TAYLOR SLOUGH COASTAL	Elevation, Flow	No
022908295	BOTTLE CREEK AT ROOKERY BRANCH NEAR HOMESTEAD, FL	**Access Data**	EVERGLADES NATIONAL PARK	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
02290878	BROAD RIVER NEAR THE CUTOFF, FL	**Access Data**	LOSTMANS	Elevation, Flow, Temperature, Salinity	No
02290769	CANAL 111 AT S-18-C NEAR FLORIDA CITY, FL	**Access Data**	C-111 SOUTH	Elevation, Flow	No
02290888	CHATHAM RIVER NEAR THE WATSON PLACE, FL	**Access Data**	CHATAM/TURNER	Elevation, Flow, Salinity	No
251154080471900	CUTHBERT LAKE OUTLET NEAR FLAMINGO, FL	**Access Data**	TAYLOR SLOUGH COASTAL	Elevation, Flow	No
251152080370900	EAST CREEK NEAR HOMESTEAD, FL	**Access Data**	TAYLOR SLOUGH COASTAL	Elevation, Flow	No
250802081035500	EAST SIDE CREEK NEAR LAKE INGRAHAM, FL	**Access Data**	CAPE SABLE	Elevation, Flow, Specific Conductivity, Salinity, Turbidity	No

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
254707080370201	EDEN 10 IN WATER CONSERVATION AREA 3-B	Access Data	CONSERVATION AREA 3B	Elevation	No
262258080273501	EDEN 11 IN WATER CONSERVATION AREA 2-A	Access Data	CONSERVATION AREA 2A	Elevation	No
260042080351701	EDEN 12 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation	No
261035080221701	EDEN 13 IN WATER CONSERVATION AREA 2-B	Access Data	CONSERVATION AREA 2B	Elevation	No
260410080452701	EDEN 14 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation	No
253044080555900	EDEN 3 IN EVERGLADES NATIONAL PARK	Access Data	EVERGLADES NATIONAL PARK	Elevation, Temperature, Specific Conductivity, Salinity	No
260536080302501	EDEN 4 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation	No
260725080451001	EDEN 5 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation	No
260355080541401	EDEN 6 IN BIG CYPRESS NATIONAL PRESERVE	Access Data	L-28 GAP	Elevation	No
255708080295501	EDEN 7 IN WATER CONSERVATION AREA 3-B	Access Data	CONSERVATION AREA 3B	Elevation	No
255200080405001	EDEN 8 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation, Temperature, Specific Conductivity, Salinity	No
261319080353201	EDEN 9 IN WATER CONSERVATION AREA 3-A	Access Data	CONSERVATION AREA 3A	Elevation	No
252036080324300	EVERGLADES 4 IN C-111 BASIN NR HOMESTEAD, FL	Access Data	C-111 COASTAL	Groundwater Elevation	Yes
251716080342100	EVERGLADES 5A IN C-111 BASIN NR HOMESTEAD, FL	Access Data	TAYLOR SLOUGH	Elevation	No
253937080304001	G - 596	Access Data	8.5 SQ. MILE AREA	Groundwater Elevation	Yes

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
252425080320001	G - 613	Access Data	C-111 AG	Groundwater Elevation	Yes
254500080360001	G - 618	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	No
254000080460001	G - 620	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
252928080332401	G - 789	Access Data	C-111 AG	Groundwater Elevation	No
252612080300701	G - 864	Access Data	C-111 AG	Groundwater Elevation	No
252619080310201	G - 864A	Access Data	C-111 AG	Groundwater Elevation	No
251922080340701	G -1251	Access Data	TAYLOR SLOUGH	Groundwater Elevation	Yes
253233080301001	G -1363	Access Data	L-31NS	Groundwater Elevation	No
254054080295401	G -1487	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
252656080350301	G -1502	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	No
253952080321501	G -3272	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
252007080335701	G -3336	Access Data	C-111 COASTAL	Groundwater Elevation	No
252332080300501	G -3355	Access Data	C-111 SOUTH	Groundwater Elevation	No
253400080340401	G -3437	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
254446080295501	G -3574	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
254206080294701	G -3575	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
254442080305201	G -3576	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
254207080300201	G -3577	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
254210080304801	G -3578	Access Data	EVERGLADES NATIONAL PARK	Groundwater Elevation	Yes
252312080320301	G -3620	Access Data	C-111 SOUTH	Groundwater Elevation	No
252115080293701	G -3621	Access Data	C-111 SOUTH	Groundwater Elevation	Yes
253708080304201	G -3626	Access Data	8.5 SQ. MILE AREA	Groundwater Elevation	Yes
253632080321101	G -3627	Access Data	L-31NS	Groundwater Elevation	Yes

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
253539080320501	G -3628	Access Data	NDA	Groundwater Elevation	Yes
251241080385301	G -3764	Access Data	TAYLOR SLOUGH	Elevation, Temperature, Specific Conductivity, Salinity	No
251457080395802	G -3777	Access Data	TAYLOR SLOUGH	Elevation, Temperature, Wind Speed, Wind Direction, Specific Conductivity, Salinity	No
252506080300601	G -3901	Access Data	C-111 AG	Groundwater Elevation	No
252229080284201	G -3940	Access Data	C-111 SOUTH	Groundwater Elevation	No
252551081050900	HARNEY RIVER NEAR FLAMINGO FL	Access Data	CAPE SABLE	Elevation, Temperature, Salinity, Specific Conductivity	No
262100080190001	HILLSBORO CA AT S-10-A NR DEERFIELD BCH., FL	Access Data	CONSERVATION AREA 1	Elevation Headwater, Elevation Tailwater	Yes
262200080210001	HILLSBORO CA AT S-10-C NR DEERFIELD BCH., FL	Access Data	CONSERVATION AREA 1	Elevation Headwater, Elevation Tailwater	Yes
262300080220001	HILLSBORO CANAL AT S-10-D NR DEERFIELD BCH., FL	Access Data	CONSERVATION AREA 1	Elevation Headwater, Elevation Tailwater	Yes
251355080312800	JOE BAY 2E, NEAR KEY LARGO, FL	Access Data	C-111 COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
261543080495000	L-28 CANAL ABOVE S-140 NEAR CLEWISTON, FL	Access Data	L-28	Elevation, Flow	No
261533080571600	L-28 INTERCEPTOR CANAL BLW S-190 NEAR CLEWISTON FL	Access Data	CONSERVATION AREA 3A	Elevation, Flow	No

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
255154080371300	L-67A CANAL AT S-152 NR COOPERTOWN, FL	Access Data	CONSERVATION AREA 3A	Elevation, Flow, Specific Conductivity, Salinity	No
022907647	LEVEE 31 NORTH EXTENSION 1 MILE NR WEST MIAMI FL	Access Data	L-29 CC	Elevation, Flow	No
02290765	LEVEE 31 NORTH EXTENSION AT 3 MILE NR WEST MIAMI F	Access Data	L-29 CC	Elevation, Flow	No
02290766	LEVEE 31 NORTH EXTENSION AT 4 MILE NR WEST MIAMI F	Access Data	L-29 CC	Elevation, Flow	No
02290767	LEVEE 31 NORTH EXTENSION AT 5 MILE NR WEST MIAMI F	Access Data	L-29 CC	Elevation, Flow	No
02290768	LEVEE 31 NORTH EXTENSION AT 7 MILE NR WEST MIAMI F	Access Data	L-29 CC	Elevation, Flow	No
02290918	LOSTMANS RIVER BELOW SECOND BAY, FL	Access Data	LOSTMANS	Elevation, Temperature, Salinity	No
251003080435500	MCCORMICK CREEK AT MOUTH NEAR KEY LARGO, FL	Access Data	TAYLOR SLOUGH COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
253644081013001	MO - 214	Access Data	EVERGLADES NATIONAL PARK	Elevation, Specific Conductivity, Salinity	No
252820080505401	MO - 215	Access Data	EVERGLADES NATIONAL PARK	Elevation, Specific Conductivity, Salinity	No
02290829502	MO -199	Access Data	EVERGLADES NATIONAL PARK	Elevation, Specific Conductivity, Salinity, Temperature	No
254344081095101	MO - 216	Access Data	CHATAM/TURNER	Elevation, Specific Conductivity, Salinity, Temperature	No

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
251209080350100	MUD CREEK AT MOUTH NR HOMESTEAD, FL	Access Data	TAYLOR SLOUGH COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
261150080270001	N. NEW RIVER CANAL AT S-11-A NR ANDYTOWN, FL	Access Data	CONSERVATION AREA 2A	Elevation Headwater, Elevation Tailwater	Yes
261200080275001	N. NEW RIVER CANAL AT S-11-B NR ANDYTOWN, FL	Access Data	CONSERVATION AREA 2A	Elevation Headwater, Elevation Tailwater	Yes
261300080280001	N. NEW RIVER CANAL AT S-11-C NR ANDYTOWN, FL	Access Data	CONSERVATION AREA 2A	Elevation Headwater, Elevation Tailwater	Yes
253828080391100	N.E. SHARK RIVER SLOUGH NO. 4 NORTH OF GROSSMAN	Access Data	EVERGLADES NATIONAL PARK	Elevation	No
263537080211400	NORTH LOXAHATCHEE CONSERVATION AREA NO. 1	Access Data	CONSERVATION AREA 1	Elevation	No
022908205	NORTH RIVER UPSTREAM OF CUTOFF NEAR FLAMINGO, FL	Access Data	CAPE SABLE	Elevation, Flow, Temperature, Salinity, Specific Conductivity	No
254130080380500	NORTHEAST SHARK RVR SLOUGH NO1 NR COOPERTOWN, FL	Access Data	EVERGLADES NATIONAL PARK	Elevation	No
254315080331500	NORTHEAST SHARK RVR SLOUGH NO2 NR COOPERTOWN, FL	Access Data	EVERGLADES NATIONAL PARK	Elevation	No
251033080440800	OYSTER CREEK NEAR FLAMINGO, FL	Access Data	TAYLOR SLOUGH COASTAL	Elevation, Flow	No
251115081075800	RAULERSON BROTHERS CANAL AT CAPE SABLE, FL	Access Data	CAPE SABLE	Elevation, Flow	No
251032080432200	SEVEN PALM LAKE NEAR FLAMINGO, FL	Access Data	TAYLOR SLOUGH COASTAL	Elevation, Flow, Temperature, Specific	No

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
				Conductivity, Salinity	
252230081021300	SHARK RIVER BELOW GUNBOAT ISLAND NR FLAMINGO, FL	Access Data	CAPE SABLE	Elevation, Flow, Temperature, Salinity, Specific Conductivity, Signal-to-noise ratio	No
254754080344300	SHARK RIVER SLOUGH NO.1 IN CONS.3B NR COOPERTOWN	Access Data	CONSERVATION AREA 3B	Elevation	No
262240080258001	SITE 17 NR L-38, CONS AREA 2A NR CORAL SPRINGS, FL	Access Data	CONSERVATION AREA 2A	Elevation	Yes
261710080190001	SITE 19 IN CONSERVATION AREA 2A NR CORAL SPRINGS	Access Data	CONSERVATION AREA 2A	Elevation	Yes
261023080443001	SITE 62 IN CONSERVATION AREA 3A NR ANDYTOWN, FL	Access Data	CONSERVATION AREA 3A	Elevation, Precipitation	Yes
261117080315201	SITE 63 IN CONSERVATION AREA NO. 3A NR ANDYTOWN FL	Access Data	CONSERVATION AREA 3A	Elevation, Precipitation	Yes
255828080401301	SITE 64 IN CONSERVATION AREA 3A NR COOPERTOWN FL.	Access Data	CONSERVATION AREA 3A	Elevation, Precipitation	Yes
254848080432001	SITE 65 IN CONSERVATION AREA 3A NR COOPERTOWN, FL	Access Data	CONSERVATION AREA 3A	Elevation	Yes
255300080370001	SITE 69 IN CONSERVATION AREA 3BNR COOPERTOWN, FL	Access Data	CONSERVATION AREA 3B	Elevation, Precipitation, Salinity, Specific Conductivity, Temperature	Yes
263180080205001	SITE 7 IN CONS AREA NO. 1 NR SHAWANO, FL	Access Data	CONSERVATION AREA 1	Elevation, Precipitation	Yes
255250080335001	SITE 71 IN CONSERVATION	Access Data	CONSERVATION AREA 3B	Elevation	Yes

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
	AREA 3B NR COOPERTOWN, FL.				
260037080303401	SITE 76 IN CONSERVATION AREA 3B NR ANDYTOWN, FL	**Access Data**	CONSERVATION AREA 3B	Elevation	Yes
263000080120001	SITE 8C NR L-40 IN CONS AREA NO.1 NR BOYNTON BCH.	**Access Data**	CONSERVATION AREA 1	Elevation, Precipitation	Yes
263050080145001	SITE 8T IN CONS AREA NO.1 NR BOYNTON BCH, FL	**Access Data**	CONSERVATION AREA 1	Elevation, Precipitation	Yes
262750080175001	SITE 9 IN CONSERVATION AREA NO.1 IN BOYNTON BCH FL	**Access Data**	CONSERVATION AREA 1	Elevation, Precipitation	Yes
260810080222001	SITE 99 NR L-35A IN CONS AREA 2B NR SUNRISE, FL	**Access Data**	CONSERVATION AREA 2B	Elevation	Yes
262528080202700	SOUTH LOXAHATCHEE CONSERVATION AREA NO. 1	**Access Data**	CONSERVATION AREA 1	Elevation	No
251341080291200	STILLWATER CREEK NEAR HOMESTEAD, FL	**Access Data**	C-111 COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
254543080491101	TAMIAMI CANAL AT S-12-A, NR MIAMI, FL	**Access Data**	CONSERVATION AREA 3A	Elevation Headwater, Elevation Tailwater, Flow	Yes
02289019	TAMIAMI CANAL AT S-12-B NR MIAMI, FL	**Access Data**	EVERGLADES NATIONAL PARK	Elevation Headwater, Elevation Tailwater, Flow	Yes
254543080405401	TAMIAMI CANAL AT S-12-D NEAR MIAMI, FL	**Access Data**	CONSERVATION AREA 3A	Elevation Headwater, Elevation Tailwater, Flow, Gate Opening, Precipitation, Temperature, Turbidity, Specific Conductivity	Yes

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
254540080361500	TAMIAMI CANAL AT S-355A NEAR MIAMI, FL	Access Data	CONSERVATION AREA 3B	Elevation Headwater, Elevation Tailwater	Yes
254540080325700	TAMIAMI CANAL AT S-355B NEAR MIAMI, FL	Access Data	CONSERVATION AREA 3B	Elevation Headwater, Elevation Tailwater	Yes
02289041	TAMIAMI CANAL BELOW S-12-C, NEARMIAMI, FLA	Access Data	EVERGLADES NATIONAL PARK	Elevation Headwater, Elevation Tailwater, Flow, Gate Opening	Yes
02289085	TAMIAMI CANAL EAST END 1 MILE BRIDGE NR MIAMI, FL	Access Data	EVERGLADES NATIONAL PARK	Elevation, Flow	No
02289060	TAMIAMI CANAL OUTLETS L-30 TO L-67A NR MIAMI, FL	Access Data	EVERGLADES NATIONAL PARK	Elevation, Flow	No
02289080	TAMIAMI CANAL WEST END 1 MILE BRIDGE NR MIAMI, FL	Access Data	EVERGLADES NATIONAL PARK	Elevation, Flow	No
251127080382100	TAYLOR RIVER AT MOUTH NEAR HOMESTEAD, FL	Access Data	TAYLOR SLOUGH COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
02289035	THREE MILE CANAL BELOW G409 NEAR CLEWISTON, FL	Access Data	L-28	Elevation, Flow, Nitrogen	No
255014080355801	TI-9 IN WATER CONSERVATION AREA 3-B	Access Data	CONSERVATION AREA 3B	Elevation	No
251253080320100	TROUT CREEK AT MOUTH NEAR KEY LARGO, FL	Access Data	C-111 COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
02290930	TURNER RIVER NR CHOKOLOSKEE ISLAND, FL	Access Data	CHATAM/TURNER	Elevation, Temperature, Salinity	No
253047080555600	UPSTREAM BROAD RIVER NEAR	Access Data	EVERGLADES NATIONAL PARK	Elevation, Flow, Temperature,	No

USGS Site Number	USGS Site Name	Link	Watershed	Available Data	Coop Program
	EVERGLADES CITY FL			Salinity, Specific Conductivity	
251241080385300	UPSTREAM TAYLOR RIVER NEAR HOMESTEAD, FL	**Access Data**	TAYLOR SLOUGH	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
255634080450001	W-11 IN WATER CONSERVATION AREA 3-A	**Access Data**	CONSERVATION AREA 3A	Elevation	No
260007080464401	W-18 IN WATER CONSERVATION AREA 3-A	**Access Data**	CONSERVATION AREA 3A	Elevation	No
254759080483201	W-2 IN WATER CONSERVATION AREA 3-A	**Access Data**	CONSERVATION AREA 3A	Elevation	No
251433080265000	WEST HIGHWAY CREEK NEAR HOMESTEAD, FL	**Access Data**	C-111 COASTAL	Elevation, Flow, Temperature, Specific Conductivity, Salinity	No
251203080480600	WEST LAKE OUTLET TO LONG LAKE NEAR FLAMINGO, FL	**Access Data**	TAYLOR SLOUGH COASTAL	Elevation, Flow	No
255151080371501	WETLAND AT S-152 OUTFLOW NEAR COOPERTOWN, FL	**Access Data**	CONSERVATION AREA 3B	Temperature, Specific Conductivity, Salinity	No
255154080371303	WETLAND BELOW S-152 IN WCA-3 NR COOPERTOWN, FL	**Access Data**	CONSERVATION AREA 3B	Elevation, Temperature, Specific Conductivity, Salinity	No

TABLE 5-2: SFWMD AND ENP STATIONS

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
2A159					•	SFWMD	CONSERVATION AREA 2A	Data
ALLYGW					•	SFWMD	CONSERVATION AREA 3A	Data
ANGEL					•	SFWMD	EVERGLADES NATIONAL PARK	Data
BCA10		•	•			SFWMD	EVERGLADES NATIONAL PARK	Data
BCA20		•	•			SFWMD	EVERGLADES NATIONAL PARK	Data
BERM3			•			SFWMD	S332D DETENTION AREA	Data
C111AK5					•	SFWMD	C-111 SOUTH	Data
C111AK6					•	SFWMD	C-111 SOUTH	Data
C111VC1					•	SFWMD	C-111 AG	Data
C111VC2					•	SFWMD	C-111 AG	Data
C111W11					•	SFWMD	C-111 AG	Data
C111W12					•	SFWMD	C-111 AG	Data
C111W14					•	SFWMD	C-111 AG	Data
C111W15					•	SFWMD	C-111 SOUTH	Data
C111W16					•	SFWMD	C-111 SOUTH	Data
C111W17					•	SFWMD	C-111 SOUTH	Data
CSSSD1			•			SFWMD	C-111 COASTAL	Data
CSSSD2			•			SFWMD	C-111 COASTAL	Data
CSSSD3			•			SFWMD	C-111 COASTAL	Data
CT50R			•			ENP	C-111 COASTAL	Data
DS3			•			SFWMD	SDA	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
ENPBR		•	•			ENP	LOSTMANS	Data
ENPCA		•	•			ENP	CHATAM/TURNER	Data
ENPCN		•	•			ENP	EVERGLADES NATIONAL PARK	Data
ENPCW		•	•			ENP	CAPE SABLE	Data
ENPGI		•	•			ENP	CAPE SABLE	Data
ENPHC		•	•			ENP	C-111 COASTAL	Data
ENPHR		•	•			ENP	CAPE SABLE	Data
ENPLN		•	•			ENP	CAPE SABLE	Data
ENPLO		•	•			ENP	LOSTMANS	Data
ENPNR		•	•			ENP	CAPE SABLE	Data
ENPSR		•	•			ENP	CAPE SABLE	Data
ENPTE		•	•			ENP	CAPE SABLE	Data
ENPTR			•			ENP	TAYLOR SLOUGH	Data
ENPWE		•	•			ENP	CAPE SABLE	Data
ENPWP		•	•			ENP	CHATAM/TURNER	Data
ENPWW		•	•			ENP	LOSTMANS	Data
EP1			•			ENP	C-111 COASTAL	Data
EVER8		•	•			ENP	C-111 SOUTH	Data
FPDA8					•	SFWMD	S332D DETENTION AREA	Data
FRGPD2					•	SFWMD	S332D DETENTION AREA	Data
G210	•					SFWMD	CONSERVATION AREA 1	Data
G211	•		•			SFWMD	L-31N CC	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
G251	•		•			SFWMD	CONSERVATION AREA 1	Data
G300	•		•			SFWMD	CONSERVATION AREA 1	Data
G301	•		•			SFWMD	CONSERVATION AREA 1	Data
G310	•		•			SFWMD	CONSERVATION AREA 1	Data
G3273					•	SFWMD	EVERGLADES NATIONAL PARK	Data
G3338					•	SFWMD	C-111 SOUTH	Data
G3339					•	SFWMD	C-111 SOUTH	Data
G336G	•		•			SFWMD	CONSERVATION AREA 2A	Data
G338			•			SFWMD	CONSERVATION AREA 1	Data
G3A10			•			SFWMD	CONSERVATION AREA 3A	Data
G3A11			•			SFWMD	CONSERVATION AREA 3A	Data
G3A12			•			SFWMD	CONSERVATION AREA 3A	Data
G3AN11			•		•	SFWMD	CONSERVATION AREA 3A	Data
G3AN14					•	SFWMD	CONSERVATION AREA 3A	Data
G3ANE		•	•		•	SFWMD	CONSERVATION AREA 3A	Data
G3ANW		•	•		•	SFWMD	CONSERVATION AREA 3A	Data
G3AS		•	•			SFWMD	CONSERVATION AREA 3A	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
G3AS31			•		•	SFWMD	CONSERVATION AREA 3A	Data
G3AS32					•	SFWMD	CONSERVATION AREA 3A	Data
G3AS33		•			•	SFWMD	CONSERVATION AREA 3A	Data
G3AS34					•	SFWMD	CONSERVATION AREA 3A	Data
G3ASW		•	•			SFWMD	CONSERVATION AREA 3A	Data
G3ASWX		•		•		SFWMD	CONSERVATION AREA 3A	Data
G3BS11			•		•	SFWMD	CONSERVATION AREA 3B	Data
G3BS12					•	SFWMD	CONSERVATION AREA 3B	Data
G3BS13					•	SFWMD	CONSERVATION AREA 3B	Data
G3BS14					•	SFWMD	CONSERVATION AREA 3B	Data
G64	•					SFWMD	CONSERVATION AREA 3A	Data
G69	•					SFWMD	EVERGLADES NATIONAL PARK	Data
G737	•		•			SFWMD	TAYLOR SLOUGH	Data
G94A	•		•			SFWMD	CONSERVATION AREA 1	Data
G94B	•					SFWMD	CONSERVATION AREA 1	Data
G94C	•		•			SFWMD	CONSERVATION AREA 1	Data
G-968					•	SFWMD	CONSERVATION AREA 3B	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
HES27				•	•	SFWMD	FEEDER CANAL	Data
HES28				•	•	SFWMD	FEEDER CANAL	Data
HUMBLE					•	SFWMD	L-31NS	Data
JBTS		•	•			SFWMD	C-111 COASTAL	Data
L28S2			•			SFWMD	CONSERVATION AREA 3A	Data
L31NN			•		•	SFWMD	EVERGLADES NATIONAL PARK	Data
L31NS			•	•	•	SFWMD	EVERGLADES NATIONAL PARK	Data
L31NW02					•	SFWMD	L-31NS	Data
L31NW03					•	SFWMD	C-111 AG	Data
L31NW06					•	SFWMD	L-31NS	Data
L37WCA3A			•			SFWMD	CONSERVATION AREA 3A	Data
LASPALM11			•	•		ENP	8.5 SQ. MILE AREA	Data
LASPALM12			•	•		ENP	8.5 SQ. MILE AREA	Data
LASPALM13			•	•		ENP	8.5 SQ. MILE AREA	Data
LASPALM14			•	•		ENP	8.5 SQ. MILE AREA	Data
LASPALM15					•	ENP	NDA	Data
LOOP1			•			SFWMD	EVERGLADES NATIONAL PARK	Data
LOOP2			•			SFWMD	EVERGLADES NATIONAL PARK	Data
LPC1			•			SFWMD	8.5 SQ. MILE AREA	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
LPDC1			•			SFWMD	8.5 SQ. MILE AREA	Data
LPG1			•			SFWMD	8.5 SQ. MILE AREA	Data
LPG2			•			SFWMD	8.5 SQ. MILE AREA	Data
LPG3			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LPG5			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LPG7			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LPG8			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LPG16			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LPG17			•			ENP	EVERGLADES NATIONAL PARK	Data not availabl e online
LXWS		•		•		SFWMD	CONSERVATION AREA 1	Data
NESRS3			•			SFWMD	EVERGLADES NATIONAL PARK	Data
NP-112			•			ENP	TAYLOR SLOUGH	Data
NP-201		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-202		•	•			ENP	EVERGLADES NATIONAL PARK	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
NP-203		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-205		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-206		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-31W			•			ENP	TAYLOR SLOUGH	Data
NP-33		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-34		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-35		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-36		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-44		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-46			•			ENP	TAYLOR SLOUGH	Data
NP-62			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-67			•			ENP	TAYLOR SLOUGH	Data
NP-72			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-A13		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-C27			•			ENP	C-111 COASTAL	Data
NP-CHP		•	•			ENP	TAYLOR SLOUGH	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
NP-CR2		•	•			ENP	TAYLOR SLOUGH	Data
NP-CR3			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-CV5N			•			ENP	C-111 SOUTH	Data
NP-CY2			•			ENP	TAYLOR SLOUGH	Data
NP-CY3		•	•			ENP	TAYLOR SLOUGH	Data
NP-DO1			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-DO2			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-DO3			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-EPS		•	•			ENP	C-111 COASTAL	Data
NP-EV6			•			ENP	C-111 COASTAL	Data
NP-EV7		•	•			ENP	C-111 COASTAL	Data
NP-FMB		•		•		ENP	EVERGLADES NATIONAL PARK	Data
NP-N10		•	•			ENP	TAYLOR SLOUGH	Data
NP-N14			•			ENP	TAYLOR SLOUGH	Data
NP-NCL			•			ENP	TAYLOR SLOUGH	Data
NP-NESS20		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-NMP			•			ENP	TAYLOR SLOUGH	Data
NP-OL			•			ENP	TAYLOR SLOUGH	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
NP-OT3		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-P37		•	•			ENP	TAYLOR SLOUGH	Data
NP-P38		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-RG1		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-RG2		•	•			ENP	EVERGLADES NATIONAL PARK	Data
NP-RG3			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-RG4			•			ENP	SDA	Data
NP-RG5			•			ENP	SDA	Data
NP-ROB		•	•			ENP	C-111 AG	Data
NP-SP1			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-SPARO			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-SR1			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-TMC			•			ENP	EVERGLADES NATIONAL PARK	Data
NP-TSB		•	•			ENP	TAYLOR SLOUGH	Data
NP-TSH			•			ENP	TAYLOR SLOUGH	Data
NTS-1			•			ENP	TAYLOR SLOUGH	Data
NTS18			•			ENP	SDA	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
PB1108					•	SFWMD	CONSERVATION AREA 1	Data
PC17A	•		•		•	SFWMD	FEEDER CANAL	Data
R-127		•			•	ENP	TAYLOR SLOUGH	Data
R-158					•	ENP	TAYLOR SLOUGH	Data
R3110		•	•			ENP	TAYLOR SLOUGH	Data
RAULBRO			•			ENP	CAPE SABLE	Data
ROYAL PA		•				ENP	TAYLOR SLOUGH	Data
RUTZKE					•	SFWMD	TAYLOR SLOUGH	Data
S14	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data
S140			•			SFWMD	CONSERVATION AREA 3A	Data
S140W		•		•		SFWMD	CONSERVATION AREA 3A	Data
S141			•			SFWMD	CONSERVATION AREA 2B	Data
S142	•		•			SFWMD	CONSERVATION AREA 3A	Data
S143			•			SFWMD	CONSERVATION AREA 2A	Data
S144	•		•			SFWMD	CONSERVATION AREA 2B	Data
S145	•		•			SFWMD	CONSERVATION AREA 2A	Data
S146	•					SFWMD	CONSERVATION AREA 2B	Data
S150	•		•			SFWMD	CONSERVATION AREA 3A	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
S151	•					SFWMD	CONSERVATION AREA 3B	Data
S151H			•			SFWMD	CONSERVATION AREA 3A	Data
S151T			•			SFWMD	CONSERVATION AREA 3B	Data
S173	•					SFWMD	L-31NS	Data
S176	•		•			SFWMD	C-111 AG	Data
S177	•	•	•			SFWMD	C-111 AG	Data
S178	•		•			SFWMD	C-111 SOUTH	Data
S18C	•	•	•			SFWMD	C-111 SOUTH	Data
S190	•		•			SFWMD	CONSERVATION AREA 3A	Data
S190		•	•		•	SFWMD	CONSERVATION AREA 3A	Data
S194	•		•			SFWMD	L-31NS	Data
S196	•		•			SFWMD	L-31NS	Data
S197			•			SFWMD	C-111 COASTAL	Data
S199	•		•			SFWMD	C-111 COASTAL	Data
S200	•		•			SFWMD	C-111 AG	Data
S31			•			SFWMD	CONSERVATION AREA 3B	Data
S32A	•					SFWMD	L-30 CC	Data
S328	•		•			SFWMD	TAYLOR SLOUGH	Data
S331	•	•	•			SFWMD	L-31NS	Data
S332B	•		•			SFWMD	SDA	Data
S332BN	•		•			SFWMD	SDA	Data
S332BS	•		•			SFWMD	SDA	Data
S332C	•		•			SFWMD	L-31NS	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
S332CS			•			SFWMD	SDA	Data
S332D	•		•			SFWMD	S332D DETENTION AREA	Data
S332DX1	•		•			SFWMD	S332D DETENTION AREA	Data
S333	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data
S334	•	•	•			SFWMD	EVERGLADES NATIONAL PARK	Data
S335	•		•			SFWMD	L-29 CC	Data
S336	•	•	•			SFWMD	L-29 CC	Data
S337	•		•			SFWMD	L-30 CC	Data
S338	•		•			SFWMD	L-29 CC	Data
S339	•		•			SFWMD	CONSERVATION AREA 3A	Data
S340	•		•			SFWMD	CONSERVATION AREA 3A	Data
S343A	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data
S343B	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data
S344	•		•			SFWMD	CONSERVATION AREA 3A	Data
S355A	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data
S355B	•		•			SFWMD	EVERGLADES NATIONAL PARK	Data

DBHydro Site Name	Flow	Rain	Stage	Weather	Groundwater	Agency	Watershed	Link
S356	•					SFWMD	EVERGLADES NATIONAL PARK	Data
S356GW					•	SFWMD	L-29 CC	Data
S357	•	•		•		SFWMD	8.5 SQ. MILE AREA	Data
S357N	•	•		•		SFWMD	8.5 SQ. MILE AREA	Data
S362	•		•			SFWMD	CONSERVATION AREA 1	Data
S38	•		•			SFWMD	CONSERVATION AREA 2A	Data
S39	•		•			SFWMD	CONSERVATION AREA 1	Data
S7	•	•	•			SFWMD	CONSERVATION AREA 2A	Data
S8	•		•			SFWMD	CONSERVATION AREA 3A	Data
S9	•	•	•			SFWMD	CONSERVATION AREA 3A	Data
S9A	•		•			SFWMD	CONSERVATION AREA 3A	Data
WC2AN1			•			SFWMD	CONSERVATION AREA 2A	Data
WC2AS1			•			SFWMD	CONSERVATION AREA 2A	Data
WCA1ME				•		SFWMD	CONSERVATION AREA 1	Data
WCA2E4			•			SFWMD	CONSERVATION AREA 2A	Data
WCA2F4			•	•	•	SFWMD	CONSERVATION AREA 2A	Data
WFEED	•		•		•	SFWMD	FEEDER CANAL	Data

6 HYDROLOGIC FORECASTS

6.1 GENERAL

Water levels in the WCAs, ENP, ENP-SDCS Basin are monitored daily by the USACE and SFWMD by use of staff gages and data collection platforms (DCPs) placed at the locations pertinent to water management. Daily weather forecasts are provided by the SFWMD and NWS. The NWS is the federal agency responsible for developing and disseminating flood forecasts but does not produce flood forecasts for any locations within the WCAs, ENP, ENP-SDCS Basin. The NWS Miami-South Florida Weather Forecast Office issues weather related warnings and watches for the WCAs, ENP, ENP-SDCS Basin and adjacent areas that can be obtained at: https://www.weather.gov/mfl/.

6.1.1 Role of USACE

The Jacksonville District Water Management Section conducts water management activities for the WCAs. The Water Management Section also monitors real-time and historic hydrometeorological data associated with water management activities, within WCAs, ENP, ENP-SDCS Basin, conducted by the non-federal sponsors (SFWMD, STOF).

6.1.2 Role of Other Agencies

As non-federal sponsors of the C&SF Project, SFWMD and the STOF are responsible for monitoring hydrometeorological data and information for the prediction of hydrologic conditions associated with the water management decision making process. The NWS is the federal agency responsible for providing weather forecasts, watches, and warnings. The State of Florida (SFWMD, FDEP) is responsible for forecasts related to water quality aspects related to the WCAs, ENP, ENP-SDCS Basin.

6.2 FLOOD CONDITION FORECASTS

Flood condition forecasts are not made for the WCAs, ENP, ENP-SDCS Basin. The total storage volumes and peak Standard Project Flood (SPF) elevations for WCAs, ENP, ENP-SDCS components of the C&SF Project are contained in Chapter 7 and Chapter 8, respectively. Currently, there is no operational model for the WCAs, ENP, ENP-SDCS Basin in use for real time forecasting. The SFWMD conducts monthly positional analysis forecasts for all three WCAs using regional simulation models (hydrology and operations), driven by historical climatological inputs and current system conditions, and generates water levels and inflows/outflows projections. These forecasts are evaluated by water managers and used in addition to other tools to plan for future operations but do not capture rapidly changing localized flood conditions. Meteorological forecasts issued by SFWMD can be found at the following link: https://www.sfwmd.gov/weather-radar/sfwmd-forecast.

6.3 CONSERVATION PURPOSE FORECASTS

Both the USACE and SFWMD have several gages to monitor water levels within the WCAs. The SFWMD provides weekly ecological conditions and water supply reports to USACE and SFWMD water managers. This information may be used for operational planning for the

purposes of conservation for ecological benefits and for water supply. These weekly reports may be found at the following website: https://www.sfwmd.gov/science-data/operational-planning. The USACE, in consultation with SFWMD, has formulated regulation schedules for these areas that take into consideration the congressionally authorized project purposes which include flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, water supply for Everglades National Park, protection of fish and wildlife resources, groundwater recharge, recreation, and navigation.

6.3.1.1 Requirements

Conservation requirements are taken into account during formulation of the regulation schedules, therefore are not part of the operational requirements within the C&SF Project.

6.3.1.2 Methods

Not applicable.

6.4 LONG-RANGE FORECASTS

6.4.1 Requirements

Long range (up to a year) forecasts are made based on a statistical analysis of historical data gathered in the WCAs and are considered in the water management decision making process. The regulation schedules are adjusted periodically based on new data and predictions of future water use in the WCAs. Adjustments to the regulation schedules may include periodic drawdowns for environmental reasons; holding water stages in the WCAs higher than normal during unusual, prolonged wet or dry conditions; and/or making releases for water supply to agricultural users during drought conditions. These adjustments may necessitate preparation of National Environmental Protection Act (NEPA) documentation. In addition, the three-month precipitation outlook provided by the NWS is also considered for water management operations for the WCAs. This information is available at **https://www.weather.gov/hun/climateforecast**. The regulation schedules and the processes for changing them are described in Chapter 7.

6.4.2 Methods

The NWS and SFWMD develop daily and weekly (7-day) quantitative precipitation forecasts (QPF) for the WCAs, ENP, ENP-SDCS Basin. These QPFs are available at https://www.sfwmd.gov and https://www.wpc.ncep.noaa.gov/#page=ovw. Forecast scenarios are not simulated by the USACE. Rather, hydrometeorological data, regulation schedules and other operating criteria, stage-storage relationships, analysis of past stage behavior following discharge changes, weather forecasts and knowledge of the WCAs, ENP, ENP-SDCS Basin are primarily utilized in the water management decision-making process.

The NOAA Climate Prediction Center (CPC) provides information on the ENSO cycle and other phenomena such as the North Atlantic Oscillation and Madden Julian Oscillation. The ENSO cycle may be represented by one of three phases; El Niño, Neutral, and La Niña. The terms El Niño and La Niña represent opposite extremes of the ENSO cycle. A full ENSO cycle has historically taken 2-7 years to complete with the El Niño phase typically lasting 9-12 months and

the La Niña phase typically lasting 1-3 years. El Niño episodes are associated with increased storminess and precipitation across the southern U.S. during portions of the Fall, Winter, and Spring seasons. Conversely, less storminess and precipitation in the southern states during portions of these seasons are associated with La Niña episodes. The neutral phase of the cycle represents precipitation patterns closer to historical averages.

In addition, the CPC, in collaboration with the Hurricane Research Division (HRD) and the National Hurricane Center (NHC), produces an Atlantic Hurricane Season Outlook. The ENSO cycle is one of several factors which can influence overall tropical cyclone activity during a given season. El Niño episodes can contribute to conditions which are less favorable for hurricane activity in the Atlantic Basin while La Niña episodes can contribute to conditions more favorable for hurricane activity in the Basin.

6.5 DROUGHT FORECAST

6.5.1 Requirements

The websites cited in Item 6-04 may also be used for drought forecasts. Long range and seasonal forecasts for droughts are available at **https://www.weather.gov/akq/Extended**. The volume and duration of releases from the WCAs are primarily determined by regulation schedules, other operating criteria, and/or hydrometeorological conditions/data. Stage-storage relationships, examining past stage behavior following discharge changes, weather forecasts, and monthly positional analysis forecasts for all three WCAs by SFWMD and/or knowledge of the basin are utilized for operational decision making. Operational planning will rely on the best available and actionable scientific information about observed and expected hydrologic changes that affect drought.

6.5.2 Methods

Operational strategies should be formulated with consideration of both severity and duration of future potential droughts. The USACE Civil Works Technical Report 2015-03 , Recent U.S. Climate Change and Hydrology Literature Applicable to U.S. Army Corps of Engineers Missions South Atlantic Gulf Region 03, documents studies by Chen et al (2012) and Cook et al (2014) of trends in the frequency and severity of droughts. These studies did not show trends for either frequency or intensity of droughts in the South Atlantic Gulf Region. However, researchers identified a statistically significant decline in drought frequency (droughts per century over the past 1,000 years) and a “general increase in soil moisture as defined by the Palmer Drought Severity Index (PDSI) over the same period.”

6.6 WATER QUALITY FORECASTING

SFWMD has numerous water quality gages in the WCAs, ENP, ENP-SDCS Basin. Real-time water quality data can be found at https://www.sfwmd.gov/science-data/environmental-monitoring. Additionally, State and USFWS scientists provide environmental and water quality conditions, information, and recommendations on water management activities for various

locations within the WCAs, ENP, ENP-SDCS Basin to the Jacksonville District Water Management Section.

The State of Florida is responsible for regulating water quality and is responsible for achieving state water quality standards. The State constructed STA-1W, STA-2, STA-3/4, and STA-5/6 and USACE constructed STA-1E. The State is operating the all 5 STAs which directly interact with the C&SF Project and monitors nutrients and water quality entering the WCAs. SFWMD, acting on behalf of the state, may petition the USACE for operational changes within the C&SF system where it sees that water quality benefits may be achieved in the project area. Additionally, Phase 2 of the Decomp Physical Model (DPM) Field Test may continue through 2021, subject to constraints noted in the 2017 Operational Strategy for Water Conservation Area 3 Decompartmentalization (DECOMP) and Sheet Flow Enhancement Project – Physical Model Phase 2. S-152 is operated in accordance with this 2017 DPM Operational Strategy. During Phase 2 of the DPM, operation of S-152 will be consistent with the FDEP Permit for DPM Phase 2 (including any modifications to the permit). When water quality constraint criteria per this FDEP permit are exceeded, S-152 releases may be reduced or discontinued.

7 WATER CONTROL PLAN

This chapter defines and describes the operational plan for the Water Conservation Areas (WCAs), Everglades National Park (ENP), and ENP-South Dade Conveyance System (SDCS) to meet all of the Central and Southern Florida (C&SF) Project congressionally authorized purposes.

7.1 GENERAL PROJECT PURPOSES, GOALS, OBJECTIVES, AND BENEFITS

The C&SF Project that is represented in this System Operating Manual (SOM)-Volume 4, includes the WCAs, ENP, and ENP-SDCS. The Central and Southern Florida Ecosystem Restoration Critical Project, Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project (SBC Project) is also represented in SOM-Volume 4. The SBC Project Water Control Plans (WCP) for Basin 1, 2 and 4 are not updated as part of this WCP and provided in Appendix G of the SOM. The local sponsor for the SBC Project is the Seminole Tribe of Florida (STOF). The local sponsor for the remaining portions of the C&SF Project covered in this WCP is the South Florida Water Management District (SFWMD). The U.S Army Corps of Engineers (USACE) operates and maintains project works on the St. Lucie Canal, Caloosahatchee River, Herbert Hoover Dike, Lake Okeechobee major spillways, and the main outlets for Water Conservation Areas (WCAs); (S-10A, S-10C, and S-10D in WCA-1), (S-11A, S-11B, and S-11C in WCA-2A), (S-12A, S-12B, S-12C, and S-12D in WCA-3A), and (S-355A and S-355B in WCA-3B). The local sponsors operate the remainder of the project in accordance with regulations prescribed by USACE.

The congressionally authorized project purposes for the WCAs, ENP, ENP-SDCS component of the C&SF Project include flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, water supply for ENP, protection of fish and wildlife resources, groundwater recharge, recreation, and navigation. Another objective is the maintenance of marsh vegetation in the WCAs, which provides a dampening effect on hurricane-induced wind tides. Levees L-40, L-36, L-35A, L-35, L-37, L-33, L-30, L-31N, and L-31W form the east coast protection levee. The east coast protection levee prevents floodwaters, which historically flowed from north to south across the broad flat peninsula, from flowing into the areas that are now developed along the southeast coast of Florida.

This WCP combines the 2012 WCP water management operations for WCA-1 and WCA-2 with the new water management operations for WCA-3, ENP, and ENP-SDCS that were developed in the Combined Operational Plan (COP). The COP is an integrated operational plan for two modifications of the C&SF Project – known as Modified Water Deliveries (MWD) to ENP and the Canal 111 (C-111) South Dade (SD) Projects. The purpose of the COP was to define the water management operations for the WCA-3A and WCA-3B outlets, structures in the L-31N and the C-111 basins constructed as part of the C&SF Project and the recently constructed components of the MWD to ENP and C-111 SD Projects.

Concurrent with the MWD to ENP and C-111 SD Projects authorization, the C&SF Project Comprehensive Review Study (known as the Restudy) was authorized in 1992. The Water Resources Development Act (WRDA) of 2000 (PL 106-541), Section 601(b)(1)(A) approved the

Comprehensive Everglades Restoration Program (CERP) as a framework for modifications to the C&SF project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water related needs of the region, including water supply and flood risk management. Many of the economic and social objectives are similar to those of the original C&SF Project. However, unlike the original set of objectives for the C&SF Project, the Restudy includes objectives that recognize the importance of the natural system in achieving sustainability of the region. The COP is the last step to implement operational changes to convey water from WCA-3A to the ENP using the constructed features of the pre-CERP Foundation projects (i.e., MWD to ENP and C-111 SD Projects). Development and implementation of the COP is the final action required before both the MWD to ENP and C-111 SD Projects can be considered complete. The COP is anticipated to be in place until construction of new CERP infrastructure, including features which would enable increased flow deliveries into the WCAs, ENP, and Florida Bay. A limited suite of CERP-related water control structures, which are currently owned and operated by SFWMD, are identified in Table 7-3 and discussed in this WCP. The SFWMD will operate state-owned structures in accordance with their Florida Department of Environmental Protection (FDEP) issued permits and any future modifications of the FDEP permits. The WCP includes the state-owned structures only to gather all pertinent operational criteria into one document.

The COP goals, derived from the MWD to ENP and C-111 SD Projects purposes include:

1. Improve water deliveries (timing, location, volume) into ENP and take steps to restore natural hydrologic conditions in ENP given current C&SF infrastructure and features expected to be completed by the time of implementation, to the extent practicable by:
    a. Changing schedule of water deliveries so that it fluctuates in accordance with local meteorological conditions, including providing for long term and annual variation in ecosystem conditions in the Everglades (Timing) (P.L. 101-229, Section 101b).
    b. Restoring North East Shark River Slough (NESRS) as a functioning component of the Everglades hydrologic system (Location) (P.L. 101-229, Section 101b).
    c. Adjusting the magnitude of water released to ENP to minimize effects of too much or too little water (Volume) (1992 MWD GDM, Section 44).
2. Maximize progress toward restoring historic hydrologic conditions in the Taylor Slough, Rocky Glades, & Eastern Panhandle of ENP.
3. Protect the intrinsic ecological values associated with WCA-3A and ENP.
4. Minimize the damaging freshwater flows to Manatee Bay/Barnes Sound through the S-197 structure and increase flows through Taylor Slough and coastal creeks (1994 C-111 GRR, Section 5.2).
5. Include consideration of cultural values and tribal interests & concerns within WCA-3A and ENP.

Water management operations at the main outlets for WCA-1, WCA-2, and WCA-3 are determined through a decision-making process that considers all the congressionally authorized project purposes for the WCAs. The decision-making process to determine quantity, timing, and duration of the potential releases from the WCAs include consideration of diverse information

related to water management. This information includes but is not necessarily limited to: C&SF Project conditions, estuary conditions and projected needs (e.g., Biscayne Bay, Florida Bay), WCAs conditions and projected needs, WCA water levels, ENP conditions and projected needs, East Coast Canals (ECC) available capacity, ENP-SDCS available capacity, current climate conditions, climate forecasts, hydrologic outlooks, projected WCAs level ascension and recession rates, and water supply conditions and projected needs. This information helps address uncertainties in meeting the projects objectives due to modeling accuracy or future conditions not originally anticipated in the modeling period of record and supports a more flexible and adaptive decision-making process. If new information becomes available through implementation of the COP WCP and/or the COP Adaptive Management and Monitoring Plan (AMMP) that would necessitate a need to modify water management operations, this information will be incorporated as appropriate in accordance with laws and regulations including the National Environmental Policy Act of 1970 (NEPA).

All elevations in this document are in feet in relation to the National Geodetic Vertical Datum of 1929 (NGVD) unless otherwise stated. This document will be updated to the North American Vertical Datum of 1988 (NAVD) upon completion of datum updates throughout the control system and monitoring program.

7.2 PROJECT RELATIONSHIPS

This updated version of the WCAs, ENP, and ENP-SDCS WCP depicts the current approved operating criteria for the region. The projects within this document are hydraulically linked to project features within adjacent WCPs, including Lake Okeechobee and Everglades Agricultural Area (EAA) (Volume 3), and the ECC (Volume 5). The WCAs, ENP, ENP-SDCS and adjacent regions interact together to provide for C&SF Project purposes.

7.3 MAJOR CONSTRAINTS

This subsection discusses 11 major constraints.

7.3.1 Protection of the Cape Sable Seaside Sparrow and Other Listed Species

The Everglades Restoration Transition Plan (ERTP) was implemented in October 2012 through the 2012 WCP and included operational guidance for the constructed features of the MWD to ENP and C-111 SD Projects. USACE reinitiated Endangered Species Act (ESA) consultation on ERTP in November 2014, as a result of an exceedance of an Incidental Take Re-initiation Trigger from the November 2010, ERTP Biological Opinion (BO) for the Cape Sable Seaside Sparrow (CSSS). USFWS issued a new BO for ERTP in July 2016, developed in formal ESA consultation with the USACE. As a result of this consultation, USFWS determined that current conditions within CSSS habitat threatened the survival of the CSSS, and as a result, USFWS issued a “jeopardy” BO which explained that unless alternatives to current water operational practices (which then included the 2012 WCP) were explored and implemented, continued implementation of ERTP was likely to jeopardize the continued existence of the CSSS. The revised BO, issued in July 2016, presented a Reasonable and Prudent Alternative (RPA) that would avoid jeopardizing the CSSS. The RPA identified operational modifications and proposed

expediting restoration initiatives for some of the structures in the southern portion of the Everglades ecosystem to provide suitable nesting habitat for the endangered CSSS. Main elements of the RPA included: habitat performance targets; actions to move water east; surveys and studies; and adaptive management. These RPA actions included additional seasonal closures to outlet structures within WCA-3A (S-12A, S-12B, S-343A, S-343B, S-344), with the flexibility to open under high water conditions between October and November, and adjustments in operations in the ENP-SDCS that would enable additional flows to Biscayne Bay during the dry season as well as increased flows toward eastern ENP to extend hydroperiods during the early dry season. In response to the 2016 ERTP BO, USACE committed to taking specific actions to comply with the BO terms and conditions and implementing the RPA.

The 2016 ERTP BO stated that the S-12A/S-12B and associated structures currently direct water flows to the north of CSSS A habitat, resulting in increased hydroperiods within this area. A delay in opening and implementing early closure of the S-12A, S-12B, S-343A, S-343B, and S-344 structures beyond their restrictions under ERTP was prescribed by USFWS to limit flow into western SRS and provide drier conditions for this region. Structural closings for S-12A, S 12B, S-343A, S-343B, and S-344 under ERTP were retained under Increment 1 of the MWD to ENP Project; however the Increment 1 Operational Strategy was modified to address the mandated RPA of the 2016 ERTP BO, to include expanded closure periods for the S-12A, S-12B, S-343A, S-343B, and S-344 structures under Increment 1.1 and 1.2. Increment 2 maintained the required closure periods for these structures and analyzed a set of alternatives to address the mandated RPA of the 2016 ERTP BO to raise the maximum operating limit in the L-29 Canal up to a maximum of 8.5 feet NGVD.

The BO issued July 22, 2016, may be accessed at the following website:

http://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/G-3273-and-S-356-Pump-Station-Field-Test/

The 2016 ERTP BO acknowledged the above planning efforts by USACE to increase flows into NESRS under the MWD to ENP Project and required USACE to proceed as scheduled, and as allowable by law, to complete NEPA analysis on Increment 2 prior to March 2018, and COP in 2019.

The RPA further specified that the USACE shall implement the COP in 2019, while including a provision for an adaptive management mechanism through which the USFWS and USACE may pursue amendments to the current BO. The USFWS and USACE have agreed to amend the BO to reflect the revised anticipated date for COP, currently August 2020. Formal consultation for COP began with submittal of a Biological Assessment to the USFWS in December 2019. A BO for COP is anticipated from USFWS in May 2020. It is anticipated that this updated BO will relax the S-344 and S-332D seasonal operation restrictions, as coordinated with USFWS. The updated operations for these structures are detailed in **subsection 7.4.8.4**.

Successful recovery of CSSS requires continued collaborative efforts among federal, tribal, and state partnering agencies. The USACE, within its authorities, will continue to work with the

USFWS to find other helpful initiatives which could be enacted by partners and stakeholders to aid in this important effort.

7.3.2 U. S. Highway 41/Tamiami Trail South of L-29 Borrow Canal

The 2008 MWD to ENP Tamiami Trail Limited Re-evaluation Report (LRR) included recommendations to build a one-mile long bridge in the project area's eastern segment and raise the headwater stage constraints in the L-29 Borrow Canal by one foot from 7.5 feet NGVD to 8.5 feet NGVD. This required road mitigation on parts of Tamiami Trail (U.S. Highway 41) in between S-333 on the west and S-334 on the east. To ensure the safety and stability of the roadway sub-base infrastructure along this segment of Tamiami Trail , operational constraints [referenced within Section 6 (Recommended Plan) of the 2008 Tamiami Trail LRR] were set forth within the "Contract Between the United States of America and Florida Department of Transportation (FDOT) for Relocation, Rearrangement, or Alteration of Facilities Modified Water Deliveries to Everglades National Park Project (Relocation Agreement)" dated September 25, 2008. FDOT allowed the USACE to use a new standard for the Tamiami Trail roadway (adopted in the March 2008 FDOT Flexible Pavement Design Manual) thereby reducing the required separation (Design Base Highwater Clearance) between the Design High Water (DHW) and the bottom of the road base. DHW (also referred to as Base Clearance Water Elevation) is defined as the average October wet season elevation plus the rainfall from a specific design storm event (10-year frequency, with duration [1-hour, 8-hour, or 24-hour] producing the highest stage and drawing down within a specific period). Funds have been appropriated by the State of Florida and the U.S. Congress for elevation of the Tamiami Trail road base to support a DHW of up to 9.7 feet NGVD. Actual construction may begin as early as 2021. Once the road is elevated existing constraints at Tamiami Trail will be removed, and other constraints on operations will need to be resolved.

Operational constraints as outlined within the Relocation Agreement are minimum protective standards that were included in the MWD to ENP Increment 2 Operational Strategy and retained for the COP WCP. In coordination with FDOT, USACE has implemented additional constraints that are not explicitly spelled out in the Relocation Agreement. Out of concern that these additional constraints reduce the ability to meet field test goals and objectives of maximizing flows to NESRS, the USACE is currently working with technical staff from the FDOT to further refine the restrictions as described within this WCP and, in coordination with ENP, has implemented expanded hydrologic monitoring of water levels along this section of Tamiami Trail. Data collected in accordance with the Increment 2 monitoring plan developed in consultation with the FDOT will help to inform L-29 Borrow Canal operations in COP.

The requirements of the Relocation Agreement, including any subsequent amendments to this agreement between the USACE and FDOT, shall remain unchanged until full completion of Tamiami Trail Next Steps roadway construction, currently anticipated by 2022.

7.3.3 8.5 Square Mile Area

The 8.5 SMA (Las Palmas Community) Project features are designed to mitigate for increased flood risk as a result of increased water levels in NESRS and other areas of ENP resulting from

the MWD to ENP Project The 8.5 SMA Project features are to be operated to maintain the water levels within the project area between L-357W and L-31N at pre-MWD levels and to preserve or enhance the hydropatterns of land located west of L-357W (ENP and the publicly owned natural areas), consistent with the evaluation methodology previously applied for the 2000 General Reevaluation Report and Final Supplemental Environmental Impact Statement (GRR/EIS). The hydrologic modeling and flood risk evaluations conducted to support development of the COP included application of an evaluation methodology which is consistent with evaluation metrics used for the 2000 GRR/EIS authorization. As required by the 2000 GRR/EIS Record of Decision, periodic flooding east of the proposed levee, before and after project implementation, will remain unchanged from conditions in existence prior to implementation of the MWD to ENP Project.

The combination of local conditions, including, but not limited to, proximity to NESRS, comparatively low ground surface elevations, and the high transmissivity of the surficial aquifer system, make the areas along the 8.5 SMA western boundaries challenging to maintain water levels below ground surface elevations and require real-time monitoring and modifications to water management alternatives to ensure flood mitigation success. The 8.5 SMA monitoring plan is located in the AMMP (Part C.6 of Appendix C of the COP EIS, Water Quality and Hydrology Monitoring Plan for 8.5 SMA Flood Mitigation). The constructed features of the 8.5 SMA Project available for water management operations include: the canals C-357 and C-358, the 8.5 SMA Detention Area and flow way and the Northern Detention Area (NDA), pump stations S-357 and S-331, and structure S-357N. S-357 and S-357N provide primary flood mitigation to the residents of the 8.5 SMA, and S-331 provides secondary flood mitigation benefits only during high water conditions in NESRS.

7.3.4 Water Supply Releases to Lower East Coast from WCAs during Low Water Conditions

During low water conditions, it is difficult to draw water from the interior of the WCAs. The regulation schedules for WCA-1, WCA-2A, and WCA-3A include a "floor" or minimum water levels (14.0 feet, 10.5 feet, and 7.5 feet NGVD respectively) below which water supply releases (municipal and industrial use, agricultural irrigation and prevention of saltwater intrusion) from these WCAs must be preceded by an equivalent volume of inflow from Lake Okeechobee and/or WCAs. The water levels in these WCAs may continue to recede due to evaporation and seepage. There is no requirement to maintain the minimum elevations. Releases from WCA-3A recommended by the TTFF to ENP do not require this preceding water delivery when below the floor water level. The operational criteria for the WCAs are further defined in **subsection 7.4.8**.

7.3.5 Maintenance of Marsh Vegetation in WCAs to Prevent Wind Tides

A major factor in water management for WCA-3A is the maintenance of marsh vegetation. Prolonged high and low water levels are detrimental to the establishment and maintenance of marsh vegetation. If large areas of open water develop as a result of a loss of vegetation, risk of potential hurricane-induced wind tides increases. In Part I, Supplement 33 GDM for WCA-3 (1960), it was noted that one of the factors for establishing the regulation schedule and levee

heights was the retention of marsh vegetation that would prevent large wind tides and waves from developing during hurricanes. It was determined through the GDM analysis that a marsh vegetation that could prevent wind tides could be retained with a seasonal regulation schedule varying between 9.0 to 11.0 feet NGVD. After consideration of other factors such as water supply and fish and wildlife resources, a seasonal regulation schedule varying from 9.5 to 10.5 feet NGVD was selected. The regulation schedule varies from high stages in the winter (dry season) to low stages in the beginning of the summer (wet season). Based on the assumption of marsh vegetation preventing wind tides, the levee design criteria in the GDM was to provide two and a half feet of freeboard above the Standard Project Flood (SPF) profile, and about four feet above the period of record stage at that time.

7.3.6 WCA-2B and WCA-3B

Regulation schedules are not used for WCA-2B and WCA-3B due to high rates of seepage from these areas. However, releases from WCA-2A and WCA-3A to WCA-2B and WCA-3B, respectively, can be made. The southeast corner of WCA-3B has a very high transmission rate that results in significant accumulation of water in the L-30 Borrow Canal. S-338 may not always be capable of routing WCA-3A releases and seepage from WCA-3B to tide due to structure capacity limitations and downstream-conditions.

7.3.7 WCA-3B Release Capability

The outlet for WCA-3B was originally S-12E. However, S-12E never functioned as intended due to tailwater conditions which were higher than designed. Subsequent construction of the ENP-SDCS has made S-12E a non-functional structure; the gates have been removed and a steel plate has been welded to it to prevent flow through the structure. The G-69 structure was removed in 2007 as the function of that structure was tied to the L-67 pilot test. The currently available release routes from WCA-3B are: 1) to tide through S-31 and S-26 via the Miami Canal (C-6), 2) to ENP through S-355A and S-355B into the L-29 Borrow Canal subject to the L-29 stage constraint, and 3) to the L 31N through S-337 and S-335. The original design release capability from WCA-3B (through the S-355A, S-355B, S-31, and S-337) is approximately 3,305 cfs. Water levels in the L-29 Borrow Canal influence the S-355A and S-355B tailwaters and have the potential to prevent or limit release capacity from the S-355s.

7.3.8 WCA-3A Release Capability

The S-12s are not capable of achieving the original design capacity of 32,000 cfs. Outlet capacity of the S-12s has either reduced over time or was never as large as assumed for the original design routings. The topography adjacent to the S-12s results in very little head differential across the structures under normal water levels. There has been a change in the discharge rating curves for the S-12s over time. The U.S. Geological Survey (USGS) periodically updates the discharge rating curve for each of the S-12s. Experience has shown that actual S-12 releases have been about forty percent less than the design rating curves. The most recent discharge rating curve available should be used for determination of S-12s' release capability.

The original design headwater of the S-12s was 12.4 feet and the peak average elevation for WCA-3A under the SPF event was 13.90 feet (C&SF Part I, Supplement 33). This stage level is reached only one time in the 41-year period of record of simulated COP operations, and the median value of the nearest gage (WCA3A-28) is approximately 9.0 feet NGVD. The result is that the S-12 structures are very rarely operating near their design criteria, and generally the system will be operated in a manner where the S-12s will very rarely demonstrate flows near their design capacity. The as-built crest elevation of the L-29 Borrow Canal and crown elevation of Tamiami Trail (U.S. Highway 41) in the S-12A to S-12D reach has been established to protect against the risk of overtopping from an adjacent flood of elevation 11.5 feet NGVD (corresponds to WCA-3A three gage average stage of 12.45 feet, based on historical regression). See **subsection 7.3.9** for further information.

7.3.9 S-12 Stability and Risk of Overtopping

The stability analysis conducted during design of the S-12s is predicated on a maximum design headwater elevation of 12.4 feet with the differential head across the structure limited to 5.5 feet. The as-built crest elevation of L-29 and crown elevation of Tamiami Trail (U.S Highway 41) in the S-12A to S-12D reach has been established to protect against the risk of overtopping from an adjacent flood stage of 12.4 feet NGVD. The exceedance of these design conditions should be considered an immediate increase in risk to levee stability and would require decisive and prescribed measures to reduce the WCA-3A stage. In addition, application of the FDOT road base impact criteria to this reach of Tamiami Trail (U.S. Highway 41) (estimated crown elevation of 14.95 feet) would result in a not to exceed regulated water stage of approximately elevation of 11.5 feet, adjacent to the roadbed (corresponds to WCA-3A three gage average stage of 12.45 feet, based on historical regression).

The top of the gates at the S-12s (A/B/C/D) is 11.0 feet NGVD. When the S-12s headwater approaches this level, the S-12s may be opened an amount only to prevent water from overtopping the structure gates to protect gate instrumentation.

7.3.10 L-31N/C-111

The L-31N and C-111 canal system has several structures where water management operations are limited. Tailwater elevations of 6.0 feet and 5.3 feet NGVD at S-331 and G-211, respectively, create undesirable conditions relative to adjacent agricultural and residential areas.

7.3.11 Pump Station Mechanical Longevity

The mechanical longevity of an individual pump unit can be affected by numerous conditions, some of which are addressed in the pump manufacturer's Operation and Maintenance Manual(s). Other factors affecting pump station longevity have been realized through the experience of site-specific conditions at the pump station location and these factors are addressed through specific procedures at the pump station. Individual pump units at pump stations will be operated to avoid conditions that could lead to mechanical breakdowns of the pump units. This includes, but is not limited to, avoiding repeated cycling of pumps units between "On" and "Off", rotating the use of pump units from different pump stations that service the same body of water, and engaging the

use of individual pump units of a pump station or pump stations that service the same body of water in a staggered manner including when it is prior to "On" criteria occurring. The pump station operator will establish specific procedures to maximize pump unit availability.

7.4 OPERATIONAL STRATEGY TO MEET PROJECT OBJECTIVES

The complexity of water management operations is a clear consequence of the multiple, varied, and sometimes-conflicting goals for the regional system (i.e., flood risk management, water supply, environment, navigation, etc). Day-to-day water management operations for the structures within the WCAs and ENP-SDCS will necessitate the use of operating criteria and other related information contained within this WCP and SOM. The WCP and the SOM Structure Descriptions and Rating Curves (Appendix A of the SOM) contain a compilation of water control criteria, guidelines, diagrams, and specifications that govern the release functions of the pertinent structure(s) for the congressionally authorized project purposes. In general, they indicate controlling or limiting rates of release, levels, and storage space required for the project purposes.

7.4.1 Achieving Natural System Goals, Objectives, and Benefits

Normal operations are expected to achieve the goals and objectives for the system which are detailed above in **subsection 7.1** and as recorded in the EIS for the COP (2020, until superseded by any future EIS or EA). This section first discusses the individual operational considerations and project objectives and then concludes with the system operational criteria. The operational criteria and overall strategy for the water management operations are expected to accomplish the goals of the C&SF system and COP. As future projects are developed and installed, these changes should interact with the existing system in order to accomplish the restoration goals of the larger C&SF Project.

7.4.2 Flood Risk Management

During high water events, water is passed southward from WCA-1 into WCA-2A; from WCA-2A into WCA-3A; and from WCA-3A into ENP and/or the ENP-SDCS. The water control structures typically pass the water from north to south to allow for a smooth articulation of water through the WCAs and into ENP and/or ENP-SDCS. Releases from the WCAs to tide via ECC can also be made. When the ECC are full, discharging water eastward from the WCAs could cause or aggravate local flooding. This is also possible if the ECC are being utilized for release to tide from the WCAs and a significant rainfall event over the ECC occurs. Therefore, water from the WCAs can only be released to tide via the ECC when rainfall over adjacent areas has not produced large amounts of runoff and canal capacity exists (SOM Volume 5 details the ECC). The release capacity to tide through the structures that connect the WCAs to the coastal canal system is often relatively small compared to the primary structures (e.g., S-10s, S-11s, and S-12s). For example in WCA-1, S-39 has a design capacity of approximately five percent of that of a single S-10 structure. In addition, favorable conditions for an extended period are required to make meaningful releases through the coastal structures.

7.4.2.1 Water Conservation Areas

The S-10, S-11, and S-12 spillways were sized to pass the SPF. The basic purpose of these spillways is to provide a means of controlling flow and providing conveyance for all flood releases up to the Spillway Design Flood (SDF). Rapid removal of flood storage in the WCAs is limited due to the slow movement of water in the densely vegetated WCAs, relative to the potentially high rates of inflows that come from upstream structures combined with rainfall. The relatively flat terrain and dense vegetation often lead to sloping pool conditions in the WCAs and backwater effects. When conditions in the coastal canals permit, some additional releases to tide can be made by SFWMD from the WCAs.

The USACE is currently nearing completion of an updated WCA flood routing analysis study, the Baseline and Modification Model (BAMM). The intent of the BAMM study is to identify and quantify the cumulative changes to design stage and flow conditions within the WCA system (WCA-1, WCA-2, and WCA-3) due to infrastructure and operational changes that have occurred since the originally authorized C&SF design. The BAMM effort includes development of a new regional flood routing model and model simulations of SPF hydraulic routings for each of the WCAs. The BAMM flood routing results will be used by the USACE to conduct comprehensive risk analysis of levees and structures within the WCAs, including hydraulic, hydrological, geotechnical, and structural engineering, if results warrant. The USACE will evaluate any substantial WCA design deficiencies and determine the resulting path forward based on human health and safety and other C&SF Project requirements.

7.4.2.2 ENP-South Dade Conveyance System

The C&SF Project features in South Miami-Dade County maintain optimum stages for the purposes of flood risk management, water supply, reducing seepage from ENP, groundwater recharge, and prevention of saltwater intrusion. The C-111 SD spillways (S-196, S-194, S-176, S-177, S-18C, and S-197) were designed to pass 40 percent of the SPF without exceeding design stages, and to control releases during floods in excess of design to prevent damaging velocities at the structures and in the canal.

7.4.2.3 Lake Okeechobee and the Everglades Agricultural Area

Releases can be made from Lake Okeechobee and the EAA to the WCAs. To maintain EAA canal levels, EAA canal water is typically pumped into STAs prior to delivery to the WCAs. For more detailed discussion, refer to SOM Volume 3, Lake Okeechobee and Everglades Agricultural Area.

7.4.3 Water Quality

The State of Florida is responsible for regulating water quality and is responsible for achieving state water quality standards. USACE is responsible for developing water control plans for operation of the C&SF system. SFWMD, acting on behalf of the state, may petition the USACE for operational changes within the C&SF system where it sees that water quality benefits may be achieved in the project area. USACE considers such requests and whether they interfere with achievement of the congressionally authorized project purposes.

The consent decree in United States v. South Florida Water Management District, Case No. 88-1886-Civ-Moreno ("Consent Decree"), a 1988 lawsuit the United States filed against the State of Florida, commits the State to taking such action as is necessary so that waters delivered to the ENP and Loxahatchee National Wildlife Refuge (LNWR or WCA-1) achieve state water quality standards. The Federal (USACE, ENP, and LNWR) and State parties (SFWMD and FDEP) agreed that the actions set forth in the Consent Decree were necessary to halt or prevent imbalances in natural populations of aquatic flora and fauna and other water quality violations in ENP and LNWR. The Consent Decree is still being implemented and its requirements, among other things, include State construction and operation of Stormwater Treatment Areas (STA). The State constructed STA-1W, STA-2, STA-3/4, and STA-5/6 and USACE constructed STA-1E. The State is operating all 5 STAs.

The consent decree provides for a Technical Oversight Committee (TOC), with a representative from each settling party, to make technically based recommendations concerning research, monitoring, and Consent Decree compliance. The TOC regularly discusses the status of compliance and potential causes when there are exceedances of consent decree limitations.

Appendix A of the Consent Decree sets flow dependent limits on total phosphorus for water released into ENP Shark River Slough (SRS). Generally, increased water flows across Tamiami Trail results in a lower allowable phosphorus concentration limit. The Long-Term Limit for ENP Shark River Slough has a fixed lower total phosphorus concentrations limit (7.6 ppb annual flow-weighted mean - FWM) and does not prevent or limit flows that exceed base period flows as observed in Appendix A.

Since the Parties entered into the Consent Decree, there have been water quality concerns associated with flows to the Everglades Protection Area which includes ENP, LNWR and the WCAs. The SFWMD, FDEP, and the Environmental Protection Agency (EPA) engaged in technical discussions starting in 2010. In 2012, the State committed to a suite of additional water quality projects, known as Restoration Strategies, to address then existing flows to the Everglades Protection Area and work in conjunction with the STAs constructed under the Consent Decree to meet the Water Quality Based Effluent Limit (WQBEL) established for the STAs. The WQBEL and Restoration Strategies were incorporated into the Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit and associated State Consent Order, which were endorsed by EPA. Work on Restoration Strategies began immediately and that work is scheduled, pursuant to the NPDES permit and Consent Order, to be completed and fully operational by the end of 2025. Based upon current and best available technical information, the State, USACE and its federal partners believe at this time that the State Restoration Strategies, implemented in accordance with the NPDES permit and Consent Order along with the STAs constructed under the Consent Decree, will be sufficient and are anticipated to achieve water quality requirements for existing flows to the Everglades Protection Area. In the interim, the upstream pollution control remedies being implemented under State law, the Consent Decree STAs, and constructed components of Restoration Strategies are making significant progress in reducing phosphorus levels entering the Everglades Protection Area. Based on the State of Florida's current implementation schedule for Restoration Strategies, confirmation of

attainment of the WQBEL for inflows to the Everglades Protection Area will require up to five years of monitoring after the features are fully functional in 2025.

COP represents a significant step in changing C&SF operations to redistribute flows and increase water volume to ENP above existing flows. COP has been formulated and evaluated based on the existing inflows to the Everglades Protection Area, consistent with the assumptions used for the development of Restoration Strategies.

The USACE and its Federal and State partners recognize that achieving long-term hydrologic improvement may temporarily impact water quality, particularly as measured by the current Consent Decree, Appendix A, compliance methodology. Because COP will significantly alter the timing and distribution of flows into ENP, while also increasing the volume of water delivered to SRS, the Federal parties conducted a water quality evaluation to assess the effect of COP on compliance with Appendix A. That analysis shows that COP has the potential in the near term to result in more frequent exceedances of the Appendix A limits due to the following: 1) the redistribution of flows from west to east across Tamiami Trail; 2) higher flow volumes across Tamiami Trail into ENP, an increase from 571k to 733k acre-feet average annual flows (a 28% increase), that will result in lower Appendix A limits; and/or 3) increased volume and duration of flows during low-stage water deliveries through the S-333 and S-12D to SRS, when localized higher phosphorus concentration water predominates. The potential water quality impacts associated with COP are directly influenced by the quality of water delivered to the upstream areas (WCA-3A) and low water conditions in WCA-3A. Restoration Strategies are expected to address the upstream water quality concerns associated with the nutrient levels in the water delivered to WCA-3A. Components of the CERP Central Everglades Planning Project (CEPP) project (including plugs along the Miami canal, the Blue Shanty flow way, and distributed inflow points at the northern boundary of WCA-3A from the EAA basin) are expected to improve sheet flow and reduce dry out conditions in WCA-3A. Once Restoration Strategies are fully implemented, the WQBEL is achieved, and the CEPP features are completed, the increased flows expected to be delivered to the NESRS should not result in any increased potential for violations of Appendix A.

Consistent with the authorizing legislation for the MWD to ENP and C-111 SD Projects, the COP formulation goals and objectives prioritized restoration of natural hydrologic conditions in ENP over other identified planning considerations, including water quality. To address the potential near-term water quality concerns associated with the increased COP flows to NESRS the multi-agency water quality sub-team evaluated potential water quality mitigation strategies by leveraging sensitivity modeling simulations. Based on review of the modeling results, the analysis conducted by this team found that through the application of water quality adaptive management strategies, water quality could be improved relative to the No Action baseline. The COP AMMP (Appendix C of the COP EIS) developed strategies to help improve water quality delivered to ENP from WCA-3A, however, these strategies may reduce the quantity of water delivered to ENP. The water quality strategies were developed and designed to avoid any net reduction of water volumes delivered to the ENP during a given water year. The intent is that any temporary reduction in volumes delivered to the ENP due to the implementation of the water

quality strategies will be accounted for/tracked and that volume will be made/released to the ENP later in the water year when water is available in the system (typically during the wet season). These AMMP water quality strategies are also detailed as Annex in the WCP (**subsection 7.16.1**) include; 1) limited delays/flow reductions in releases to the ENP during the dry season to wet season transition 2) shifting S-12D flows to S-12C temporarily and 3) reducing dry season recession rates in WCA-3A by reducing releases from WCA-3A when the stage (3-station average stage as defined in **subsection 7.4.8.1.3**) is at or below 10 feet NGVD on 1 December. The AMMP describes the criteria and triggers for these strategies which potentially could nominally reduce high nutrient pulses to ENP during the dry season to wet season transition. The intent is to implement these minor operational adjustments to improve water quality via the operational flexibility allowed under adaptive management. Once the S-333 HW stage declines to 8.5 feet NGVD during the dry season to wet season transition and/or the WCA-3A stage is at or below 10 feet NGVD on 1 December, a water quality group (USACE, DOI, SFWMD, FDEP and other agencies) will evaluate conditions for potential recommendations to implement the above strategies. These strategies will only be implemented on a case by case basis and will include evaluation of the local and regional water stage information, weather forecasts, water supply conditions, and latest available water quality conditions (including provisional Total Phosphorus (TP) data provided by the SFWMD from the S-333, S-152, S12s and other appropriate structures, typically available one to two weeks following surface water sample collection). Recommendations from the water quality team will be presented to the periodic scientist meeting for WCA-3A prior to implementation of these water quality strategies. USACE shall make the operational decision whether or not to implement the water quality strategies in consideration of water quality and all other congressionally authorized project purposes.

Many of the water quality concepts outlined in CEPP may also be considered during the implementation and operation of COP. In an effort to address these potential impacts and determine updates to Appendix A to reflect increased inflows into ENP since the Consent Decree was entered, the parties to the Consent Decree have established a process and scope for evaluating and identifying necessary revisions to the Appendix A compliance methodology utilizing the scientific expertise of the TOC. The TOC may consider all relevant data, including the 20 years of data collected since Appendix A was implemented. Ultimately, such evaluations and changes to the Appendix A compliance methodology would be recommended by the Consent Decree's TOC for potential agreement by all parties.

7.4.4 Water Conservation/Water Supply

SFWMD moves water from WCAs into regional canal system to maintain canal stages, which provides recharge to the aquifer for existing legal uses and other beneficial uses. Some of the beneficial uses that have been identified specifically in legislation or later approved plans are water supply for municipal and industrial use, agricultural irrigation, ENP, and for salinity control and dilution of pollutants in project canals.

In the Lower East Coast, low coastal elevations over highly porous formations, combined with extensive groundwater use, require critical management of surface and groundwater levels to

control saltwater intrusion. When sufficient water is available, water supply releases can be made from the WCAs, or transferred from Lake Okeechobee, to the coastal areas to prevent saltwater intrusion and recharge the surficial aquifer system. Inland movement of saltwater in tidal canals and streams is basically a function of the relative densities of freshwater and saltwater, the rates of freshwater release, and tidal action. The coastal spillways prevent a saltwater wedge from moving up the canals and maintain a sufficient freshwater head to prevent saltwater intrusion in the aquifer.

The surficial aquifer system, including the water table and Biscayne aquifers, underlies approximately 3,000 square miles of Miami-Dade, Broward, and southern Palm Beach counties. It is a surficial, highly permeable, wedge-shaped aquifer that is approximately 200 feet thick at the coast but thins to a few feet thick near its western boundary 35 to 40 miles inland. The surficial aquifer system provides water for six water use categories established by the FDEP (public water supply, domestic self-supply, industrial and power generation water supply, agricultural and landscape irrigation) along the southeast coast. Seepage and water supply releases from the WCAs prevent saltwater intrusion along the coast and recharge the surficial aquifer system. Due to the high degree of connectivity between the surficial aquifer system and surface water, changes in surface water elevations have a direct impact on groundwater levels and saline water intrusion.

7.4.4.1 Water Supply Operations to the Lower East Coast

One of the objectives of the C&SF Project is to retain enough water in storage to meet water supply needs of the project area including municipal and industrial uses, agricultural supplemental irrigation, and prevention of saltwater intrusion. The WCAs can function to store water from rainfall events which may later be released when additional water is needed in the developed areas. At times, water supply releases are also made from the WCAs to the EAA.

When there is insufficient water available in the WCAs and sufficient water is available in Lake Okeechobee, water may be transferred from Lake Okeechobee through the WCAs to meet water supply needs. SFWMD can make water supply releases to the east coast from the WCAs through S-5A(S), S-39, S-38, S-143, S 141, S-142, S-34E, S-31, S-337, S-151, and S-333.

In order to prevent salt-water intrusion and meet water supply demands in the ENP-SDCS south of S-331, water supply deliveries typically begin when the water levels fall below the stages listed in **Table 7-1**. These stages are not meant to be maintained at these levels because even with water supply deliveries, the water levels in the canals usually decline considerably below these stages. For additional operating criteria, refer to **subsection 7.4.8**. It is anticipated that water supply deliveries to the SDCS will not be needed when S-356 is pumping. If S-356 is pumping and S-334 and/or S-335 are to be utilized to deliver water supply to ENP-SDCS, then S-356 will stop pumping.

TABLE 7-1. WATER SUPPLY DELIVERIES ALLOWED WHEN APPROACHING IDENTIFIED CANAL STAGES IN ENP-SDCS.

Canal	Reach	Elevation (feet NGVD)
Levee 31N Borrow Canal	S-331/S-173 to S-176	4.0
Canal 111	S-176 to S-177	3.0
Canal 111	S-177 to S-18C	2.0
Canal 111	S-18C to S-197	1.0

7.4.4.2 Water Supply Operations to ENP

One of the objectives of the C&SF Project is to improve water supply deliveries to ENP. The WCAs function to store water from rainfall events which may later be released when additional water is needed in ENP as identified by the Tamiami Trail Flow Formula (TTFF). See **subsection 7.4.8.1.3.1**.

7.4.5 Recreation

Recreation is an authorized project purpose for the C&SF Project. WCA-1 is designated as the Arthur R. Marshall LNWR. WCA-2 and WCA-3 together compose the Everglades and Francis S. Taylor Wildlife Management Area (EWMA), which are managed by Florida Fish and Wildlife Conservation Commission (FWC). There are abundant recreational facilities within the project area, both private and public. The Greater Everglades, which includes ENP, the EWMA, and LNWR provide opportunities for sightseeing, wildlife viewing, photography, hiking, bicycling, boat touring, boating, kayaking, canoeing, camping, fishing, and hunting. ENP receives over a million visitors per year, as does the EWMA, while LNWR receives about 400,000 visitors annually. Recreation in these areas increases tourist activity and provides economic benefits to the communities within and surrounding the area. Recreation is considered in the decision-making process and may influence water management operations on rare occasions. When water levels are too high or too low, FWC issues recreational closures. These closures are further detailed in **subsections 7.4.6.2 and 7.4.8.1.3**, respectively.

7.4.6 Fish and Wildlife

Preservation of fish and wildlife is an authorized project purpose. The WCAs are public hunting and fishing areas and provide exceptional opportunities for high quality wildlife-dependent recreation. Florida Bay and the Gulf Coast region of ENP also provide excellent fishing opportunities. The effects of the regulation schedules on fish, wildlife, and vegetation in the WCAs were and are important considerations in determining seasonal water levels along with recession and ascension rates. The regulation schedules for WCA-1, WCA-2A, and WCA-3A include a "floor" elevation; these are minimum levels (14.0 feet, 10.5 feet, and 7.5 feet NGVD respectively) that were established to help reduce adverse impacts on fish and wildlife resources. The WCAs also preserve an Everglades wetland environment interspersed with tree islands that provide important habitat for a diversity of plant and wildlife species. These tree islands habitats can be adversely affected by prolonged high water conditions.

7.4.6.1 Protected Species and Their Habitat

Forty-five federally listed threatened and endangered species are either known to exist or potentially exist within the Everglades (WCAs, ENP, coastal areas) including the Florida panther, Florida manatee, smalltoothed sawfish, Cape Sable Seaside Sparrow, Everglade snail kite, wood stork, American alligator, American crocodile, and Eastern indigo snake. In addition, designated critical habitat also occurs in the area including: marl prairie areas in ENP and the East Everglades for the CSSS; all of WCA-3A, all of WCA-1, and portions of SRS for the Everglade snail kite; coastal areas along Florida Bay for the American crocodile; and coastal areas around ENP for the Florida manatee.

State-listed species in the Everglades include the Big Cypress fox squirrel, Everglades mink, Florida sandhill crane, little blue heron, reddish egret, roseate spoonbill, Southeastern American kestrel, and tricolored heron. The Everglades contain some of the largest and most important wading bird colonies in North America. The EWMA provides numerous and abundant nesting opportunities for Florida's wading birds; the Alley North colony in WCA-3A is often the largest colony in the Greater Everglades.

7.4.6.2 Terrestrial Wildlife

Terrestrial wildlife, such as deer, marsh rabbits, bobcats, and raccoons, are native and common within the WCAs. During periods of high-water levels, resident deer and other terrestrial mammals in WCA-3A can be negatively impacted to the point of population reduction. As water levels rise, terrestrial wildlife respond by moving to elevated locations such as tree islands, spoil islands, and surrounding levees. As water levels continue to rise, the areas of high ground become more limited, making large and small mammals much more vulnerable to stress, disease, starvation, and predation. When restricted to higher ground, preferred food sources are limited, and wildlife must resort to less nutritious foods. Over time, fat reserves become exhausted and malnutrition and death will occur. The FWC and USFWS monitor conditions and provide important information when there is concern that high-water levels could negatively affect wildlife populations and their habitats.

In the EWMA, the deer herd management goal is to maintain the density at or slightly below the predicted high-water carrying capacity. To assist with this goal, management strategies such as antler restrictions, conservative harvest rates, careful monitoring of the deer herd, public access restrictions during periods of high water, and ecological recommendations provided to water managers are used. A large proportion of an Everglades deer diet is aquatic herbs (Labisky 2003, Loveless 1959). Everglades deer are generally healthy and free of parasites and disease, but when deer are crowded on elevated sites and suffering from stress and malnutrition, there is increased susceptibility to parasitism and disease (Loveless 1959).

Water levels in WCA-3A exceed the FWC high water criterion when the combined average of the Site 62 and Site 63 gages is greater than 11.60 feet NGVD. Under these conditions, essential wildlife behaviors are disrupted, recreation is impacted, and public access may be limited by FWC Executive Order. Prolonged high-water levels pose an increasing threat to state and federally listed species, and high water conditions that last longer than 60 days are detrimental to

wildlife health and habitats, and can have long-lasting impacts. The FWC position paper entitled Hydrologic Requirements for the Everglades and Francis S. Taylor Wildlife Management Area dated November 20, 2013 (**https://myfwc.com/media/6679/4bevergladespositionpaper.pdf**) provides biologically based guidance for managing water levels to ensure the conservation, protection, and restoration of fish and wildlife populations, habitats, species diversity, and cultural resources. FWC biologists use deer as an indicator of increased wildlife use of levees and under normal conditions, less than 10 deer will be observed during a spotlight survey on the L-5 levee. The observation of more than 10 deer on the L-5 levee is an indicator that high water conditions are having a detrimental effect on wildlife health and habitats. FWC biologists report wildlife monitoring results through the existing WCA-3 Periodic Scientists Call.

When water levels exceed the FWC high water criterion and impacts are imminent, FWC Commissioners or the Office of the Executive Director may call an Emergency High Water Meeting. USACE, USFWS, Department of the Interior (DOI), SFWMD, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), STOF, and the Miccosukee Tribe of Indians of Florida (MTIF) may be invited to attend in order to share information, assess the status of the regional water management system, and develop management strategies and options for relief from high water conditions that create deleterious ecological conditions.

7.4.7 Navigation

There are no authorized project features for navigation; however, recreational boating in ENP and the WCAs and associated project canals is very popular. The minimum stages for the conservation pools in the WCAs help reduce adverse impacts on recreational boating during drought periods.

7.4.7.1 Access to Cultural Areas Downstream of S-12A

To provide the MTIF access to cultural areas the MTIF may request S-12A releases up to 100 cfs during periods of time when the structure would have otherwise remained closed (1 October to 14 July). The USACE must request consultation with USFWS to avoid impacts on CSSS subpopulation A. The duration of this release would not exceed five consecutive days. The initial release would be managed as a field test to determine any potential effects associated with the release on CSSS subpopulation A. If no adverse impacts occur, subsequent releases would be coordinated and monitored appropriately.

During the decision making process to determine whether to implement the request from the MTIF hydro-meteorological data such as, but not limited to, water levels at gage NP-205, rainfall, and rainfall forecasts will be utilized. Other pertinent details related to this decision-making process are in the USFWS BO for ERTP:

http://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/G-3273-and-S-356-Pump-Station-Field-Test/

During implementation of the S-12A up to 100 cfs release for access to MTIF cultural areas, relevant environmental data will be monitored. If NP-205 stage is observed to increase or anticipated to increase above 5.7 feet NGVD, S-12A will be closed. Water levels at gage

SPARO, located between S-12A and NP-205, also provides additional insight into the effectiveness of S-12A releases for providing access to cultural areas while still avoiding impacts on CSSS subpopulation A.

7.4.8 Overall Plan for Water Management

This section defines and describes the day-to-day operating criteria and other information for the WCAs, ENP, and ENP-SDCS features to meet all of the C&SF Project congressionally authorized purposes.

7.4.8.1 Water Conservation Areas

The WCAs, located south and east of the EAA and west of the urbanized East Coast, comprise an area of about 1,350 square miles (approximately 864,000 acres)(See **Figure 7-1**). The WCAs make up a large portion of the original Everglades. Surface water inflows from the EAA typically enter these areas following treatment from one of the STAs. Flow across the WCAs is generally slow due to flat slopes and relatively dense vegetative cover. The flat ground slopes and dense vegetation often lead to sloping pool conditions observed by different stages in the interior and outer portions of the WCAs. An interior levee across the southern portion of WCA-2 subdivides it into WCA-2A and WCA-2B. This levee reduces water losses due to seepage into the extremely porous aquifer that underlies WCA-2B, and obviates the need to raise existing levees to the grade needed to provide protection against wind tides and wave run-up. Two interior levees, L-67A and L-67C run diagonally from pump station S-9 in a southwest direction to S-333 subdividing WCA-3 into WCA-3A and 3B. These levees reduce water losses due to seepage into the porous aquifer that underlies WCA-3B.

Regulation schedules contain instructions and guidance on how project water management structures are to be operated to maintain water levels in the WCAs. The regulation schedule prescribes the seasonal and monthly limits of storage which guides project regulation for the planned purposes. The regulation schedules vary from high stages in the late fall and winter to low stages at the beginning of the wet season. This seasonal range permits the storage of rainfall and runoff during the wet season for use during the dry season. In addition, it serves to maintain and preserve the vegetative regime including tree islands in the WCAs, which are essential to fish and wildlife and the prevention of wind tides. Regulation schedules must take into account the various and sometimes-conflicting project purposes.

Conceptually, reservoir storage is commonly divided into the inactive zone, the water supply (conservation) zone, and the flood control zone. The distribution of water between the flood control and water supply zones varies seasonally in the WCA's. The regulation schedules for WCA-1, WCA-2A, and WCA-3A include a "floor" or minimum water levels (14.0 feet, 10.5 feet, and 7.5 feet NGVD respectively) below which water supply releases (for municipal and industrial use, agricultural irrigation and prevention of saltwater intrusion) from these WCAs must be preceded by an equivalent volume of inflow from Lake Okeechobee and/or WCAs. For example in WCA-3A, if the water level measured at the Site 3-69W gage fell below 7.5 feet NGVD, water could be transferred from Lake Okeechobee and/or WCA-2A through WCA-3A to meet water supply demands. The water levels in these WCAs may continue to recede due to

evaporation and seepage. There is no requirement to maintain the minimum elevations. Releases from WCA-3A recommended by the TTFF to ENP do not require this preceding water delivery when below the floor water level.

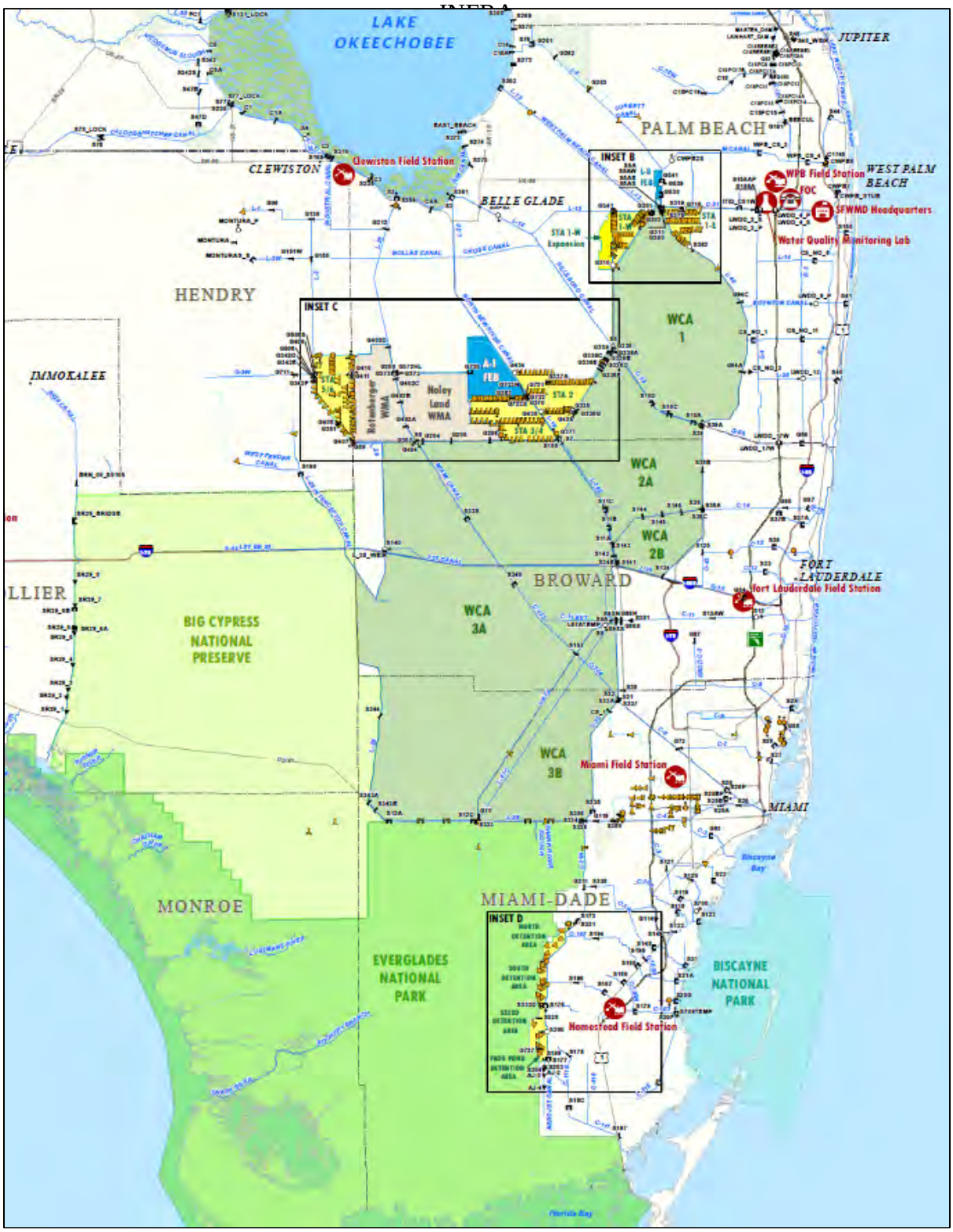


FIGURE 7-1. INFRASTRUCTURE MAP.

7.4.8.1.1 Water Conservation Area 1

WCA-1 resides within the Arthur R. Marshall LNWR (see **Figure 7-2**) boundary which has an area of 221 square miles and is completely contained by L-7, L-40 and L-39. Inflows to the area were previously controlled by pump stations S-5A and S-6 (until 2000 when S-6 pump station flows were routed south for treatment in STA-2 and then released to WCA-2A). These pump stations are designed to remove 3/4 of an inch of agricultural area runoff from their tributary drainage area per day. S-5A pumps water from the West Palm Beach Canal and has a design capacity of 4,800 cfs. S-319 also pumps water from the West Palm Beach Canal with a design capacity of 3,980 cfs to provide flood risk management to the C-51W Basin. WCA-1 inflows (S-5A and S-319) are directed through STA-1E and STA-1W whose releases are now the primary inflows to WCA-1. Releases from STA-1E are through S-362 and releases from STA-1W are through G-310 and G-251 into WCA-1. In the event of extreme high water, inflows to WCA-1 may be diverted untreated through G-300, G-301 and G-338 which are SFWMD structures. S-6 may also operate in conjunction with G-338 to send untreated water to WCA-1 in the event of extreme high water upstream of WCA-1.

WCA-1 is regulated primarily by the S-10s, which consists of three spillways; S-10A, S-10C, and S-10D. The design capacity of the S-10s is 14,800 cfs under SPF stages. Water can also be released to the east into the Hillsboro Canal via S-39. This is a single bay gated spillway with a design capacity of 800 cfs. S-5AS can be used to release water from WCA-1 to the L-8 Borrow Canal and the West Palm Beach Canal.

The WCA-1 regulation schedule is shown in **Figure 7-3**. From 1 January through 30 June the indicator water level gage for regulation is 1-8 Canal (1-8C) (USGS Site ID: 263000080120001). During 1 July through 31 December the 1-8C gage is used as the indicator gage, except during rising stages when the 1-8C stage exceeds the average of the interior gages, 1-7 (USGS Site ID: 263180080205001), 1-8T (USGS Site ID: 263050080145001), and 1-9 (USGS Site ID: 262750080175001). In that case, the average interior stage (gages 1-7, 1-8T, 1-9) is used as the indicator stage. The S-10s have no required minimum low flow release. The regulation schedule is intended to produce favorable conditions for wetland fish and wildlife resources, including species listed under provisions of the ESA. This regulation schedule was put into effect to achieve the benefits of allowing higher water levels during wet years in the northern portion of the LNWR; increase the hydroperiod of interior marshes of the LNWR such that dry-out does not occur on an annual basis; increase the proportion of the interior marsh of the LNWR that serves as nursery areas for aquatic organisms; improve the timing of winter stage drawdown in the LNWR to benefit wading birds; restore conditions in the LNWR similar to those found when the areas were used by snail kites for nesting; and allow for the storage of a greater quantity of water within the C&SF system during wet and normal rainfall years.

The fourth and current WCA-1 regulation schedule was implemented in May 1995. In this schedule Zone A1 (15.75-17.5 feet NGVD) is the flood control zone from 1 January through 30 June. In Zone A1, releases are made up to maximum capacity at the S-10s and up to maximum capacity at S-39 when agreed between USACE and SFWMD. From 1 July through 31 December, attempts are to be made to maintain water levels within Zone A2 of the regulation

schedule. In Zone A2, S-10 releases are based on USACE forecasts and water supply releases are made as needed. If Lake Okeechobee stage is above WCA-1 stage or no more than one foot below WCA-1 stage, water supply releases must be preceded by an equivalent volume of inflow. In Zone B (14.0 feet NGVD to 17.0 feet NGVD), the water supply zone, water supply releases are made from WCA-1 as needed. If Lake Okeechobee stage is above WCA-1 stage or no more than one foot below WCA-1 stage, water supply releases must be preceded by an equivalent volume of inflow. In Zone C (below 14.0 feet NGVD), the drought zone, there would be no net release of water from WCA-1. Below this elevation no further releases will be permitted from the area unless a supply of water from another storage area is transferred to WCA-1. Experience has shown that it is difficult to draw water out of the interior of WCA-1 when the stage is below 15.5 feet NGVD.

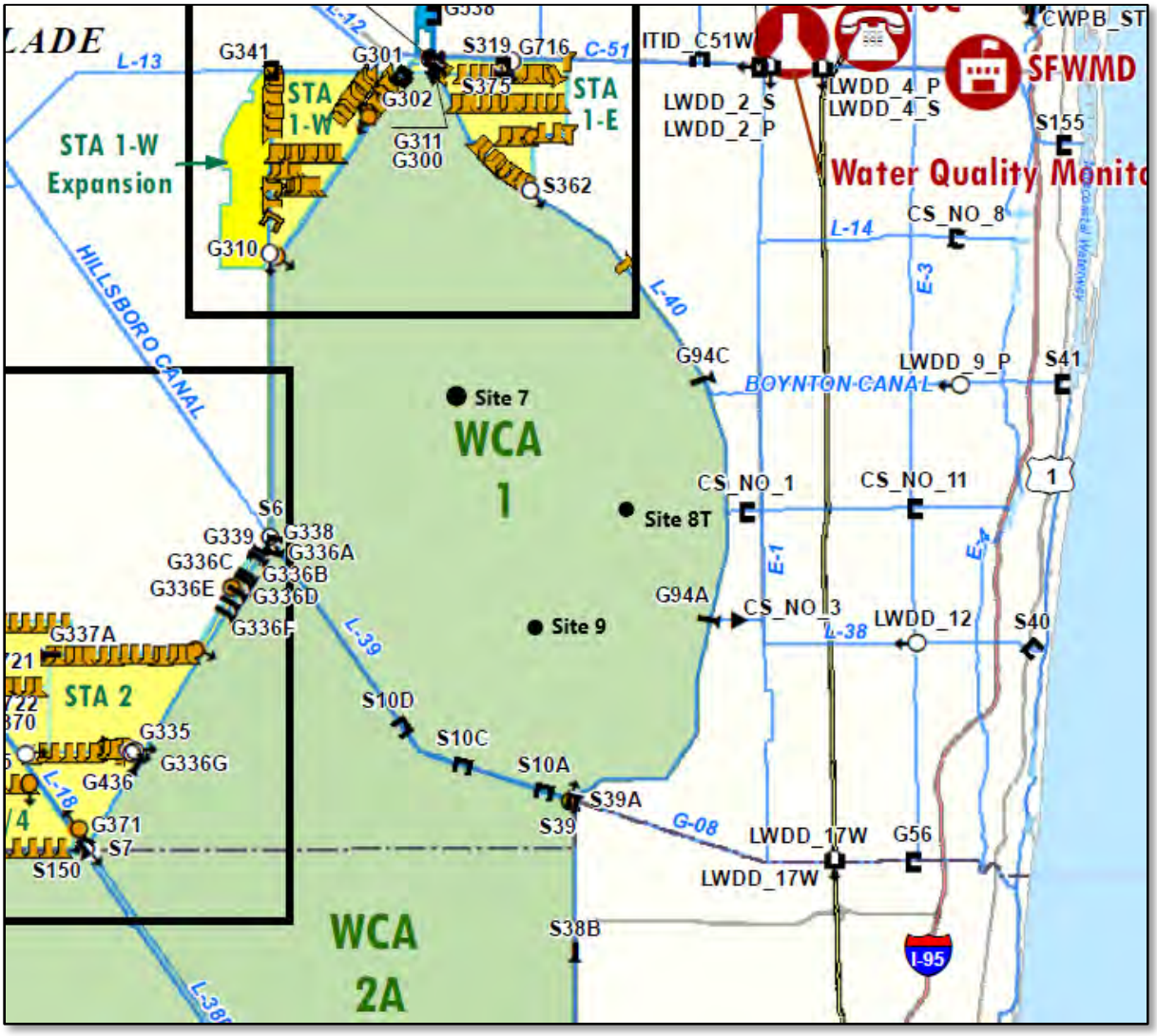
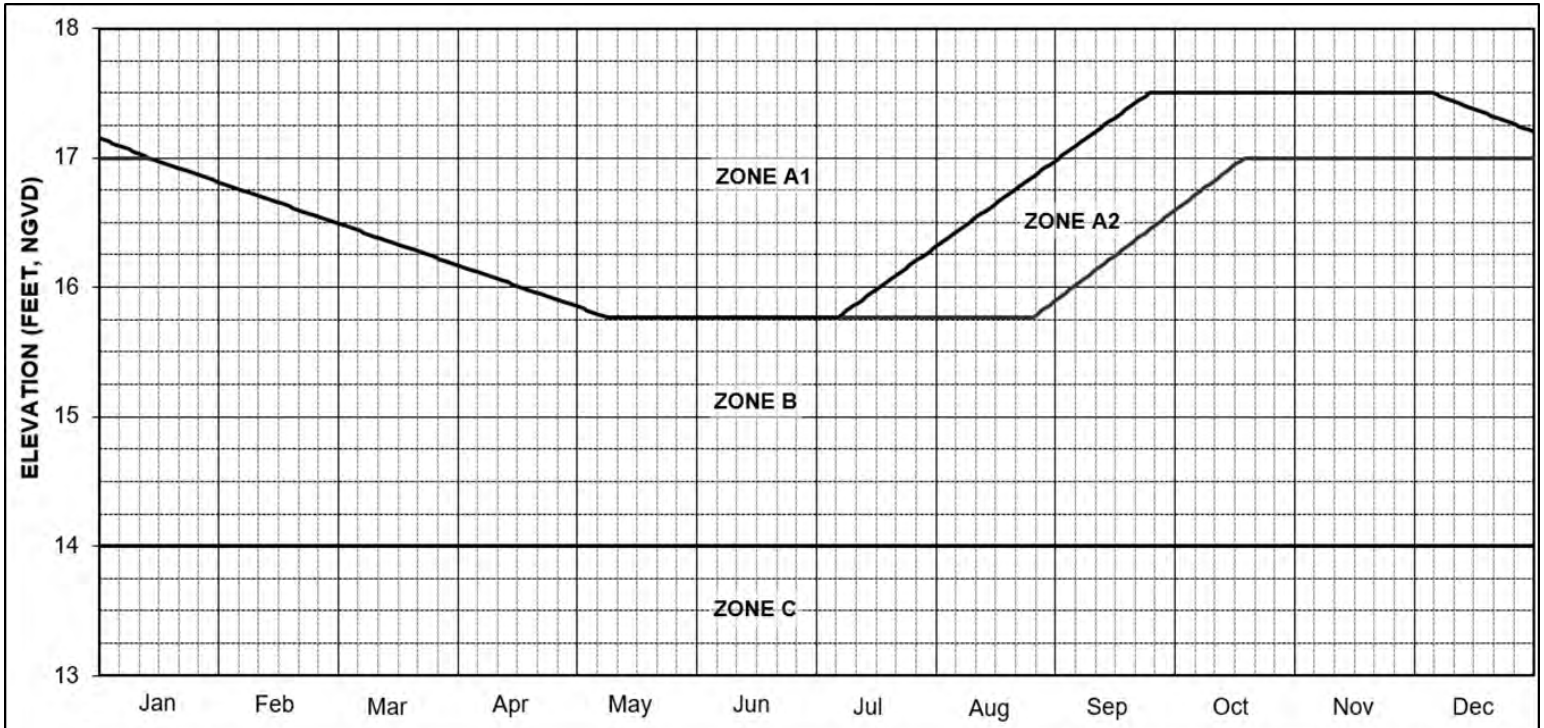


FIGURE 7-2. WCA-1 MAP



Zone	Releases
A1	Up to maximum at S-10 (and S-39 when agreed between Corps and SFWMD). Water Supply Released as needed.
A2	S-10 releases based on Corps forecasts. Water Supply releases as needed. If Lake Okeechobee Stage is above WCA 1 stage or no more than one foot below WCA 1 stage, then water supply releases from WCA 1 must be preceded by an equivalent volume of inflow.
B	Water supply as needed. If Lake Okeechobee Stage is above WCA 1 stage or no more than one foot below WCA 1 stage, then water supply releases from WCA 1 must be preceded by an equivalent volume of inflow.
C	No net releases from WCA 1. Any water supply releases must be preceded by an equivalent volume of inflow.

Dates	Use gauge	Conditions
1 Jan - 30 Jun	1-8 Canal	All
1 Jul - 31 Dec	1-8 Canal	Except as noted below
	Avg 1-7, 1-8T, 1-9	During rising stages when canal stage exceeds average

CENTRAL AND SOUTHERN FLORIDA PROJECT
REGULATION SCHEDULE
Water Conservation Area 1

US ARMY ENGINEER DISTRICT
JACKSONVILLE, FLORIDA
03 May 1995

FIGURE 7-3. WCA-1 REGULATION SCHEDULE

7.4.8.1.2 Water Conservation Area 2A

WCA-2A lies between the WCA-1 and WCA-3 (see **Figure 7-4**). The Hillsboro Canal runs between WCA-1 and WCA-2A and the North New River Canal runs between WCA-2A and WCA-3A. In addition to the S-10s, WCA-2A receives inflow from pump station S-7 (following treatment in STA-3/4) and pump stations G-335 and G-436 (following treatment in STA-2). STA-2 releases via pump stations G-335 through culvert structures G-336A-F and G-336G into WCA-2A. The S-7 station has a design capacity of 2,490 cfs, and pumps water from the North New River Canal (following treatment in STA-3/4). Pumping begins when the canal level exceeds 11.5 feet NGVD to 12.0 feet NGVD, unless the water level in WCA-2A is low enough to allow gravity flow from the canal through the spillway at S-7; or the water level in WCA-3A is low enough to permit gravity flow through S-150 into WCA-3A. S-6 has a design capacity of 2,925 cfs, and pumps water from the Hillsboro Canal into STA-2. Pumping should begin when canal stages exceed 11.5 feet NGVD to 12.0 feet NGVD.

The main outlets from WCA-2A are the S-11s, which consists of three spillways: S-11A, S-11B, and S-11C. The design capacity of the three structures is 17,200 cfs under SPF stages. Water can also be transferred into WCA-2B through S-144, S-145, and S-146. These structures have design capacity of 210 cfs each. S-143, with a design capacity of 500 cfs, releases water to the east into the North New River Canal through S-34E. S-38, with a design capacity of 500 cfs, releases water into the C-14 canal.

The WCA-2A regulation schedule is shown on **Figure 7-5**. When the WCA-2A stage is in Zone A, flood releases are made up to maximum capacity at the S-11s; up to maximum capacity at S-144, S-145, and S-146; and up to maximum practicable at S-143 and S-38 when agreed by USACE and SFWMD. The L-35B and L-38 Borrow Canals should not be drawn down below 10.5 feet NGVD. Releases from WCA-2A to WCA-2B from S-144, S-145, and S-146 are to be terminated if the WCA-2B stage (measured at gage 99) exceeds 11.0 feet NGVD. In Zone B, only releases for water supply to the Lower East Coast service Area for municipal and industrial uses, agricultural supplemental irrigation, and to prevent saltwater intrusion are made. During droughts a minimum elevation in the borrow canals of 10.5 feet NGVD, will be observed. Below this elevation no further releases will be permitted from the area unless preceded by an equivalent volume of inflow. The S-11s have no required minimum low-flow release.

From 1 January through 31 January, the Site 2-17 gage (USGS Site ID: 262240080258001) is the indicator gage for regulation; however, if the Site 2-17 stage recedes to 11.5 feet NGVD, the indicator gage becomes the S-11B HW gage. From 1 February through 30 June the S-11B HW gage is the indicator gage for regulation. Then from 1 July through 31 December the Site 2-17 gage is the indicator gage for regulation. Water Conservation Area 2B

Water releases from WCA-2B are made via S-141. S-141 is a three-bay spillway structure that controls the water level in WCA-2B, and permits releases from the area to the North New River Canal through S-34E. Whenever the pool elevation in WCA-2B exceeds 11.0 feet NGVD, as measured at Site 99 (USGS Site ID: 260810080222001), S-141 will be operated for flood releases through S-34E if canal capacity is available and inflows from S-144, S-145, and S-146

will be suspended. Water levels in WCA-2B are mainly dependent on seepage and rainfall. A regulation schedule is not utilized for WCA-2B due to high rates of seepage from the area.

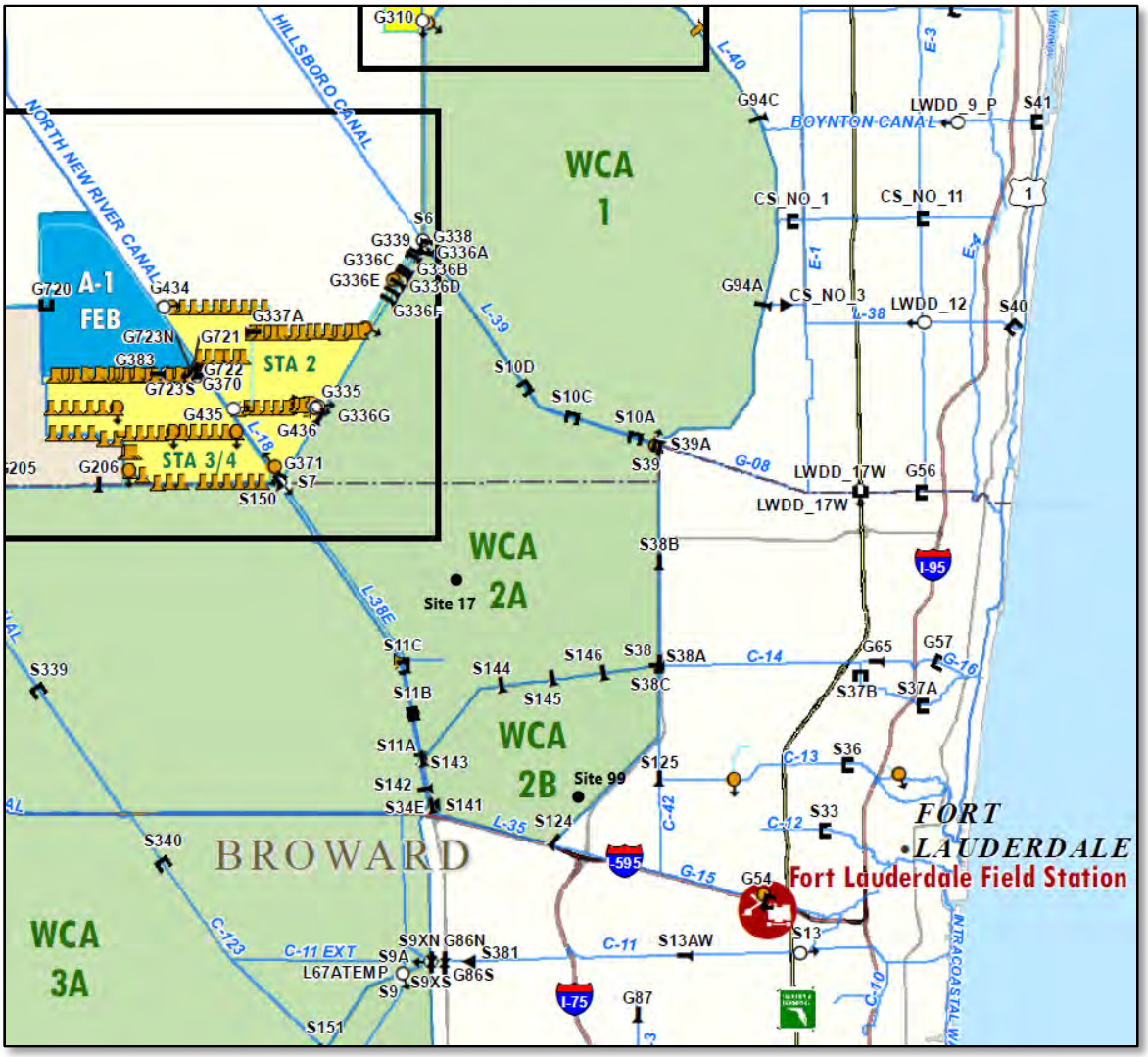
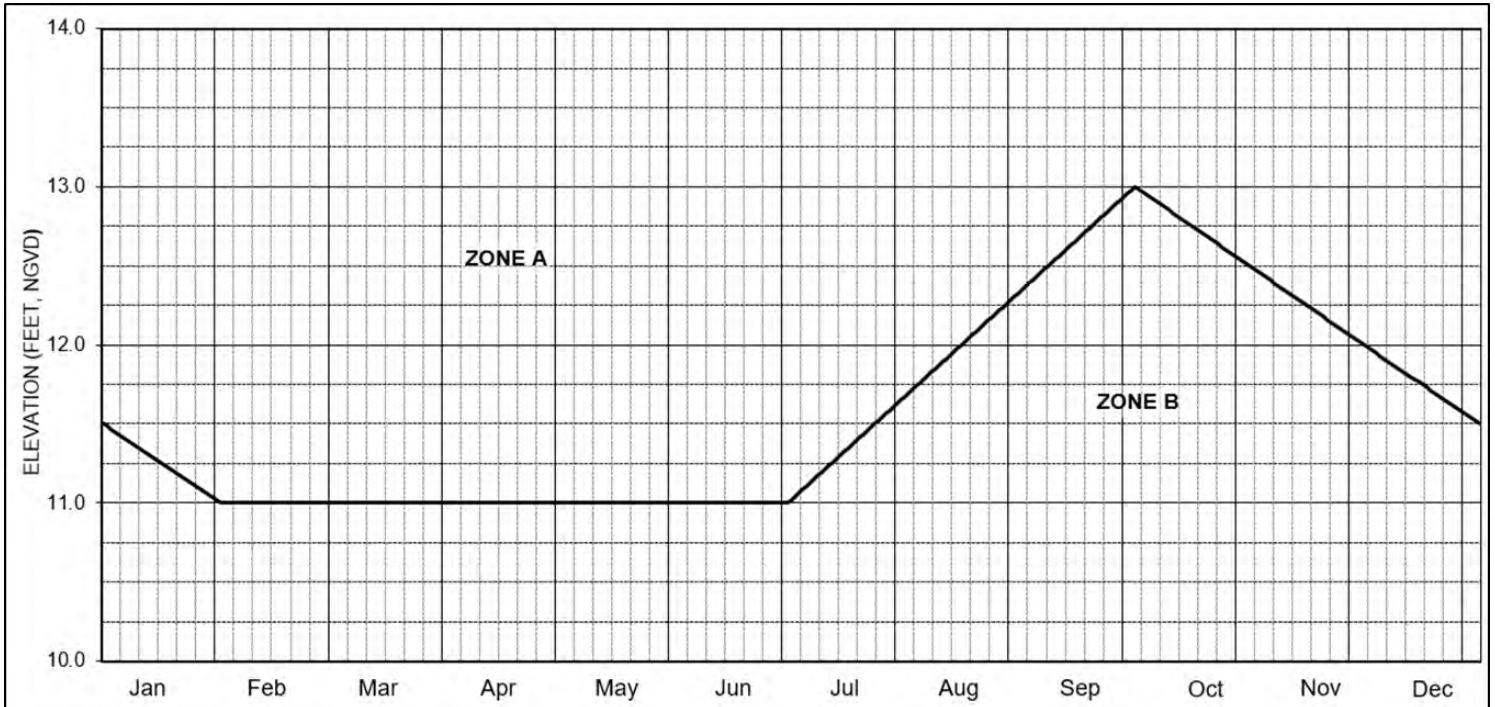


FIGURE 7-4. WCA-2A MAP



Zone	Releases
A	Up to maximum at S-11; Maximum capacity at S-144, 145, & 146; Maximum practicable at S-143 & S-38 when requested by the Corps of Engineers but not to exceed 11.0 ft, NGVD, in WCA 2B. L-35B & L-38 borrow canals should not be drawn down below 10.5 ft, NGVD.
B	Water supply. L-35B & L-38 borrow canals should not be drawn down below 10.5 ft, NGVD, unless water is supplied from another source.

Dates	Use gauge	Conditions
1 Jan - 31 Jan	2-17	If 2-17 stage recedes to 11.5 ft, NGVD, swithch to S-11B HW gauge.
1 Feb - 30 Jun	S-11B HW	All
1 Jul - 31 Dec	2-17	All

CENTRAL AND SOUTHERN FLORIDA PROJECT
REGULATION SCHEDULE
Water Conservation Area 2A

US ARMY ENGINEER DISTRICT
JACKSONVILLE, FLORIDA
28 March 1998

FIGURE 7-5. WCA-2A REGULATION SCHEDULE

7.4.8.1.3 Water Conservation Area 3A

WCA-3A lies south of STA 5/6, Rotenberger and Holey Land tracts, STA 3/4, STA 2, and WCA-2 (see **Figure 7-6**). The updated 2020 WCA-3A regulation schedule is shown in **Figure 7-7**. The WCA-3A stage is the 3 station average of gages A-3 (Site 63) (USGS Site ID: 261117080315201), A-4 (Site 64) (USGS Site ID: 255828080401301), and A3-28 (Site 65) (USGS Site ID: 254848080432001).

In addition to receiving releases from the S-11s, WCA-3A receives inflow from S-150 and S-190 by gravity and from pumping at S-8, S-9, S-9A, and S-140. Inflows from S-8 and S-150 consist of STA-3/4 and STA-5/6 treated water. S-9 and S-9A removes runoff from the South New River Canal (C-11W Basin) up to the design capacity of 2,880 cfs and 500 cfs, respectively. Pumping occurs at S-9/S-9A with S-381 open (deflated), to maintain the stage in the South New River Canal below 3.6 feet NGVD. When S-381 is closed, S-9A is used to return seepage from WCA-3A. S-140 removes water from the L-28 Borrow Canal up to the design capacity of 1,305 cfs. S-140 is used to maintain canal levels below 10.5 feet NGVD, unless gravity flow into WCA-3A is possible at an adequate rate. S-190 is a gravity structure on the L-28 Interceptor Canal that releases runoff from the SBC Project Basin into WCA-3A.

The S-12s (S-12A, S-12B, S 12C, and S-12D), S-333, and S-333N are the main outlets from WCA-3A to ENP for water deliveries. However, both S-12A and S-12B have a closure period (1 October through 14 July, with limited conditional openings during October for S-12A/B and November for S-12B) for the protection of CSSS subpopulation A (further defined in **Table 7-3**). The S-12s consist of four 6-gate spillways with a combined capacity designed to be 32,000 cfs under the SPF stages. However, as noted in **subsection 7.3.8**, the S-12s are not capable of achieving the original design capacity. S-333 is a single-bay gated spillway with a design capacity of 1,350 cfs. S-333 also releases from WCA-3A to the ENP-SDCS for water supply and when conditions result in the transfer of S-333 releases to S-334. S-333N is being constructed adjacent to S-333 to move water from WCA-3A to L-29 Borrow Canal. S-333N has a design capacity of 1,150 cfs. S-333N is scheduled to be constructed and operational by June 2020. S-333N will be operated in accordance with FDEP permit 0362076-001 or any subsequent modifications issued to SFWMD.

S-343A and S-343B may release, the design capacity of 195 cfs each, from WCA-3A into the Big Cypress National Preserve when the WCA-3A water stage is in Zone A. These structures have a closure period (1 October through 14 July) for the protection of the CSSS subpopulation A. S-344 may release, the design capacity of 135 cfs, from WCA-3A to the Big Cypress National Preserve when the WCA-3A water stage is in Zone A.

S-14 was built to provide gravity drainage from the lower reaches of the L-28 Borrow Canal, via the L-29, Section 2, Borrow Canal, through the Tamiami Trail (U.S. Highway 41) into ENP. However, S-14 never functioned as intended due to tailwater conditions which were higher than design assumptions and currently is not operational. The former S-12F culvert structure, equipped with stoplogs, located in the Tamiami Canal (U.S. Highway 41) between S-12C and S-

12D, has been removed and replaced with an earthen plug. S-12F will be removed as part of the CEPP Old Tamiami Trail roadway removal project, scheduled to start in 2020.

S-142, with a design capacity of 430 cfs, releases from WCA-3A into the North New River Canal through S-34E. S-151 releases from WCA-3A to the C-304 in WCA-3B for flood diversion and for the purpose of providing water supply to Miami area canals and the ENP-SDCS. S-151 may release up to the design capacity of 1,105 cfs subject to the headwater at S-31 not exceeding 9.0 feet NGVD.

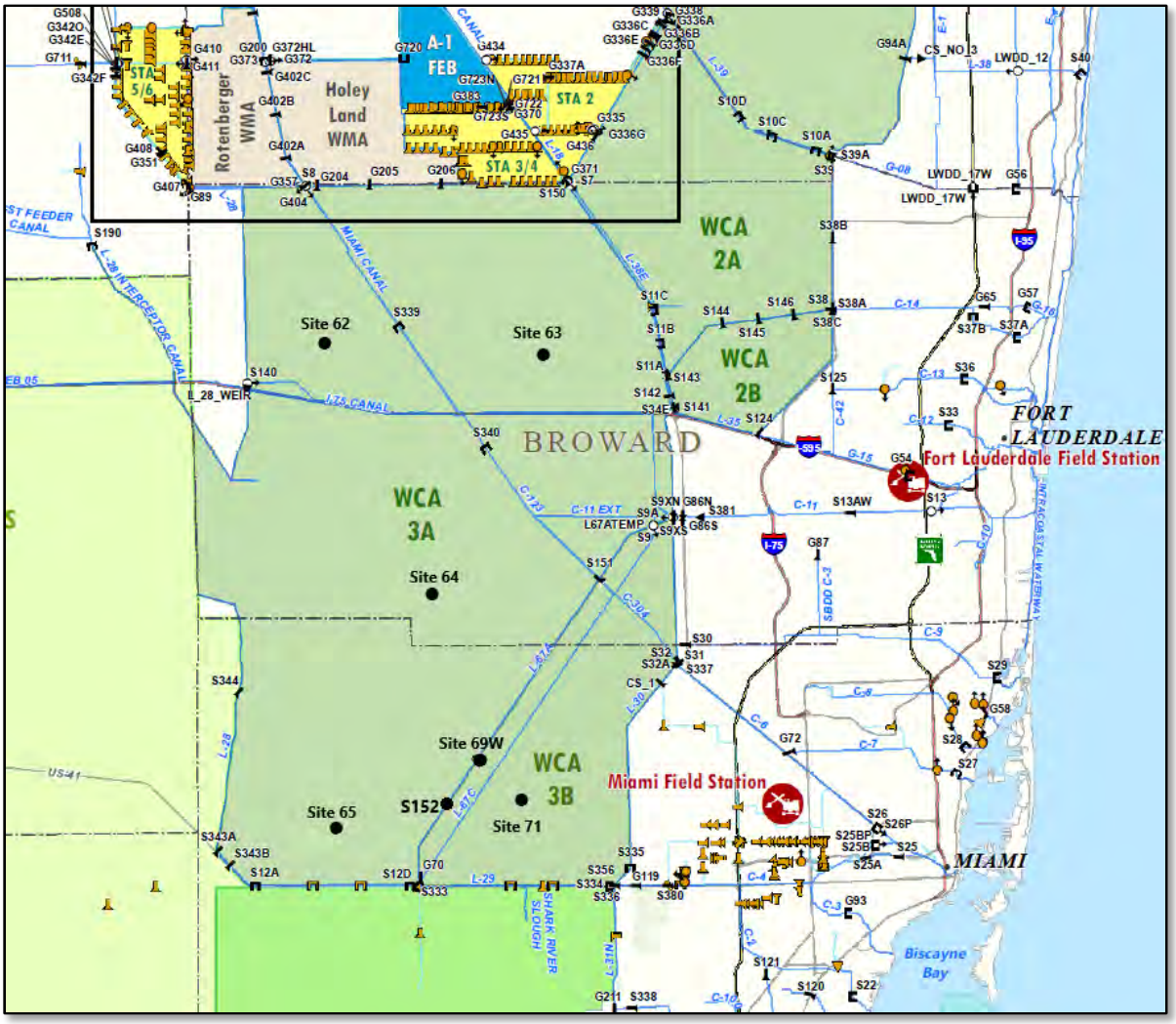
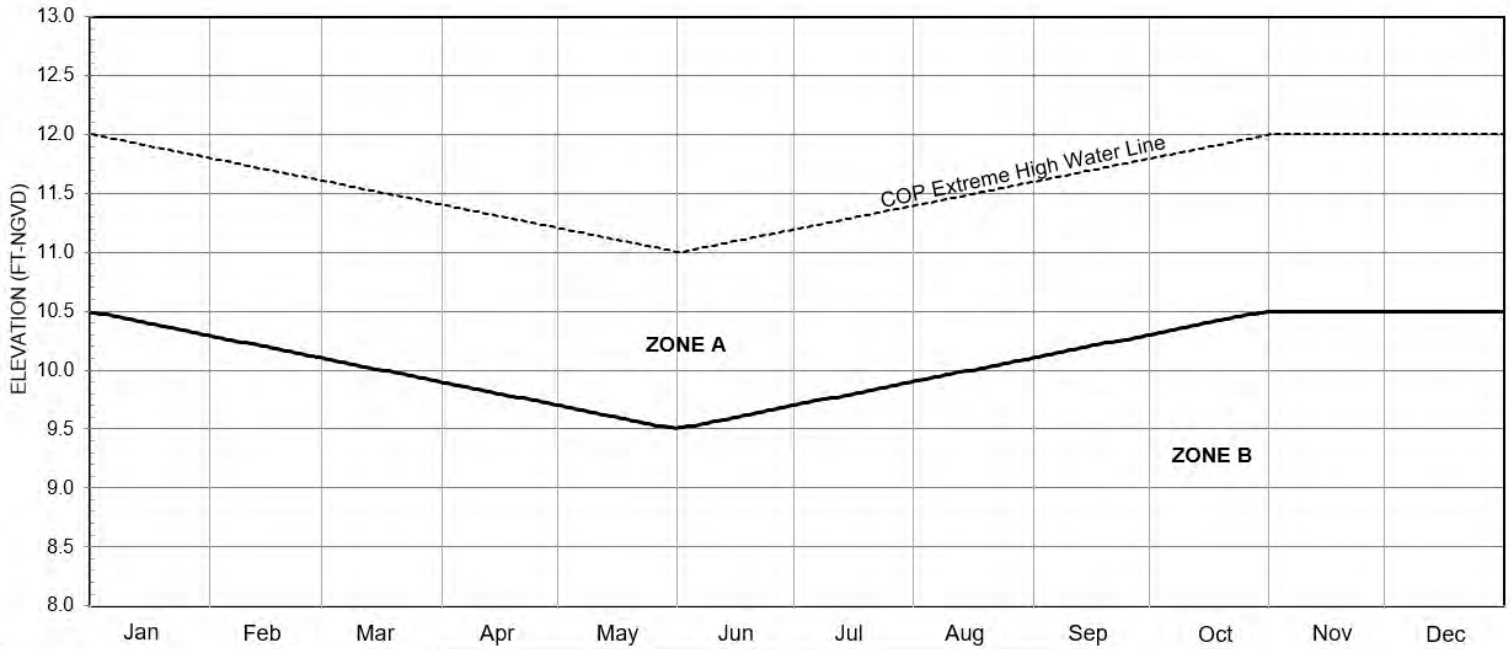


FIGURE 7-6. WCA-3A AND WCA-3B MAP



Zone	Releases
A	Maximum releases at S-333, S-12D, S-12C, S-12B, S-12A, S-343B, S-343A, S-344, and S-151 subject to downstream constraints.
B	Up to the TTFF weekly target flows at S-333, S-12D, S-12C, S-12B, and S-12A (listed in priority order) to prioritize water deliveries to NESRS first and WSRS second, subject to downstream constraints.
Notes	S-343A and S-343B are closed from 1 October through 14 July. S-12A and S-12B are closed from 1 October through 14 July with high water exit strategy

Condition	COP Extreme High Water Line (EHWL)
1	When WCA-3A stage is above the EHWL and is not projected to rise above Elevation 12.7 feet, NGVD, S-333 has the priority over S-356. S-334 may also be used up to its maximum capacity of 1,200 cfs to send water to L-31N Canal while adhering to the conveyance flow constraints identified below within the South Dade Conveyance System. Under this condition, first priority will be water deliveries to the eastern boundary structures of ENP if capacity is available.
2	When WCA-3A stage is above the EHWL and in the position analysis with the appropriate (analog) years are used (1) is projected to rise above Elevation 12.7 feet, NGVD (2) within the next 60 days, S-333 has the priority over S-356. S-334 may be utilized up to its maximum capacity of 1,200 cfs subject to SDCS flow constraints and through use of all remaining available coastal discharge structures including S-197. Extreme High Water Condition 1 priorities remain and will be maximized before sending additional water south to S-197.
3	Extreme High Water Condition 3. When WCA-3A's three gage average stage is above 12.3 feet NGVD then S-197 may be increased up to 2,400 cfs until WCA 3A water levels recede to below 12.0 feet NGVD. S-333 has the priority over S-356. S-334 may be utilized up to its maximum capacity of 1,200 cfs subject to SDCS flow constraints and through use of all remaining available coastal discharge structures including S-197. Extreme High Water Condition 1 priorities remain and will be maximized before sending additional water south to S-197.

CENTRAL AND SOUTHERN FLORIDA PROJECT
REGULATION SCHEDULE
Water Conservation Area 3A
US ARMY ENGINEER DISTRICT
JACKSONVILLE, FLORIDA
August 2020

FIGURE 7-7. WCA-3A REGULATION SCHEDULE

S-152 releases water from WCA-3A to WCA-3B and is part of the Decompartmentalization and Sheetflow Enhancement Physical Model (DPM) project. S-152 and the associated 3,000-foot L-67C levee gap are temporary features for the DPM, which is a field-scale test that is being conducted to determine the best plan for future decompartmentalization of WCA-3, as envisioned in CERP. The DPM operational window is anticipated to be from November 2017 through 2021. S-152 releases up to the design capacity of 750 cfs from WCA-3A to WCA-3B under the following restrictions:

- L-67A must be above 7.5 feet NGVD.
- Site 71 gage (USGS ID: 255250080335001) in WCA-3B must be below 8.5 feet NGVD.
- Water quality constraint criteria per FDEP Permit Number 0304879 (or any subsequent modifications issued to USACE) must be met.
- May be closed when S-355A and S-355B are closed due to L-29 canal stage constraints.

S-339 and S-340 are structures on the C-123 (Miami Canal) that prevent over drainage of the northern end of WCA-3A, and force water through the marsh. These structures also provide the ability to transfer water to ENP and to Miami-Dade County canals including ENP-SDCS. These structures are normally closed, and operated according to the Operations Schedule for Canal 123, Structures 339 and 340 (**Figure 7-8**). The Site 62 gage (gage 3-2/"Deer gage") (USGS ID: 261023080443001) is the indicator gage for operation of these structures.

When the average of the Site 62 and Site 63 gages is 9.30 feet NGVD, water stages are on average 1.0 feet below the ground surface over approximately 25% of WCA-3A North. At or below this water level, the risk of muck fires is increased and FWC will close the area to public access. Muck fires burn the soil and can cause extensive damage, in particular the loss of tree islands that provide critical upland habitat for wildlife species. If the water levels reach the criteria for FWC to close the area to public access, then the same water levels (9.30 feet NGVD average of Site 62/63 gages) will be utilized to recommend re-opening the area. However, since the Site 62 and Site 63 gages are approximately 5 miles south of the WMAs and may not reflect actual conditions near the L-5 levee, where most off-road vehicle activity occurs, FWC will assess field conditions prior to re-opening the area. When the average of the Site 62 and Site 63 gages is ≥11.60 feet NGVD, essential wildlife behaviors are disrupted, recreation is impacted, and public access may be limited by FWC Executive Order.

The 2020 WCA-3A Regulation Schedule has two zones: Zone A and Zone B as well as an Extreme High Water Line (EHWL) above Zone A. Zone A is above Zone B and delineated by a seasonally varying line that ranges from a maximum of 10.5 feet NGVD (1 November) to a minimum of 9.5 feet NGVD (1 July). In Zone A, maximum releases at S-333, S-333N, S-12D, S-12C, S-12B, S-12A, S-343A, S-343B, S-344, and S-151 subject to the closure periods and downstream constraints. An FDEP permit (issued to SFWMD) regulates operation of S-333N. When water stages are in Zone B, the WCA-3A release targets are computed by the TTFF for S-333, S-333N, S-12D, S-12C, S-12B, S-12A (listed in priority order) to prioritize releases to Northeast Shark River Slough (NESRS) first and Western Shark River Slough (WSRS) second. The TTFF is further described in **subsection 7.4.8.1.3.1**. The EHWL ranges from a minimum of

11.0 feet NGVD (1 June) to a maximum of 12.0 feet NGVD (01 November to 1 January) and is further described in **subsection 7.4.8.1.3.2**.

The “floor” or minimum elevation for WCA-3A is 7.5 feet NGVD, measured at Site 3-69W gage (USGS Site ID: 255300080370001). Below this stage, no further releases for water supply to the Lower East Coast for municipal and industrial uses, agriculture supplemental irrigation or prevention of saltwater intrusion unless preceded by an equivalent volume of inflow.

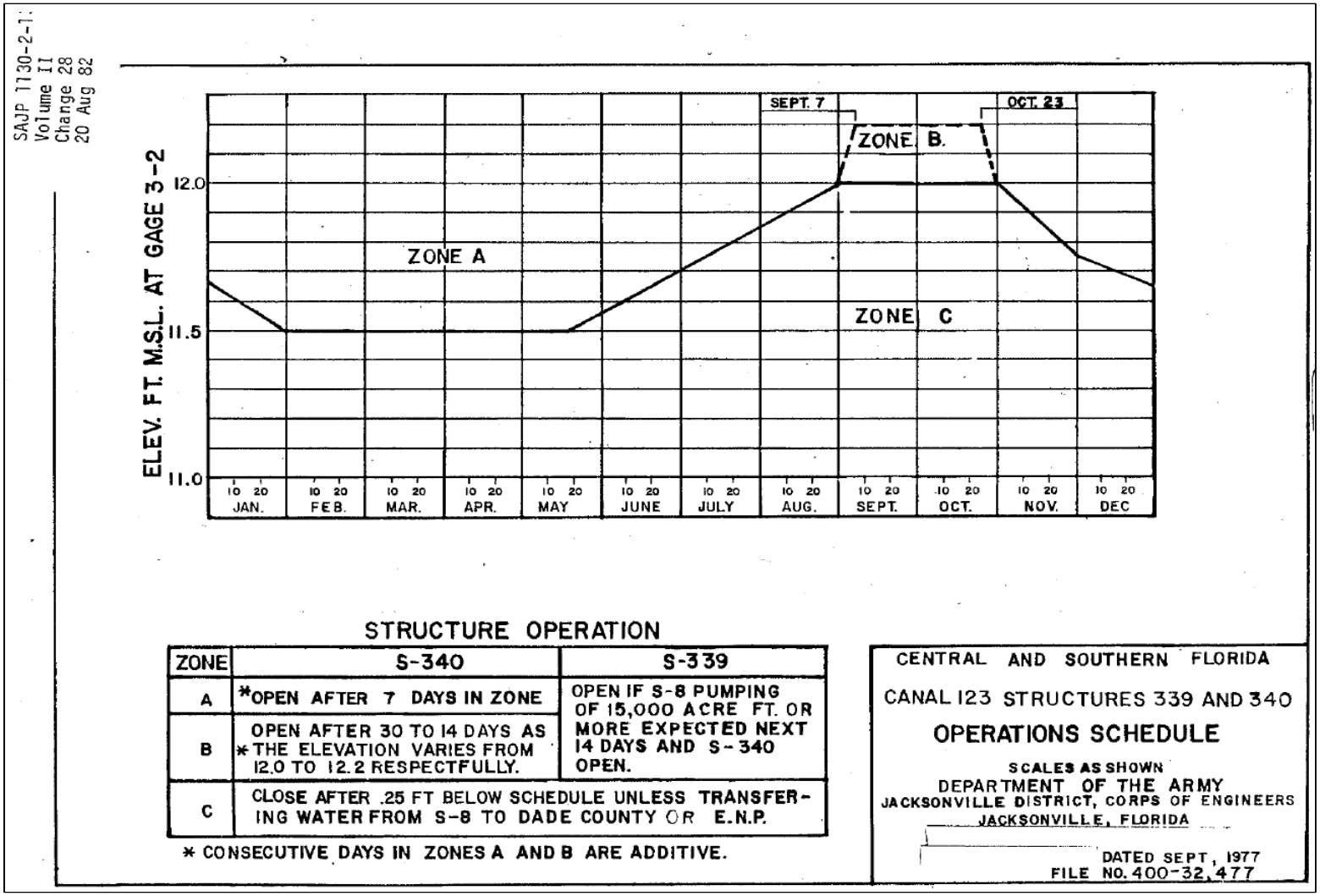


FIGURE 7-8. S-339 AND S-340 REGULATION SCHEDULE

7.4.8.1.3.1 Tamiami Trail Flow Formula

COP developed a set of water management operating protocols for WCA-3A and WCA-3B key outlet structures to ENP that leveraged decades of infrastructure improvements. The operational protocols shifted the system towards enhanced ecosystem and landscape performance yet maintained constraints imposed by flood risk management, water supply and other key systems requirements. The new operational protocols or TTFF replace the Rainfall Plan (RFP) and determine releases from WCA-3A to ENP (when WCA-3A stage is in Zone B of the regulation schedule).

The TTFF improves upon the RFP, achieves hydrologic targets including:

- Surface water flow deliveries that resemble more natural processes
- Gradual rate changes to deliver surface water flows
- Surface water flow distributed across the entire slough

The TTFF uses a network of stage, potential evapotranspiration (PET), and rainfall gages in WCA-3A and ENP to guide real-time operations to convey water from WCA-3A across Tamiami Trail to ENP to meet ecological, flood risk management, and water supply needs in WCA-3A and ENP. The TTFF uses multiple stage stations for the start of the current week and the previous week's flow in a linear approximation formula to compute a flow target for the coming week. The flow formula and its variables are listed below.

$$Q_t^{sum} = \beta^1 * S_t^{avg1} + \beta^2 * S_t^{nesrs2} + \beta^3 * Q_{t-1}^{sum} + \beta^4 * R_t^{Avg} + \beta^5 * PET_t + \beta^6 * ZA_t$$

where

$\boldsymbol{Q_t^{sum}}$ is the target daily releases (sum of S-12A, S-12B, S-12C, S-12D, S-333, and S-333N) for the current (upcoming) week, t (cfs),

$\boldsymbol{S_t^{avg1}}$ is the average of observed stages (feet NGVD) at WCA-3A stages A-3 (Site 63), A-4 (Site64) and A3-28 (Site 65) for the start of the current week *t*,

$\boldsymbol{S_t^{nesrs2}}$ is the observed stage (feet NGVD) at ENP gage NESRS2 (USGS Site ID: 254315080331500) for the start of the current week t,

$\boldsymbol{Q_{t-1}^{sum}}$ is the daily average of **observed** releases (sum of S-12C, S-12D, S-333, S-333N, S-12A, and S-12B) for the previous week t-1 (cfs),

$\boldsymbol{R_t^{avg}}$ is the areal average for the total weekly rainfall (inches) for the entire WCA-3A, Mullet Slough, and WCA-3B for current week t,

$\boldsymbol{PET_t^1}$ is the total weekly potential evapotranspiration (inches) at the 3AS3WX location, and

$\mathbf{ZA_t}$ is the Zone A regulation stage (feet, NGVD) value for time step t (beginning of current week).

βs are TTFF coefficients (see **Table 7-2** below).

TABLE 7-2. TTFF COEFFICIENTS AND ASSOCIATED STANDARD ERROR.

Parameter	S_t^{avg1}	S_t^{nesrs2}	Q_{t-1}^{sum}	R_t^{avg}	PET_t^1	ZA_t
Coefficient	318.42	-44.62	0.644	24.32	-96.31	-221.79
Standard Error	18.22	18.50	0.016	7.23	28.83	13.67

The TTFF is applied at the beginning of the current week t, time at which rainfall and PET for that week are not known, so the application of the formula requires the use of expected or forecasted values. Forecast rainfall is obtained from the 7-day Quantitative Precipitation Forecast (QPF) issued by the SFWMD's meteorologists. This process offers improved spatial resolution and provides specific knowledge/expertise from District Meteorologists. Any time an update is produced for south Florida weather forecast by the SFWMD's Meteorologists, the 7-day QPF for WCA-3 value is also updated and made available to staff in charge of implementing the TTFF. The WCA-3 rainfall area is the aggregation of WCA-3A, WCA-3B and Mullet Slough. The TTFF deliveries to ENP are not subject to the WCA-3A minimum elevation criterion that requires WCA-3A releases to be preceded by an equivalent volume of inflow.

Since in most of the cases observed rainfall and PET will not agree with the corresponding forecast, a correction term is applied to the computed target release for the current week t which is obtained as the difference between the recomputed target releases for the previous week t-1, using observed rainfall and PET for the preceding 7-day period and using the target release computed at that point in time (i.e., 7 days ago). The application of the weekly correction to the release target makes the approaches to obtain forecast rainfall and PET less critical. The coefficients for rainfall and PET in the TTFF indicate that if 1-inch error in any direction (over or underestimate) is made on the selected forecast for rainfall and PET, the impact for that week will be approximately at most ± 120 cfs.

The TTFF balances ecological restoration objectives of the MWD to ENP and C-111 SD Projects completed infrastructure by redistributing the existing WCA-3A and ENP water budget, while remaining forward compatible with future expected flow increases into WCA-3A. The decision-making process to determine releases from the WCAs maintains the flexibility outlined in **subsection 7.1**. Release decisions made by USACE that differ from the TTFF, which are anticipated to be infrequent, should be unique and will be defined by a desired outcome or time-period. These release decisions will be documented in the periodic inter-agency meetings for the AMMP (meeting frequency 1-2 times per year) and other established meetings (e.g., WCA-3 Periodic Scientists Calls and AMMP technical sub-team meetings) to help inform future AMMP considerations.

While refinement of the TTFF to improve upon some of the inherent limitations acknowledged in linear generalization of the optimal signal is possible, these efforts can be pursued in subsequent CEPP operational plan development activities anticipated in upcoming years. Additionally, the COP AMMP (Appendix C of the COP EIS) developed strategies to help improve the performance of the TTFF during dry conditions. These strategies are also included

as an Annex in the WCP (**subsection 7.16.2**) and may be implemented to modify the TTFF target flows to ENP during specific drought conditions. Annex 8 of Appendix H of the COP EIS provides more detail on the development of the TTFF.

7.4.8.1.3.2 Extreme High Water Line

The 2020 WCA-3A regulation schedule includes the EHWL to provide operational flexibility for water management operations when extreme high water levels in WCA-3A exist. The purpose of the EHWL is to provide a capacity for regional water managers to effectively respond to extreme high water levels in WCA-3A. The operations described here are not expected to be triggered frequently and are intended to be available as the last resort if needed to help reduce risks to the WCA-3A perimeter levee system, the population of people who would be put at risk if the levee system failed, hurricane evacuation routes, and wildlife and tree islands from extreme high water conditions.

The EHWL is shown in **Figure 7-7** and ranges from 11.0 to 12.0 feet NGVD. When WCA-3A water levels are above the EHWL, this will trigger a thorough evaluation of the C&SF system conditions from Lake Okeechobee and its watershed to the WCAs, EAA, ECC, ENP, and ENP-SDCS, including consideration of other related actions which may be undertaken by the State of Florida. The information from this evaluation along with input provided from ENP will be used by USACE and SFWMD to decide on whether or not to implement any or all actions authorized by the EHWL. The conditions detailed below outline the additional operational flexibility for water management operations authorized by the EHWL.

Condition 1. When WCA-3A stage is above the EHWL but below 12.3 feet and the SFWMD position analysis (P90) does not project it to rise above Elevation 12.7 feet NGVD within the next 60 days, S-333 may have priority over S-356. S-334 may also be used up to its maximum capacity of 1,200 cfs to send water to tide and the eastern ENP boundary subject to SDCS system constraints. Under this condition, first priority will be water deliveries to the eastern boundary structures of ENP if capacity is available. S-332B, S-332C, and S-332D will be used to send water to North Detention Area (NDA), South Detention Area (SDA), and S-332D Detention Area. S-336, S-338, S-194, and S-196 will be used to make maximum practicable WCA-3A releases to tide (coastal release structures) subject to downstream conditions.

Condition 2. When WCA-3A stage is above the EHWL but below 12.3 feet NGVD and the SFWMD position analysis (P90) projects it to rise above Elevation 12.7 feet NGVD within the next 60 days, S-333 may have priority over S-356. S-334 may also be used up to its maximum capacity of 1,200 cfs to send water to tide through the use of all remaining coastal release structures including S-197 subject to SDCS system constraints. Extreme High Water Condition 1 priorities remain and will be maximized before sending additional water south to S-197. When in Extreme High Water Condition 2 and S-18C HW is above 2.3 ft. NGVD, S-197 releases may be increased to a daily average maximum of 1,200 cfs to accommodate additional flows through S-334. The expectation is that routing excess water from WCA-3A to S-197 would occur when S-334 is releasing at least 100 cfs. The total available capacity at S-197 will be decreased to 600 cfs when S-18C HW falls below 2.3 feet NGVD.

Condition 3. When WCA-3A stage is above 12.3 feet NGVD then S-197 may be increased up to 2,400 cfs until WCA-3A stage falls below 12.0 feet NGVD. S-333 may have priority over S-356. S-334 may be utilized up to its maximum capacity of 1,200 cfs subject to SDCS system constraints and through use of all remaining available coastal release structures including S-197. Extreme High Water Condition 1 priorities remain and will be maximized before sending additional water south to S-197.

In addition, the WCA-3A releases to the L-29 Borrow Canal and through the SDCS have the following constraints under extreme high water conditions:

1. The L-29 Borrow Canal maximum operating stage is 8.5 feet NGVD subject to the FDOT constraints (refer to **subsection 7.3.2**). S-333 and S-356 releases will be reduced or terminated when L-29 Borrow Canal stage exceeds 8.5 ft. NGVD to lower the L-29 below 8.5 feet NGVD as required.
2. S-333N operates in accordance with the criteria specified in the FDEP CERPRA permit (#0362076-001) issued to SFWMD.
3. When the average stage in L-31N at the HW of S-332B, S-332C, and S-332D cannot be maintained below 4.4 feet NGVD then;
    a. When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,125 cfs, S-334 may be used to deliver up to a maximum flow rate of 250 cfs to S-332B, S-332C, S-332D, S-200, and S-199. S334 releases above 250 cfs shall be passes through S-176 and S-177.
    b. When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,000 cfs S-334 may be used to deliver up to a maximum of 400 cfs to S-332B, S-332C, S-332D, S-200, and S-199. S-334 releases above 400 cfs shall be passed through S-176 and S-177.
    c. When the daily average stage in L-31N using the HW of S-332B, S-332C, and S-332D can be maintained below 4.2 feet NGVD then there is no limit on the S-334 releases (up to 1,200 cfs) as long as the other L-31N canal reaches are maintained within or below their respective ranges.
    d. If potential storm or an actual flooding condition in the L-31N Canal basin requires the use of S-356 as a flood risk management reduction measure, then S-334 operation will cease until S-356 HW can be maintained between 5.5 feet NGVD and 5.8 feet NGVD.
4. 8.5 SMA flood mitigation must be maintained and S-333/S-333N releases to NESRS may be suspended if the adherence with the 8.5 SMA flood mitigation criteria is not achieved as further defined in **subsection 7.4.8.3.2**. The intent of a reduction and a temporary suspension of WCA-3A releases to NESRS is to allow 8.5 SMA to recover from a prolonged hydroperiod that exceeded the flood mitigation criteria. An after-action report will be required anytime WCA-3A releases to NESRS are stopped because 8.5 SMA flood mitigation criteria are not being met.

Operations as per the EHWL Conditions 1, 2 or 3 will end with a transition period of less than 14 days and the when the WCA-3A stage is at least 0.2 feet below the EHWL.

7.4.8.1.4 Water Conservation Area 3B

A regulation schedule has not been historically used for WCA-3B due to the limited inflow and high rates of seepage from the area. The regulatory outlet for WCA-3B was originally S-12E. However, S-12E never functioned as intended due to tailwater conditions which were higher than design assumptions. Subsequent construction of the ENP-SDCS has made S-12E a non-functional structure. Currently, releases from WCA-3B can be made through S-31, S-337, S-355A, and S-355B. See **Table 7-3** for additional S-31 and S-337 operating criteria to avoid fish kills.

WCA-3B inflow and outflow structures including the S-355A and S-355B water control structures shall be operated consistent with FWC guidance below for achieving inundation and recession/ascension targets in WCA-3B to the extent that achieving or trying to achieve the identified goals does not conflict with 1) flood damage reduction, 2) water supply, or 3) the other operational constraints listed above.

7.4.8.1.4.1 FWC Hydrologic Management Strategy for WCA-3B (Measured at Site 71)

1. Dry Season Low Range Surface Water Depth: 0.06 to 0.96 feet.
2. Wet Season High Surface Water Depth: Approximately 2.0 feet.
3. 1 January Target Surface Water Depth Range: 1.16 to 2.06 feet.
4. Recession Rate Guidelines (1 January – 1 June): Approximately 0.05 to 0.07 feet per week to benefit snail kites, wood storks, and wading birds.
5. Ascension Rate Guidelines (1 June – 1 October): Maximum of 0.25 feet per week and approximately 0.05 feet per week minimum.
6. Tree Island Threshold: Surface Water Depths >2.0 feet for no more than 60 days per year (8.5 feet NGVD at Site 71).

7.4.8.2 Everglades National Park

Public Law 91-282, passed in June 1970, assured the ENP a minimum supply of water from the C&SF Project. The Supplemental Appropriations Act of 1984, Public Law 98-118, authorized an experimental program for the delivery of water to the ENP for the purpose of determining an improved schedule for such delivery. This “Experimental Program” was to last for two years, but was subsequently extended until 1989. The Energy and Water Development Appropriations Act, 1992, Public Law 102-104, extended the Experimental Program until modifications of the C&SF Project authorized under section 104 of Public Law 101-229, the MWD to ENP Project, are completed and implemented.

Because the COP is the plan for full implementation contemplated under Public Law PL 102-104, it does not call for continuation of Minimum Deliveries as identified in Public Law PL 91-282, but is aimed at more natural deliveries to ENP that are tied to rainfall and are based on the operations developed under the Experimental Program. Nevertheless, the modeling shows that the COP should far exceed the Minimum Deliveries required under Public Law PL 91-282 on an annual basis.

The physical roadway of Tamiami Trail (U.S. Highway 41) is undergoing a series of construction phases to enable increased flow to pass under the eastern 10 miles of road adjacent to the L-29 Borrow Canal between S-333 and S-334. Over three miles of bridges have been installed, with a 1-mile stretch on the eastern side and a 2.3-mile stretch on the western side. Federal and State funding has also been allocated to further modify the road base in this area to support L-29 Borrow Canal stages up to 9.7 feet NGVD to facilitate future CERP implementation. Figure 7.9 shows the ENP, ENP-SDCS map.

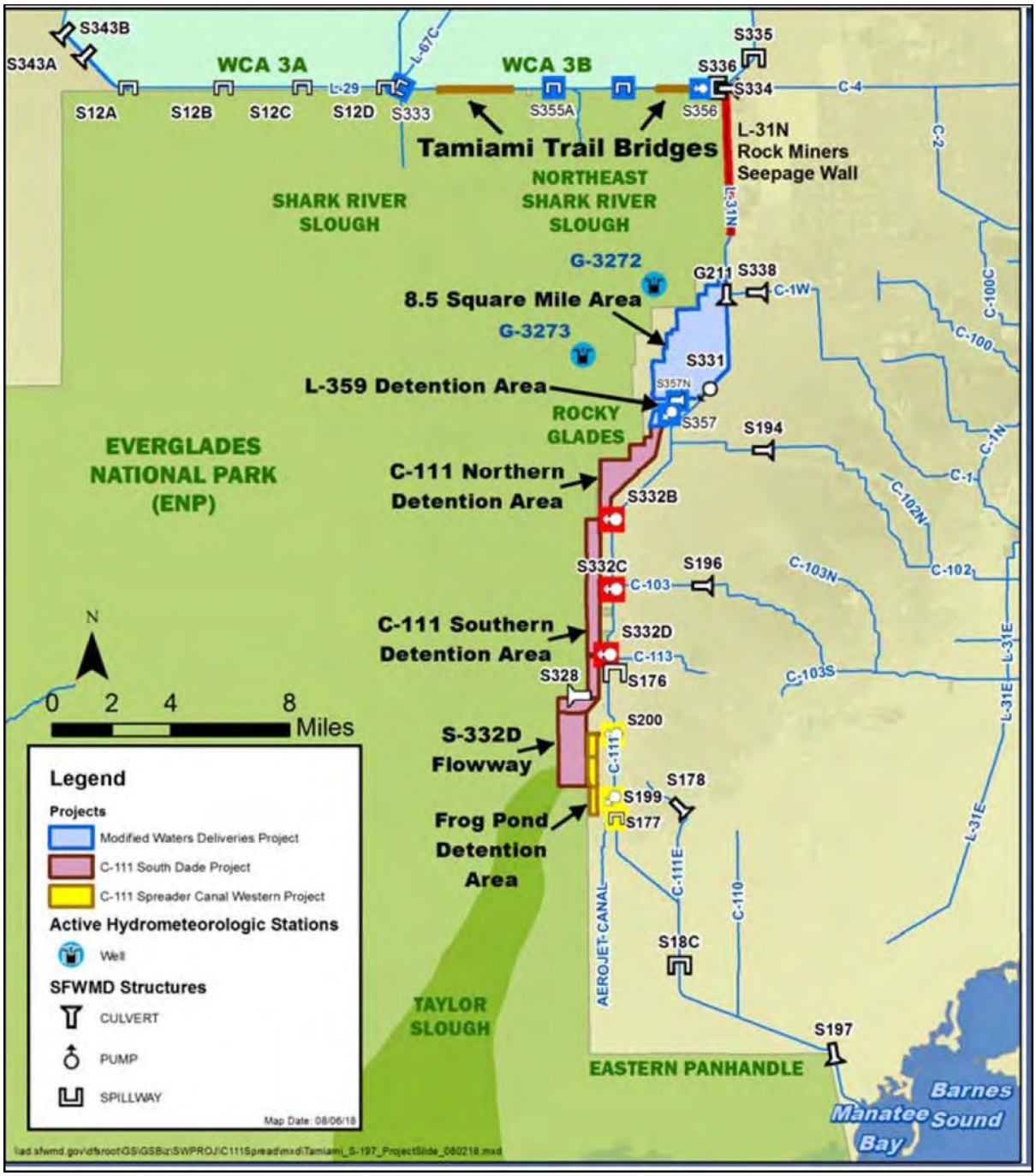


FIGURE 7-9. ENP AND ENP-SDCS MAP

7.4.8.2.1 Northeast Shark River Slough

The L-29 Borrow Canal conveys water released through S-333 or S-356 to ENP/NESRS. The L-29 Borrow Canal will be maintained up to 8.5 feet NGVD for up to 90 cumulative days per water year (1 May through 30 April), with the opportunity to increase the duration based on written FDOT approval. The number of either cumulative or consecutive days will be measured when L-

29 Borrow Canal stage exceed 8.3 feet NGVD. L-29 Borrow Canal stage higher than 8.5 feet NGVD for longer than 90 days will need FDOT written approval.

In order to avoid exceeding 8.5 feet NGVD in the L-29 Borrow Canal, the 5-day QPF will be monitored and stages in the L-29 Borrow Canal may be reduced. This criteria is further defined in **Table 7-3**. Once the L-29 Borrow Canal reaches a stage of 8.5 feet NGVD, all inflows to the L-29 Borrow Canal (S-333, S-333N, S-355A, S-355B, and S-356) will be suspended. S-334 may be used to ensure the L-29 Borrow Canal stage remains at or below 8.5 feet NGVD provided that the inflows are secured.

7.4.8.2.2 Routing Water towards Taylor Slough (Florida Bay)

SDCS operations utilize the C-111 NDA, C-111 SDA, and the S-332D Flow-way to maintain canal stage targets in the lower L-31N canal. Prolonged use of the C-111 SD detention areas, particularly following significant rain events, has the tendency to set up a large stage difference between the marsh to the west and the canal stage in the lower L-31N and C-111 Canals. This is expected and is how the system is designed to work, as it is the water level in the detention areas that provides the hydraulic ridge that supports this stage difference. The hydraulic ridge can dissipate quickly following an abrupt cessation of pumping. This abrupt cessation can lead to a rapid reduction in the water level of the marsh near the detention areas. However, drying down of the marsh occurs naturally during the dry seasons. The rate of marsh recession that can occur when pumping is halted after a significant rain event is much faster than naturally induced recession rates, and rapid recession can be particularly harmful to fish communities. The new seasonal operations for S-332B, S-332C, S-332D, S-200, and S-199 support maintenance of the hydraulic ridge and its gradual recession.

Analyses performed during COP indicate that supplemental water deliveries up to 400 cfs may be made from L-30 Canal (upstream of S-335) from 1 August thru 14 February. The following S-335 operating criteria provide these flows:

1. Release up to 200 cfs when S-335 HW stages are 5.3 to 6.0 feet NGVD.
2. Release up to 400 cfs when S-335 HW stages are 6.0 to 6.5 feet NGVD.
3. Supplemental releases suspended when the S-335 TW stage equals or exceeds 6.1 feet NGVD or when S-176 HW stage equals or exceeds 4.7 feet NGVD.

Similar releases up to 200 cfs may also be made between 14 February and 1 May when the S-335 HW is above 6.0 feet NGVD.

Additionally, a separate source of water from WCA-3A to maintain the hydraulic ridge along the C-111 detention areas and/or provide deliveries to Taylor Slough may be used under limited circumstances. This operation will be limited to 200 cfs and when stages are 0.5 feet above the muck fire closure criteria for northern WCA3A (9.80 feet NGVD average at Site 62 and Site 63 gages). These deliveries, if provided, will be coordinated by USACE with SFWMD and ENP. This flow limit will be measured at S-334 or S-337. This operation is intended to support gradual recession rates in the marsh by providing additional water to the S-332B, S332C, S332D, S-200, and S-199 pump stations. When S-332C headwater elevation falls below 3.8 feet NGVD during

the dry season, all pump operations for Taylor Slough deliveries and the maintenance of the hydraulic ridge will cease.

7.4.8.2.3 Water Deliveries to the Eastern Panhandle of ENP via C-111

The purposes of S-18C are to maintain a desirable freshwater head to prevent saltwater intrusion through C-111, pass flood flows up to 40 percent SPF without exceeding design stages upstream, and act as a control point for water deliveries to the eastern panhandle of ENP. Material on the southern side of the C-111 between S-18C and -S-197 was removed to improve sheetflow of freshwater from S-18C to ENP and Florida Bay as well as to moderate the frequency of S-197 gate openings. Water flows across the bank along C-111 into the Eastern Panhandle of ENP. Gate operations are remotely controlled to maintain S-18C HW stages between 2.3 and 2.65 feet NGVD.

S-197 maintains water control stages in C-111 and prevents saltwater intrusion during high tides. Typically, S-197 is closed to divert water from S-18C over land to the eastern panhandle of ENP. S-197 releases water only for flood risk management according to S-197 operating criteria (**Table 7-3**). The COP operations are designed to minimize the damaging freshwater flows to Manatee Bay/Barnes Sound through the S-197 structure and preserve the design capacity of 2,400 cfs for rare use only during extreme flooding events.

7.4.8.3 Everglades National Park-South Dade Conveyance System (L-31N & C-111)

The ENP-SDCS water levels are optimized in COP to provide environmental benefits, flood risk management, and water supply, and to prevent saltwater intrusion. Canal stages and structure operations prompting water supply are listed in **Table 7-1**. Normal system operational guidance is provided in **Table 7-3**. **Subsection 7.5** also contains reference to Pre-Storm / Storm / and Storm Recovery Operations for SDCS.

7.4.8.3.1 South Dade County

The purposes of the C&SF Project works in South Miami-Dade County were to remove the 40 percent of SPF runoff from the entire 206 square mile effective drainage area, reduce depth and duration of larger floods, provide water control to prevent over drainage in the area, prevent saltwater intrusion, and provide facilities to convey up to 500 cfs to ENP when normal runoff is available. The construction of the ENP-SDCS modified the existing project works in South Miami-Dade County. More detailed discussions of the South Miami-Dade County Project works are contained in Volume 5, East Coast Canals Master Water Control Manual.

7.4.8.3.2 8.5 Square Mile Area

The 8.5 Square Mile Area (SMA), also referred as the Las Palmas Community, project features are designed to mitigate for increased flood risk as a result of increased water levels in NESRS and other areas of ENP resulting from the MWD to ENP Project. The constructed features of the 8.5 SMA Project and C-111 SD Project available for water management operations include: the canals C-357 and C-358, the 8.5 SMA flow way and the Northern Detention Area (NDA), pump stations S-357 and S-331, and structure S-357N. S-357 and S-357N provide primary flood

mitigation to the residents of the 8.5 SMA and S-331 provides secondary flood mitigation benefits only during high water conditions. Detailed structure operations are listed in **Table 7-3**.

COP modeling demonstrated all interior areas of 8.5 SMA met the flood mitigation requirements, consistent with the 2000 GRR/EIS. However modeling also indicated that there are portions of 8.5 SMA along the western ENP boundary that remain very challenging and require real-time monitoring to ensure compliance. The 8.5 SMA monitoring plan is located in the AMMP (Part C.6 of Appendix C of the COP EIS, Water Quality and Hydrology Monitoring Plan South for 8.5 SMA Flood Mitigation of the COP EIS).

The USACE will monitor rainfall at S-331 and recession rates at indicator gages located within and around the 8.5 SMA (LPG-1, LPG-2, LPG-16, and LPG-17) to ensure flood mitigation targets are met. The flood mitigation criteria must be maintained. If the flood mitigation criteria are projected to be exceeded, flows into NESRS may be temporarily suspended to help reduce water levels in the 8.5 SMA. An after-action report will be required anytime WCA-3A releases to NESRS are suspended because 8.5 SMA flood mitigation criteria are not being met.

7.4.8.4 Standing Instructions to Project Operators Summary Table

The Operating Criteria table (**Table 7-3**) lists structures and operating criteria for the WCAs, ENP, and ENP-SDCS according to their respective hydrologic basins or canals from north to south. If there is a perceived conflict between the criteria in **Table 7-3** compared to the criteria described in complementary text of this Chapter or if the table lacks clarity, then the criteria as described in the body of the text shall be consulted and shall control.

The Flood Risk Management (FRM) and Environmental Restoration (ER) operational ranges prescribed in **Table 7-3** were developed from a combination of operational experience, modeling results, analysis of historical data, and the expected performance of existing and proposed features. These ranges are not simple ON and OFF ranges used for pumps or simple OPEN and CLOSE used for gates in some earlier C&SF hydrologic modeling analyses.

When stages are above the FRM&ER HIGH stage criteria, timely action (e.g., gate adjustment or pumping changes) will be made to lower the stage at a rate consistent with the current conditions (e.g., height above the HIGH stage, rate of rise, recent basin rainfall, and expected inflows) and forecasted conditions, seasonal variability, and antecedent conditions. Within the range between the FRM&ER HIGH and FRM&ER LOW stage criteria, the operators have full discretion to adjust pumps or gates or a combination of both to achieve the stage deemed most appropriate for the current and forecasted conditions as long as they remain consistent with prescribed objectives and constraints. Changes in pumps or pumping rate (number or RPM of pumps) can be implemented to rotate pumps or compensate for unavailable pumps. For basins with high rates of surface and groundwater interactions, compliance with the operation range should be based upon the daily average stage. For canal stages being maintained by pump stations, compliance with the operation range should allow the use of daily averages (0000 to 2400 hours) with the lowest operating stage maintained above the lower limit for each pump.

When the canal stage falls below the FRM&ER LOW stage criteria, timely operational changes will be made to either raise the canal stage back to the operational range or transition into appropriate operational stages above the FRM&ER LOW stage (e.g. water conservation).

TABLE 7-3. OPERATING CRITERIA.

Basin / Canal	Operational Component	Description and Operating Criteria
WCA-1	S-10A, S-10C, S-10D	WCA-1 is regulated by three main outlet structures, S-10A, S-10C, and S-10D with a combined design capacity of 14,800 cfs under SPF stages. The S-10s release water from WCA-1 to WCA-2A based on water levels in WCA-1 and its regulation schedule (**Figure 7-3**).
WCA-1	S-39	S-39 releases water from WCA-1 to the Hillsboro Canal. Its primary purpose is to provide for water supply needs along the Hillsboro Canal during the dry season. It also can be used to release excess water from WCA-1 when downstream capacity is available. S-39 has a design capacity of 800 cfs.
WCA-2A	S-11A, S-11B, and S-11C	WCA-2A is regulated by three main outlet structures, S-11A, S-11B, and S-11C with a combined design capacity of 17,200 cfs under SPF stages. The S-11s release water from WCA-2A to WCA-3A based on water levels in WCA-2A and its regulation schedule (**Figure 7-5**).
WCA-2A	S-144, S-145, and S-146	Water can be transferred into WCA-2B via S-144, S-145, and S-146, located in L-35B. These structures each have a design capacity of 210 cfs. When WCA-2A is in Zone A, regulatory releases can be made into WCA-2B until the Site 99 gage reaches 11.0 feet NGVD.
WCA-2A	S-143	S-143 releases water from WCA-2A to supply water needs along the North New River Canal during the dry season and can be used to release excess water from WCA-2A when capacity is available in the North New River Canal and when the water is not needed in WCA-3A and the stage downstream of S-34E is not above 6.0 feet NGVD. S-143 has a design capacity of 500 cfs.
WCA-2A	S-38	S-38 releases water from WCA-2A to supply water needs in the area served by C-13 and C-14 during the dry season. It also can be used to release excess water from WCA-2A when capacity is available in C-13 and C-14 and when the water is not needed in WCA-3A. S-38 has a design capacity of 500 cfs.
WCA-2B	S-141	S-141 releases water from WCA-2B to the North New River Canal. When Site 99 gage elevation > 11.0 feet NGVD, S-141 is open for flood releases through S-34E if canal capacity is available and subject to downstream constraints.

Basin / Canal	Operational Component	Description and Operating Criteria
		A regulation schedule is not utilized for WCA-2B due to high rates of seepage from the area. S-141 has a design capacity of 435 cfs.
WCA-2A/2B	S-34E	S-34E releases water from WCA-2A or WCA-3A to supply water needs along the North New River Canal during the dry season. It also can be used to release excess water from WCA-2A, WCA-3A and/or WCA-2B when capacity is available in the North New River Canal and when the water is not needed in WCA-3. S-34E has a design capacity of 600 cfs.
WCA-3A	WCA-3A Regulation Schedule and TTFF	WCA-3A is regulated by the S-12A, S-12B, S-12C, S-12D, S-333, S-333N, S-344, S-343A, S-343B, S-151, and S-152 structures. The primary structures for WCA-3A water deliveries to ENP are the S-12s and S-333. Releases are based on the 2020 WCA-3A Regulation Schedule **(Figure 7-7**) and TTFF (**subsection 7.4.8.1.3.1**). WCA-3A stage is the three (3)-station average of gages A-3 (Site 63), A-4 (Site 64) and A3-28 (Site 65). There are two zones in the WCA-3A Regulation Schedule: Zone A and Zone B. Zone A is higher than Zone B. The zones are delineated by a seasonally varying line that ranges from a high of 10.5 feet NGVD (1 November) to a minimum of 9.5 feet NGVD (1 June). In Zone A, up to maximum releases at S-333, S-333N (per FDEP permit issued to SFWMD), S-12D, S-12C, S-12B, S-12A, S-343B, S-343A, S-344, and S-151 subject to downstream constraints and closure periods. In Zone B, weekly WCA-3A release targets will be computed with the TTFF for S-333, S-12D, S-12C, S-12B, S-12A, (listed in priority order) to prioritize water deliveries to NESRS first and WSRS second, subject to downstream constraints and closure periods.
WCA-3A	WCA-3A Tamiami Trail Flow Formula	TTFF will provide weekly release targets across Tamiami Trail. (See **subsection 7.4.8.1.3.1** and Appendix H of the COP EIS) *Note: Replaces WCA-3A Rainfall-based Management Plan.*
WCA-3A	COP Extreme High Water Line (EHWL)	COP EHWL ranges between 11.0 to 12.0 feet NGVD (see **Figure 7-7** and **subsection 7.4.8.1.3.2**)
WCA-3A	Water Supply Releases from WCAs	During low water conditions, it is difficult to draw water from the interior of the WCAs. The regulation schedules for WCA-1, WCA-2A, and WCA-3A include a “floor” or minimum water levels below which water supply releases from the

Basin / Canal	Operational Component	Description and Operating Criteria
		WCAs must be preceded by an equivalent volume of inflow. The water levels may continue to recede due to evaporation and seepage. There is not a requirement to maintain the minimum elevation. Monitoring gages for the WCAs floors are: WCA-1 - Gage 1-8C at 14.0 feet NGVD WCA-2A - S-11B HW stage at 10.5 feet NGVD WCA-3A - Gage 3-69W at 7.5 feet NGVD Water supply releases from WCA-3A are delivered for water supply to east and south Miami-Dade County to maintain minimum canal levels and prevent salt-water intrusion.
WCA-3A	S-142	S-142 releases water from WCA-3A to supply water needs along the North New River Canal during the dry season. It can also release excess water from WCA-3A when capacity is available in the North New River Canal. S-142 has a design capacity of 500 cfs.
WCA-3A	S-339	S-339 structure is a sheet pile barrier dam on C-123 (the Miami Canal) about 6 miles north of I-75. It was designed to prevent over drainage of the northern portion of WCA-3A by forcing flows from C-123 Canal out into the marsh, and to transfer water to the ENP, the Metropolitan Miami, and the south Miami-Dade County areas. The structure is closed most of the time, but it is opened fully in accordance with the operations schedule (**Figure 7-8**). The optimum headwater elevation is 11.0 feet NGVD. S-339 has a design capacity of 1,100 cfs.
WCA-3A	S-340	S-340 structure is a sheet pile barrier dam on C-123 (the Miami Canal) about 2.7 miles south of I-75. It was designed to prevent over drainage of the northern portion of WCA-3A by forcing flows from C-123 Canal out into the marsh, and to transfer water to the ENP, the Metropolitan Miami, and the south Miami-Dade County areas. The structure is closed most of the time, but it is opened fully in accordance with the operations schedule (**Figure 7-8**). The optimum headwater elevation is 9.3 feet NGVD. S-340 has a design capacity of 1,100 cfs.
WCA-3A	S-344	S-344 releases water from WCA-3A to Big Cypress National Preserve. The structure is open when WCA-3A is in Zone A and closed when WCA-3A is in Zone B subject to the below downstream constraint.

Basin / Canal	Operational Component	Description and Operating Criteria
		Downstream constraint: Loop Rd 1 Gage should be kept below 8.5 feet NGVD to avoid flooding Loop Road. S-344 has a design capacity of 135 cfs.
WCA-3A	S-343A and S-343B	S-343A and S-343B release water from WCA-3A to Big Cypress National Preserve. The structures are open 15 July through 30 September when WCA-3A is in Zone A and closed 1 October through 14 July. The structures are also closed at all times when WCA-3A is in Zone B and are subject to the below downstream constraint. Downstream constraint: Loop Rd 1 Gage should be maintained below 8.5 feet NGVD to avoid flooding Loop Road. S-343A and S-343B each has a design capacity of 195 cfs.
WCA-3A	S-12A/B/C/D	S-12A/B/C/D, all are operated in accordance with WCA-3A regulation schedule and TTFF, except for S-12A and S-12B which have the following seasonal closure criteria for the marl prairie and CSSS subpopulation A. Seasonal Closure Criteria: S-12A and S12-B closed from 1 October through 14 July with the following limited conditional opening: S-12A and/or S-12B will be conditionally opened during October under the following conditions. 1. WCA-3A stage based on 3 gage average of Site 63, Site 64, and Site 65 on 30 September is greater than 10.5 feet NGVD; or 2. WCA-3A stage is projected to rise above 10.75 feet NGVD during October, based on consideration of projected inflows and direct rainfall. 3. S-12A and/or S-12B will be closed when the WCA-3A stage falls below 10.25 feet NGVD, OR on 1 November, whichever comes first. S-12B will be conditionally opened during November under the following conditions: 1. WCA-3A stage on 31 October is greater than 11.0 feet NGVD; or 2. WCA-3A stage is projected to rise above 11.25 feet NGVD during November, based on consideration of projected inflows and direct rainfall. 3. S-12B will be closed when the WCA-3A stage falls below 10.75 feet NGVD, OR on 1 December, whichever comes first. S-12C no closure period.

Basin / Canal	Operational Component	Description and Operating Criteria
		S-12D no closure period. Additional Year-Round Operational Criteria: S-12A Year-round: To provide access to cultural areas, when TTFF results in S-12 target flows, S-12A up to 100 cfs release is available when requested by the Tribe. (See **subsection 7.4.7.1**.) S-12A Cultural Access Release: S-12A up to 100 cfs release is available when TTFF results in S-12 target flows and is requested by the MTIF. From 1 October through 14 July, the MTIF and USACE must request informal consultation with USFWS to avoid impacts on CSSS subpopulation A. The duration of this release will not exceed five consecutive days. S-12A up to 100 cfs release may only occur when 3-gage average (Sites 63, 64, 65 in WCA-3A) is greater than 8.4 feet NGVD. During S-12A up to 100 cfs release, data such as but not limited to NP-205 stage and area rainfall will be monitored. If NP-205 stage increases or is anticipated to increase above 5.7 feet NGVD, S-12A will close. S-12C/D Year-round: S-12C and/or S-12D release up to WCA-3A Regulation Schedule (Zone A maximum) or TTFF (target flow). S-12s Flow Distribution: S-12 opening sequence to meet Target Flows is prioritized from east to west (S-12D, S-12C, S-12B then S-12A) as each structure reaches their maximum flow capacity; S-12A/B/C/D may be opened if their headwater is greater than 11.0 feet NGVD to pass an amount only enough to prevent overtopping of gates to protect gate instrumentation. For S-12A and S-12B, the USACE will assess upstream conditions and will close S-12A/B gates when headwater levels drop below 10.75 feet NGVD.
WCA-3A	S-151	S-151 releases water from WCA-3A to the C-304 canal in WCA-3B for both flood diversion and water supply. S-151 may make maximum releases when WCA-3A is in Zone A and when the Site 71 gage is less than 8.5 feet NGVD. S-151 may also be used to provide water for environmental deliveries to Taylor Slough or to maintain the hydraulic ridge, subject to criteria further defined in **subsection 7.4.8.2.2**. S-151 has a design capacity of 1,105 cfs.

Basin / Canal	Operational Component	Description and Operating Criteria
WCA-3A	S-152	S-152 releases water from WCA-3A to WCA-3B Per Decompartmentalization and Sheetflow Enhancement Physical Model (DPM) phase 2, S-152 operating criteria listed below: 1. May be operated when L-67A Canal stage at S-152 HW exceeds 7.5 feet NGVD. 2. Closed when WCA-3B site 71 stage equals or exceeds 8.5 feet NGVD. 3. S-152 releases may be reduced or discontinued when S-355A and S-355B are closed due to L-29 Borrow Canal stage constraints. 4. Releases may be reduced or discontinued when water quality constraint criteria per the FDEP Permit are exceeded. Note: This is a temporary structure for the DPM, which is a field-scale test that is being conducted to determine how best to design and formulate plans for future decompartmentalization of WCA-3A, as envisioned in CERP. The phase 2 of the DPM operational window is anticipated to be from November 2017 through 2021. S-152 has a design capacity of 800 cfs, however a maximum release of 640 cfs was observed on Jul 14, 2017 during an emergency deviation.
WCA-3B	S-355A/B	S-355A and S-355B release water from WCA-3B to the L-29 canal. The structures are open whenever hydraulic gradient allows flow from WCA-3B to L-29 Borrow Canal with low risk of backflow from L-29 Borrow Canal to WCA-3B. Constraints on the Operation of S-355A and S-355B. 1. The S-355A and S-355B water control structures will be operated to comply with the following constraints: a. The S-355A or S-355B or both shall be opened only when there is sufficient stage difference between the water levels in WCA-3B at S-355A/B and the L-29 Borrow Canal and whenever the gradient allows for southerly flow from WCA-3B at S-355A/B to L-29 Borrow Canal. b. Releases from S-355A or S-355B or a combination of both shall be limited as required to prevent the L-29 Borrow Canal stage from exceeding the 8.5 feet NGVD L-29 Borrow Canal stage constraint. c. Releases from S-355A or S-355B or a combination of both shall be limited as required to prevent impacts to the existing project purposes of the C&SF

Basin / Canal	Operational Component	Description and Operating Criteria
		Project including but not limited to flood damage reduction and water supply. 2. The S-355A and S-355B water control structures shall be closed if any of the three conditions above are not met, and when there is a potential for reverse flow (from L-29 Borrow Canal to WCA-3B) through the structures. The actual open and close levels of the structures will depend on the water conditions, forecasts, and other system constraints. 3. S-355A and S-355B operations for the DPM structure S-152 will be in accordance with FDEP Permit. WCA-3B will be managed by conveying S-152 releases through WCA-3B to the L-29 Borrow Canal via S-355A and S-355B. S-152 releases will be determined based upon several conditions including but not limited to: DPM test objectives, WCA-3B water level, L-29 Borrow Canal water level, and ENP-SDCS status (Source: 2017 DPM Operational Strategy).
WCA-3B / C 304 / Miami Canal	S-31	S-31 releases water from WCA-3B and WCA-3A (C-304 canal) to the Miami Canal (C-6). The structure is open only when S-151 is also opened equal or greater amount of combined discharge at S-31 and S-337 to prevent fish kills that can occur between S-151 and S-31. S-31 can also be used to release water from WCA-3A under EHWL operations subject to channel capacity in the Miami Canal. S-31 has a design capacity of 700 cfs.
L-30	S-337	S-337 operates together with S-31 and S-151 to permit releases from WCA-3B and WCA-3A and to supply water for Miami-Dade County. The structure is open only when S-151 is also opened equal or greater amount of combined discharge at S-31 and S-337 to prevent fish kills that can occur between S-151 and S-337 and downstream capacity is available. S-337 may also be used to provide water for environmental deliveries to Taylor Slough or to maintain the hydraulic ridge, subject to criteria further defined in **subsection 7.4.8.2.2**. S-337 has a design capacity of 605 cfs.
L-30	S-335	S-335 releases water from the L-30 canal to the L-31N canal. The structure has an operating range for flood risk management of 6.5 to 7.5 feet NGVD. S-335 is closed when the TW stage equals or exceeds 6.1 feet NGVD.

Basin / Canal	Operational Component	Description and Operating Criteria
		S-335 may: 1. Release up to 200 cfs when S-335 HW stages are 5.3 to 6.0 feet NGVD from 1 August through 14 February. 2. Release up to 400 cfs when S-335 HW stages are 6.0 to 6.5 feet NGVD from 1 August through 14 February 3. These additional S-335 operations are suspended when TW stage equals or exceeds 6.1 feet NGVD or when S-176 HW stage equals or exceeds 4.7 feet NGVD. 4. Releases made for this purpose should be considered coincident to any releases being made for water supply to south Miami-Dade County. S-335 releases up to 200 cfs may continue between 14 February and 1 May when S-335 HW is above 6.0 feet NGVD. S-335 has a design capacity of 525 cfs.
WCA-3A	Water Deliveries to Maintain Hydraulic Ridge and provide water to Taylor Slough	To minimize the rapid reduction in the water level of ENP west of the L-31N Canal water managers may convey water from WCA-3A to maintain the hydraulic ridge along the C-111 detention areas and/or provide deliveries to Taylor Slough. Water deliveries from WCA-3A will be limited to 200 cfs when average stage at Site 62 and Site 63 gages is greater than 9.80 feet NGVD, which is 0.5 feet above the FWC muck fire closure criteria for northern WCA-3A. These deliveries will be coordinated by USACE with SFWMD and ENP. This flow limit will be measured at S-334 or S-337. This operation is intended to support gradual recession rates in the marsh by providing additional water to the S-332B, S332C, S332D, S-200, and S-199 pump stations, or maintain a canal stage in a range conducive to gradual recession rates. When S-332C headwater elevation falls below 3.8 feet NGVD during the dry season, all pump operations for the maintenance of the hydraulic ridge will cease. S-332BN may be utilized for supplemental water deliveries when S-332D, S-332BW, or S-332C is not available because of a routine maintenance or repair. During the water delivery operations, S-176 HW stage will be maintained between 3.8 and 4.3 feet NGVD.
L-29		L-29 Borrow Canal may operate up to 8.5 feet NGVD for up to 90 days per water year* (starting on 1 May and ending on 30 April of the following year), with the opportunity to increase the duration of stages beyond 90 days based on real-time monitoring of the Tamiami Trail (US-41 Highway 41) sub-base (interim FDOT constraint until Tamiami Trail Next Step (TTNS) construction is completed), 8.5 SMA flood mitigation

Basin / Canal	Operational Component	Description and Operating Criteria
		criteria and consideration of increased low-water stages within WCA 3A. Outside the 90-day FDOT limit, L-29 Borrow Canal level will be maintained below 8.3 feet NGVD subject to downstream constraints and L-29 Borrow Canal rainfall event driven criteria below. L-29 Borrow Canal elevation with regard to these criteria will be measured at the higher of the S-333 TTW or the S-334 HW. The L-29 Borrow Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. Highway 41) between S-333 and S-334, based upon coordination with the FDOT concerning implementation of the Relocation Agreement dated September 25, 2008. The below requirements shall remain unchanged until full completion of TTNS construction (projected 2022). When the stage in the L-29 Borrow Canal reaches a stage of 8.5 feet NGVD, input from all structures that release water into the canal (S-333, S-355A/B, and S-356) shall be suspended until the level in the L-29 Borrow Canal recedes below 8.5 feet NGVD. If rainfall beyond what was forecasted causes the L-29 Borrow Canal to exceed 8.5 feet NGVD, inflow structures will be operated with the intention of limiting event durations with L-29 Borrow Canal stages above 8.5 feet NGVD to a target maximum duration of 72 hours. The Tamiami Trail roadway subbase and roadway will be continuously monitored during implementation of COP using the monitoring plan in Appendix H of the COP EIS. Continued L-29 Borrow Canal inflows which result in either cumulative or consecutive days with L-29 Borrow Canal stages at 8.5 feet NGVD for longer than 90 days will require written approval from the FDOT, given evaluation of the monitoring data by the USACE, SFWMD, and FDOT. L-29 Event Driven Criteria**: For example, the below Quantitative Precipitation Forecasts (QPF) ranges may be used to maintain L-29 Borrow Canal below 8.5 feet NGVD. 8.4’ If the 5-day QPF is for 2 to 3 inches L-29 structural inflows shall be reduced until the stage is below 8.4 feet NGVD 8.3’ If the 5-day QPF is for 3 to 4 inches L-29 structural inflows shall be reduced until the stage is below 8.3 feet NGVD 8.2’ If the 5-day QPF is for 4 to 5 inches L-29 structural inflows shall be reduced until the stage is below 8.2 feet NGVD

Basin / Canal	Operational Component	Description and Operating Criteria
		8.1' If the 5-day QPF is for 5 to 6 inches L-29 structural inflows shall be reduced until the stage is below 8.1 feet NGVD. * The number of either cumulative or consecutive days in each period will be measured when L-29 stages exceed 8.3 feet NGVD. This does not exclude short-term operations to address the L-29 Borrow Canal Event Driven Criteria. There will be one period per water year (1 May through 30 April), subject to revision via FDOT approval. ** Stopping flows shall occur in the order prescribed by S-356 and S-333 criteria specified in Conditions 1, 2, 3, and 4 with the intent to achieve the required stage reduction within 72 hours. When 8.5 SMA flood mitigation constraints are violated, L-29 Canal stage may be lowered to elevation 7.8 feet NGVD.
L-29	S-333	S-333 releases water from WCA-3A to the L-29 Borrow Canal. The S-333 releases are in accordance with WCA-3A regulation schedule, the TTFF, and L-29 Borrow Canal maximum operating limits. S-333 is available to meet TTFF, water supply, environmental water deliveries, and the Extreme High Water Line operations. S-333 may be temporarily suspended from releasing to NESRS when 8.5 SMA flood mitigation requirements are exceeded; S-334 will not be open under these conditions. S-333 has a design capacity of 1,350 cfs. S-333N can also be used in place of or in conjunction with S-333 to achieve the S-333 operational intent.
L-29	S-333N (owned and operated by SFWMD)	S-333N is a CEPP project structure and is currently under construction with completion estimated for June 2020. S-333N will release water from WCA-3A to the L-29 Borrow Canal per FDEP permit 0362076-001, or any future modification issued to SFWMD. S-333N may be operated by SFWMD under Emergency Limited Operations for WCA-3A High Water Relief under the following conditions: 1. When the average stages at gages Site 62 and Site 63 exceed elevation 11.6 feet NGVD for 72 hours. Releases from the S-356 shall have priority over the S-333N releases. 2. S-333N is closed when the L-29 Borrow Canal stage limits the operations of the S-356, or when the average of the Site 62 and Site 63 gages recedes below an elevation of 11.0 feet NGVD.

Basin / Canal	Operational Component	Description and Operating Criteria
		3. During operations of S-333N, the following operations shall take place: a. There shall be no use of S-334 to divert WCA-3A regulatory releases to the L-31N Canal. b. S-356 will have priority over the S-333N and S-356 will be operated up to its full available capacity prior to opening G-211 and as the water levels recede in WCA-3, G-211 will be closed before the pumping at S-356 is reduced. If water is needed downstream, G-211 may be opened before S-356 is maximized or S-356 may be reduced before G-211 is closed. S-333N HW is in WCA-3A and its TW is in the L-29 Borrow Canal. S-333N has a design capacity of 1,150 cfs.
L-29	S-334	S-334 releases water from the L-29 Borrow Canal for water supply, environmental water deliveries, and flood control. Under the Extreme High Water Line operations as detailed in **subsection 7.4.8.1.3.2**, S-334 may be operated up to its design capacity of 1,200 cfs subject to SDCS flow constraints and through the use of all remaining available coastal release structures. Primary Route: L-29, L-31N, and C-111 canals and through S-333, S-334, G-211, S-331, S-176, S-177, and S-18C structures Priority order of outflow structures: S-332B/C/D, S-338, S-194, S-196, S-200, S-199, S-336, and S-197 S-334 may be used to maintain the L-29 Borrow Canal stage at or below the adjusted constraint of 8.5 feet NGVD to ensure the stability and safety of the Tamiami Trail (U.S. Highway 41) between S-333 and S-334, provided S-333 is closed based upon coordination with the FDOT concerning implementation of the Relocation Agreement dated September 25, 2008. If S-334 is operated in accordance with this condition, S-334 is closed as soon as 8.3 feet NGVD in L-29 Borrow Canal is reached following the post-event recession.
L-31N	S-356	S-356 pump station manages water stages in the L-31N and L-30 canals between S-334 and G-211 by pumping water to the L-29 Borrow Canal. The pump station has an operating range from 5.5 feet NGVD to 5.8 feet NGVD.

Basin / Canal	Operational Component	Description and Operating Criteria
		S-356 usually has priority over S-333 but when WCA-3A is above the Extreme High Water Line, S-333 may have priority over S-356. S-356 has a design capacity of 575 cfs.
L-31N	S-336	S-336 releases water from the L-30, L-31N, or L-29 Borrow Canal to supply water to Miami-Dade County and ENP when the HW stage at either S-25B or S-22 falls below the optimum stage of 2.0 feet NGVD during dry periods. S-336 may also be used to make flood releases when downstream conditions have conveyance capacity. S-336 has a design capacity of 145 cfs.
L-31N	S-338	S-338 releases water to the east, from the L-31N canal to the C-1W canal. The structure has an operating range from 5.5 feet NGVD to 5.7 feet NGVD. S-338 has a design capacity of 170 cfs.
L-31N	G-211	G-211 is a divide structure for the L-31N canal between S-335 and S-331. The structure has an operating range from 5.5 feet NGVD to 6.0 feet NGVD. G-211 is primarily used to convey water supply and environmental deliveries to south Miami-Dade County. S-356 is the first priority for keeping the reach of the L-31N Canal upstream of the G-211 from exceeding its normal operating range. Tailwater elevation 5.3 feet NGVD at G-211 creates an undesirable condition relative to adjacent agricultural and residential areas. G-211 has a design capacity of approximately 1,100 cfs.
L-31N	S-331	S-331 pump station manages water stages in the L-31N canal. S-331 has an operating range of 4.5 feet NGVD to 5.0 feet NGVD from 14 February through 31 July and 4.3 feet NGVD to 4.6 feet NGVD from 01 August through 1 January. A transition between the two operating ranges is to be accomplished between 1 January and 14 February. S-331 pumping will be secured when TW stage is above 6.0 feet NGVD. S-331 operations are available to assist S-357 in meeting 8.5 SMA flood mitigation requirements. When G-3273 > 7.5 feet NGVD and LPG-2 (or future in-kind replacement locations) recession is not expected to recover in accordance with the 8.5 SMA flood mitigation criteria, G-211 will be closed and the, S-331 HW will be lowered to 2.8 feet NGVD to 3.5 feet NGVD until stages at LPG-2 (or future in-kind replacement locations) meet 8.5 SMA flood mitigation criteria. When G-

Basin / Canal	Operational Component	Description and Operating Criteria
		3273 > 7.5 feet NGVD both S-357 and S-331 pump stations may need to be operated in tandem in order to manage the increased seepage from NESRS and L-31N Canal into the 8.5 SMA to provide the required flood mitigation. The operating intent is to gradually transition S-331 to normal operations prior to S-357 returning to normal operations. S-331 has a design capacity of 1,160 cfs. The pump station has three diesel units with each rated for 387 cfs at 3.0-foot static head. When S-331 is operating to assist in providing drainage to 8.5 SMA then up to 200 cfs can be routed to S-197 as long as S-18C HW > 2.3 feet NGVD. Flow from S-331 resulting in operation of S-332B, S-332C, and S-332D within 0.2 feet of the top of the range should result in use of available capacity at S-199 and S-200 (in coordination with SFWMD), and then, if needed, releases of up to 200 cfs at S-197. Priority would be to utilize available capacity at S-332B/C/D, S-199, and S-200 prior to opening S-197. S-331 may be used for water supply, water deliveries to Taylor Slough and maintenance of the hydraulic ridge, and environmental water deliveries to Biscayne Bay. Tailwater elevation of 6.0 feet NGVD at S-331 creates an undesirable condition relative to adjacent agricultural and residential areas.
L-31N	S-173	S-173 is a gated-culvert adjacent to S-331. S-173 may be used for water supply, water deliveries to Taylor Slough and maintenance of the hydraulic ridge, and environmental water deliveries to Biscayne Bay, consistent with the S-331 operational criteria. S-173 has a design capacity of 100 cfs.
L-31N	S-194	S-194 releases water from the L-31N canal east to the C-102 canal. The structure has an operating range from 4.1 to 4.7 feet NGVD. S-194 has a design capacity of 190 cfs.
L-31N	S-196	S-196 releases water from the L-31N canal east to the C-103 canal. The structure has an operating range from 4.1 feet NGVD to 4. 7 feet NGVD. S-196 has a design capacity of 200 cfs.
L-31N	L-31N Reach between S-331 and S-176	Structure release priorities and operating ranges: Priority 1. S-332D 3.8 feet NGVD to 4.8 feet NGVD S-332BW 3.8 feet NGVD to 4.8 feet NGVD S-332C 3.8 feet NGVD to 4.8 feet NGVD

Basin / Canal	Operational Component	Description and Operating Criteria
		S-332BN 3.8 feet NGVD to 4.8 feet NGVD Priority 2. S-196 4.1 feet NGVD to 4.7 feet NGVD S-194 4.1 feet NGVD to 4.7 feet NGVD S-176 4.5 feet NGVD to 5.0 feet NGVD (last in-line within Tier 2 unless S-200 and S-199 pumping capacities are available) If S-331 is operating to assist in providing drainage to 8.5 SMA and/or facilitate the EHWL operations, the operating ranges are: Priority 1 S-332D 3.8 feet NGVD to 4.6 feet NGVD S-332BW 3.8 feet NGVD to 4.6 feet NGVD S-332C 3.8 feet NGVD to 4.6 feet NGVD S-332BN 3.8 feet NGVD to 4.6 feet NGVD Priority 2 S-196 4.1 feet NGVD to 4.6 feet NGVD S-194 4.1 feet NGVD to 4.6 feet NGVD S-176 4.3 feet NGVD to 4.6 feet NGVD Seasonal ranges for the pump stations are detailed below.
L-31N	S-332B	S-332BN releases water into the North Detention Area (NDA) with two 125 cfs-diesel units. S-332BW releases water into the SDA with one 75 cfs-electric unit and two 125 cfs-diesel units. After S-332B is replaced, it will have four 125 cfs diesel units and two 75 cfs electric pumps; the maximum design capacity for the WCP will be unchanged at 575 cfs, with the additional electric pump station used for operational flexibility. When S-332B is replaced with a permanent pump station, up to 250 cfs can be diverted to NDA. S-332B operational criteria vary seasonally, as prescribed below: 1. Gradual Transition from condition (1 January to 14 February) operating range: 3.8 feet NGVD to 4.8 feet NGVD. 2. CSSS nesting period (15 February through 31 July) operating range: 4.0 feet NGVD to 4.8 feet NGVD. 3. South Miami-Dade Typical Planting Season (1 August to 31 December) operating range: 3.8 feet NGVD to 4.4 feet NGVD.

Basin / Canal	Operational Component	Description and Operating Criteria
L-31N	S-332C	S-332C releases water into the Southern Detention Area (SDA) with one 75 cfs-electric unit and four 125 cfs-diesel units. After S-332C is replaced with permanent station, it will have four 125 cfs diesel units and two 75 cfs electric pumps; the maximum design capacity for the WCP will be unchanged at 575 cfs, with the additional electric pump station used for operational flexibility. S-332C operational criteria vary seasonally, as prescribed below: 1. Gradual Transition (1 January to 14 February) operating range: 3.8 feet NGVD to 4.8 feet NGVD. 2. CSSS nesting period (15 February through 31 July) operating range: 4.0 feet NGVD to 4.8 feet NGVD. 3. South Dade Typical Planting Season (1 August to 31 December) operating range: 3.8 feet NGVD to 4.4 feet NGVD.
L-31N	S-332D	S-332D releases water into the S-332D Flow-way with one 75 cfs-electric unit and four 125 cfs-diesel units. Calendar based CSSS restrictions apply for southerly flows within the S-332D Flow-way (S-332DX1 releases are not counted against the S-332D release limits): 1. 500 cfs (15 July to 31 December) 2. 325 cfs (01 January to 31 January) 3. 250 cfs without the use of S-332DX1 or 375 cfs with S-332DX1 release of 125 cfs (01 February to 14 July) S-332D operational criteria vary seasonally, as prescribed below: 1. Gradual Transition (1 January to 14 February) operating range from 3.8 feet NGVD to 4.8 feet NGVD. 2. CSSS nesting period (15 February to 31 July) operating range from 4.0 feet NGVD to 4.8 feet NGVD. 3. South Miami-Dade Typical Planting Season (1 August to 31 December) operating range from 3.8 feet NGVD to 4.4 feet NGVD.
S-332D High Head Cell	S-332DX1	S-332DX1 connects the S-332D Flow-way to the Southern Detention Area (SDA). S-332DX1 is typically closed from 15 July to 30 November to prioritize releases to S-332D Flow-way toward Taylor Slough.

Basin / Canal	Operational Component	Description and Operating Criteria
		S-332DX1 gates are closed when SDA water stage measured at gage SDA 2 is > 7.5 feet NGVD (SDA S-321C weir crest elevation is at 8.0 feet NGVD). S-332DX1 is limited to 100 cfs when SDA water stage < 7.5 feet NGVD and more than 250 cfs flows through S-332D. S-332DX1 may also be open to divert S-332D flows above the calendar based CSSS release limits.
L-31N	C-111 North Detention Area (NDA)	No stage constraint; emergency overflow weir crest elevation is 10.0 feet NGVD. S-357 and S-332BW pump water into the NDA.
L-31N	C-111 South Detention Area (SDA)	No stage constraint; emergency overflow weir crest elevation is 10.0 feet NGVD. S-332BW and S-332C pump water into the SDA.
L-31N	S-176	S-176 is the divide structure between the L-31N and C-111 between S-331 and S-177. The structure has an operating range from 4.5 feet NGVD to 5.0 feet NGVD. S-176 may release up to 200 cfs when S-332B/C/D restricted by CSSS habitat or nesting conditions identified in the COP Biological Opinion (consistent with the ERTP 2016 Biological Opinion) provided that S-176 HW can be maintained within its operational range; Additional releases may be used anytime of the year, without causing S-18C HW to exceed 2.9 feet NGVD, to reduce the likelihood of triggering a Level 2 or Level 3 opening at S-197. When S-331 is operating to assist in providing drainage to 8.5 SMA and/or to facilitate the EHWL operations, operating range is lowered to a range from 4.3 feet NGVD to 4.6 feet NGVD. For the duration of these S-331 operations up to 200 cfs can be routed to S-197 as long as S-18C HW > 2.3 feet NGVD. Flow from S-331 resulting in operation of S-332B, S-332C, and S-332D within 0.2 feet of the top of the S-332B/C/D range should result in use of available capacity at S-199 and S-200, and then, if needed, releases of up to 200 cfs at S-197. Priority would be to utilize available capacity at S-332B/C/D, S-199, and S-200 prior to opening S-197. S-176 has a design capacity of 630 cfs.
C-111	S-200 (owned and operated by SFWMD)	The construction and operation of S-200 is a local responsibility and S-200 is operated per the current FDEP Permit issued to SFWMD. S-200 is intended to work in unison with the Frog Pond Detention Area and Aerojet Canal features to create a 6-mile long hydraulic ridge in ENP. The operating

Basin / Canal	Operational Component	Description and Operating Criteria
		criteria below are from the FDEP permit0293559-011. Based on the stage at S-177 HW, the operating range is: 1. Transition from 1 January to 14 February: 3.0 feet NGVD to 4.0 feet NGVD. 2. 15 February to 31 July: 3.3 feet NGVD to 4.0 feet NGVD. 3. 1 August to 31 December: 3.0 feet NGVD to 3.4 feet NGVD. Pumping at S-200 will cease if stage at monitoring station R3110 > 4.95 feet NGVD during the critical portion of the CSSS nesting season from 15 March thru 30 June. S-200 has a design capacity of 300 cfs (four 75 cfs electric pumps).
C-111	S-199 (owned and operated by SFWMD)	The construction and operation of S-199 is a local responsibility and S-199 is operated per the current FDEP Permit issued to SFWMD. S-199 is intended to work in unison with the Frog Pond Detention Area and Aerojet Canal features to create a 6-mile long hydraulic ridge in ENP. The operating criteria below are from the FDEP permit 0293559-011. Based on the stage at S-177 HW, the operating range is: 1. Transition from 1 January to 14 February: 3.0 feet NGVD to 4.0 feet NGVD. 2. 15 February to 31 July: 3.3 feet NGVD to 4.0 feet NGVD. 3. 1 August to 31 December: 3.0 feet NGVD to 3.4 feet NGVD. Pumping at S-199 will cease if stage at monitoring station EVER4 (USGS Site ID: 252036080324300) > 2.36 feet NGVD during the critical portion of the CSSS nesting season from 15 March thru 30 June. S-199 has a design capacity of 300 cfs (four 75 cfs electric pumps).
C-111	S-177	S-177 is in the C-111 south of S-176. The structure has an operating range from 3.6 feet NGVD to 4.2 feet NGVD. If the rainfall over the past 14 days exceeds 5.5 inches or if significant rainfall is forecasted, then S-177 may be opened to lower S-177 HW to 3.3 feet NGVD. When flows at S-332B/C/D are restricted to achieve the CSSS habitat or nesting conditions, up to 200 cfs may be conveyed through S-177 when S-177 HW is below its operational range. S-177 has a design capacity of 1,400 cfs.

Basin / Canal	Operational Component	Description and Operating Criteria
C-111	S-18C	S-18C is used to maintain a desirable freshwater head against northerly saltwater intrusion and to provide water to the panhandle of ENP. The structure has an operating Range from 2.3 to 2.65 feet NGVD S-18C has a design capacity of 2,100 cfs.
C-111	S-197	S-197 releases water from the C-111 to tide. The operation of S-197 is based on the S-18C HW (S-18C gates fully open) and releases are based on the Levels below: 1. Level 1. When S-18C HW > 2.7 feet NGVD, open S-197 up to 200 cfs; close when S-18C HW < 2.5 feet NGVD. Flow may be adjusted from 0 to 200 cfs within the range. When transition from Level 2, wait 24 hours and reassess. 2. Level 2. When S-18C HW > 2.9 feet NGVD, operate S-197 up to 800 cfs; reduce to Level 1 when S-18C HW < 2.4 feet NGVD. 3. Level 3. When S-18C > 3.3 feet NGVD, operate S-197 up to 2400 cfs; reduce to Level 2 when S-18C HW < 2.4 feet NGVD. Operating intent is to transition down to lower flows while holding S-18C HW < 2.4 feet NGVD. When S-331 is operating to assist in providing drainage to 8.5 SMA then up to 200 cfs can be routed to S-197 as long as S-18C HW > 2.3 feet NGVD. Priority would be to utilize available capacity at S-332B/C/D, S-199, and S-200 prior to opening S-197. When in Extreme High Water Condition 2 and S-18C HW is above 2.3 feet NGVD, S-197 releases may be increased to a daily average maximum of 1,200 cfs to accommodate additional flows through S-334 which exceed the SDCS flow constraints for S-332B, S332C, and S-332D. The total available capacity at S-197 will be decreased to 600 cfs when S-18C HW falls below 2.3 feet NGVD. S-197 has a design capacity of 2,400 cfs.
C-357 (8.5 SMA)	S-357	S-357 pumps water from the C-357 and C-358 canals to the Northern Detention Area (NDA). The pump station has a normal operational range of 3.5 feet NGVD to 6.0 feet NGVD. S-357 will be operated according to the below criteria. 1a. Angels < 6.0 feet NGVD, C-357 will be maintained between 5.5 feet NGVD and 6.0 feet NGVD. 1b. 6.0 ≤ Angels < 6.4 feet NGVD, C-357 will be maintained between 5.0 feet NGVD and 6.0 feet NGVD.

Basin / Canal	Operational Component	Description and Operating Criteria
		1c. Angels ≥ 6.4 feet NGVD, C-357 will be maintained between 4.5 feet NGVD and 5.5 feet NGVD. 1d. Angels ≥ 6.7 feet NGVD and LPG-2 ≥ 6.6 feet NGVD, C-357 will be maintained between 4.0 feet NGVD and 5.0 feet NGVD until LPG-2 < 6.4 feet NGVD. 1e. Angels ≥ 7.2 feet NGVD, and LPG-2 is projected to remain ≥ 6.6 feet NGVD for 7 days or more, C-357 will be maintained between 3.5 feet NGVD and 4.5 feet NGVD until LPG-2 < 6.4 feet NGVD. 2. LPG-2 ≥ 7.0 feet NGVD for more than 24 hours, C-357 will be maintained between 3.5 feet NGVD and 4.5 feet NGVD until LPG-2 < 6.4 feet NGVD. 3. When G-3273 > 7.5 feet NGVD and LPG-2 recession is not expected to recover in accordance with the 8.5 SMA flood mitigation criteria, S-357 HW will be lowered to 2.5 feet NGVD to 3.0 feet NGVD and S-331HW will be lowered to 2.8 feet NGVD to 3.5 feet NGVD until LPG-2 can be maintained between 6.2 feet NGVD and 6.6 feet NGVD. At elevated water levels above 7.5 feet NGVD at G-3273, both S-357 and S-331 pump stations will need to be operated in tandem in order to manage the increased seepage from NESRS and L-31N Canal into 8.5 SMA while providing the required flood mitigation. Operating intent is to transition S-331 to normal operations prior to S-357 returning to normal operations. S-357 has a design capacity of 575 cfs When both S-357 and S-331 operate at the lowest canal settings and the 8.5 SMA flood mitigation criteria are not met, WCA-3A flows to NESRS may be temporarily suspended until water levels in 8.5 SMA, specifically the area west of C-357 Canal recede below ground surface elevations. 8.5 SMA flood mitigation criteria shall be assessed against the following criteria, in accordance with Part C.6 of Appendix C of the COP EIS (Water Quality and Hydrology Monitoring Plan for 8.5 SMA Flood Mitigation): a. Water levels in 8.5 SMA are projected to exceed 6 inches below the lowest first floor elevation (lowest first floor elevation estimated at 8.5 feet NGVD) of residential properties near to L-357W Levee within 48 hours, OR b. The maximum target continuous hydroperiod for a rainfall event at LPG-2 or LPG-1 (or future in-kind replacement locations) is projected to be exceeded for more than 7 days, OR

Basin / Canal	Operational Component	Description and Operating Criteria
		c. The maximum target discontinuous hydroperiod for LPG-2 or LPG-1 (or future in-kind replacement locations) is projected to be exceeded for more than 7 days.
C-358 (8.5 SMA)	S-357N	S-357N releases water from the C-358 canal to the C-357 canal. S-375N assists to meet the authorized level of flood mitigation to the residents of the Las Palmas Community (8.5 SMA). The structure has an operating range of 3.0 feet NGVD to 5.0 feet NGVD during wet conditions and 4.0 feet NGVD to 6.0 feet NGVD during dry conditions. S-357N will be limited to 100 cfs during normal operations with the ability to utilize up to 325 cfs design capacity to assist 8.5 SMA flood mitigation.
C-111E	S-178	S-178 releases water from the C-111E to the C-111 upstream of S-18C. The structure is typically open year round but may close if stages fall below 2.0 feet NGVD. S-178 remains full open for tropical storms and hurricanes S-178 has a design capacity of 500 cfs.
S-332D Flow Way	S-328	S-328 releases water from the S-332D Flow-way to Taylor Slough. The structure is opened up to 250 cfs when S-332D flows are greater than 250 cfs. S-328 has a design capacity of 500 cfs.
C-200 Canal	G-737 (owned and operated by SFWMD)	G-737 is downstream of S-200 in the Frog Pond Detention Area. The structure is operated per FDEP permit (issued to SFWMD). G-737 may be opened when there is a positive (westward) head across the structure; upstream S-200 pump station operations adhere to the CSSS seasonal constraint at R3110. G-737 has a design capacity of 125 cfs.
L-31W Canal	S-205	The S-205 weir is located on the east side of the L-31W Canal at the south end of the S332D Flow-way. It is composed of an approximately 500-foot fixed-crest weir at 6 feet NGVD and an integrated weir with a 96-foot adjustable flashboard riser section (adjusts between 4.25 feet NGVD and 6 feet NGVD). The flashboards will remain in place year-round unless extreme conditions occur and require removing the flashboards to increase flows west toward L-31W canal.

7.5 PRE-STORM/STORM OPERATIONS

The hurricane season is from June through November. When there are tropical depressions, tropical storms, and/or hurricanes in the Atlantic/Caribbean Basin, the National Hurricane Center (NHC) issues tropical cyclone public advisories, forecast advisories, forecast discussions, and strike probability forecasts every 6 hours. It should be noted that the large bands of heavy rain associated with tropical storms and hurricanes often extend considerable distance beyond the areas of tropical or hurricane force wind.

It is important to emphasize that the C&SF Project is multi-purpose in design, and that pre-storm operations may not prevent flooding, such as experienced after Hurricane Irene in October 1999 or the no name storm in October 2000. The condition of the groundwater system at the time of a storm event is significant and is highly dependent on the amount and extent of rainfall that has already occurred prior to subsequent events. Further, there are areas of Miami-Dade County and South Florida in general, which are at low elevations and for which no amount of drawdown can prevent flooding for large rainfall events. The water levels discussed in this document are target levels and may not be attainable with the antecedent conditions, available capacity, and time available.

7.5.1 Hurricane and Tropical Storm Regulations

These regulations may be supplemented by, but not superseded by, SAJ All-Hazards Plan. The All-Hazards Plan should be consulted for related emergency preparation and actions and can be found here: **https://intranet.usace.army.mil/sad/saj/EM/Pages/Home.aspx.** The SFWMD maintains a Comprehensive Emergency Management Plan (CEMP) which provides overall guidance using an all-hazard approach for managing disasters and emergencies. The CEMP describes the policies, strategies, operational goals, and objectives through which SFWMD will mobilize resources and conduct response and recovery activities after a large-scale disaster. Sections within the emergency operations structure with specific emergency responsibilities or support roles are required to develop and maintain SOPs to carry out assigned responsibilities. Separate from emergency operations SOPs, all SFWMD divisions are responsible for establishing Suggested Operating Procedures (SOPs) that should include (but are not limited to) identifying emergency tasks specific to their organization's mission critical functions and assigning individual responsibilities for these tasks, and vital systems and records.

When a hurricane or tropical storm alert is initiated, USACE personnel from the South Florida Operations Office (SFOO) will inspect the S-10s, S-11s, and S-12s and make sure they are operating properly. The USACE, Jacksonville District, Water Management Section will provide the desired gate settings to the SFOO personnel to be used during the alert period.

7.5.2 Pre-storm / Storm / and Storm Recovery Operations for SDCS

This section provides criteria (pre-storm operations) to be used in preparing the SDCS/Miami-Dade County for forecasted storm events. The SDCS is composed of L-31N, L-31W, and C-111 canal system and control structures. Currently, for the East Coast Canal System, the canal system and control structures to the east of L-31N, the SFWMD implements canal drawdown operations

based on impending rainfall events. The goal for the SDCS is to implement a similar set of canal drawdown operating criteria which seek to balance the needs of the natural system with the authorized purposes of the C&SF Project, which is multipurpose in scope and includes flood control and water supply.

The SFWMD employs meteorologists who monitor the tropics and evaluate tropical cyclone products issued by the NHC and the Weather Prediction Center (WPC). The meteorologists advise the SFWMD Operations Office of tropical systems which require enhanced monitoring over the next 120 hours as well as of specific tropical cyclones with the potential to bring tropical storm strength winds within the next 72 hours. The SFWMD Operations Office has defined operational procedures to be implemented depending on the timing or amount of advance warning prior to the onset of tropical storm force winds. The SFWMD operational procedures are delineated based on time prior to onset of Tropical Storm force winds; the specific operating procedures for these time frames will be described in further detail in this document. Time frames are briefly summarized as follows:

1. 72 to 48 hours prior to the impact of tropical storm force winds is the earliest level of preparation when the system is evaluated and initial adjustments made to operations depending on the forecast and nature of the storm. Coordinate with USACE and local drainage districts.
2. 48 to 24 hours prior to the impact of tropical storm force winds, continue pre-storm operations and coordination with USACE and local drainage districts.
3. 24 to 12 hours prior to the impact of tropical storm force winds, bring telemetry-controlled sites to final pre-storm configuration, establish alternate emergency control station if necessary.

The remaining levels of preparation are 12 to 0 hours prior to the impact of tropical storm force winds; during the event; and recovery after the event. It is important to note that some storms form close to land and make landfall with less than 48 hours of advance warning (e.g., Tropical Storm Emily, 2017).

7.5.2.1 Notification and Briefing Process

The Executive level will be briefed prior to initiation of pre-storm operations. This may occur prior to 72 hours or as soon as the average error forecast swath shows south Florida to likely be in the path of a storm.

7.5.2.2 Drawdown Implementation

Between 24 and 72 hours prior to forecast arrival of tropical storm force winds:

The initiation of the pre-storm drawdown criteria (**Table 7-4**) will be triggered for the SDCS when Miami-Dade County is within the average error forecast swath as developed by the NHC. These pre-storm drawdown levels are not less than the level at which water supply deliveries are made during dry periods, that is 1.5 feet below optimum canal levels, except the reach north of G-211, which is 1.0 foot below current, normal operating levels. These levels are target levels and may not be attainable.

TABLE 7-4. PRE-STORM DRAWDOWN TARGETS.

Canal	Reach	Target Level for Draw-down (feet NGVD)
L-31(N)	S-335 to G-211	5.0
L-31(N)	G-211 to S-331	4.0*
L-31(N)	S-331 to S-176	4.0
C-111	S-176 to S-177	3.0
C-111	S-177 to S-18C	2.0
C-111	S-18C to S-197	No change**
C-357	S-357 HW	3.5

*If the water surface elevation measured at 8.5 SMA LPG1 or LPG2 is 5.5 feet NGVD or below, then 4.0 would be the target; otherwise, 3.5 feet NGVD at the headwater of S-331 will be the target.
**Operation as specified in the SFWMD structure book for S-197.

In an effort to achieve the specified drawdown targets, a sequence of operational actions is recommended as described in **Table 7-5**. The goal is achieve one target before preceding the next sequence, however, it may not be possible to achieve the target level and operations will proceed as based on the best available information at the time. If practical with the existing conditions and time available the L-31(N) reach from S 331/S 173 to S-176 will be lowered using only S-332B, S-332C, and S 332D.

TABLE 7-5. PRE-STORM DRAWDOWN SEQUENCING.

Sequence	Canal	Reach	Target Draw-Down Level (feet NGVD)
1	L-31(N)	S-331 to S-176	4.0
1	C-111	S-176 to S-177	3.0
2	L-31(N)	G-211 to S-331	4.0*
2	L-31(N)	S-335 to G-211	5.0

* If the water surface elevation measured at 8.5 SMA LPG1 or LPG2 is 5.5 feet NGVD or below, then 4.0 would be the target, otherwise, 3.5 feet NGVD at the headwater of S-331 will be the target.

12 to 24 hours prior to forecasted arrival of tropical storm force winds.

Continue operations as previously described, but with the following considerations:

1. **S-331:** Pump when downstream conditions allow.
2. **S-332B/C/D**: Continue Pumping. Operations are controlled from S-331, which is hardened.
3. **S-197**: Operation of this structure currently requires mobilization of field personnel and equipment to operate the gates and it is not safe to operate this structure during storm conditions, howeverS-197 is being automated now to allow remote operation. The S-197 automation is projected to be completed prior to implementation of COP in August 2020. It will have a back-up generator as well as retain its ability to be manually operated.

Recovery (conditions immediately after the storm ends or if the storm forecast changes such that Miami-Dade County is no longer likely to be affected).

Operations during Recovery consist of: 1) Maximizing releases at water control structures to minimize flooding and 2) make the transition back to operational regime in place prior to the storm. (**Table 7-6**)

Operations may also be returned to levels prior to implementing pre-storm operations as soon as the Miami-Dade County is no longer within the average forecast error swath.

Plan for Worst Case: Recovery will be necessary if storm conditions result in significant rainfall in the Miami-Dade County area. The target for operations would be to return to operational regime in place prior to the storm. However, use of water control structures under emergency flood control mode will begin or continue until recovery is complete. The following operations are suggested to continue to operate in emergency flood control mode:

TABLE 7-6. RECOVERY OPERATIONS.

Structure	Status
S-331	Pump when downstream conditions allow
S-197	Open depending on conditions
S-332B/C/D	Continue Pumping. Operation is from S-331, which is hardened

It is not possible to describe the sequence of operational actions during recovery prior to a particular storm event. The sequence of operational actions will depend largely on the rainfall distribution and rainfall amounts resulting from the storm.

Back to Normal Mode (operational regime in place prior to the storm)

The following conditions must be met before ceasing emergency flood control mode and resuming normal mode:

1. The Department of the Interior (DOI) will advise USACE of any overflow problems or adverse impacts to the CSSS Subpopulation F that may be occurring for USACE to use in

their decision regarding pumping reductions at S-332B and S-332C. This is subject to change following completion of the USFWS BO for COP.

2. Otherwise, stages in canal reaches must be within the specified operating ranges in place prior to the change in pre-storm or storm operations to resume normal mode.

When these conditions are met, the normal mode, as defined by operational regime in place prior to the storm, may be resumed. This section may be modified depending on additional information, as it becomes available.

7.5.3 Operations for Other than Named Events

SFWMD will monitor antecedent conditions, groundwater levels, canal levels, and rainfall. If these conditions indicate a strong likelihood of flooding, SFWMD will make a recommendation to USACE to initiate pre-storm operations. USACE will review the data and advise ENP and USFWS of the conditions, consult with the MTIF and make a decision whether to implement pre-storm drawdown or otherwise alter system wide operations from those contained in the table.

In addition, the Chairman of the MTIF or his designated representatives will monitor the conditions in WCA-3A and other tribal lands and predicted rainfall. If the MTIF determines these conditions indicate jeopardy to the health or safety of the MTIF, the Chairman will make a recommendation to USACE to change the operations of the S-12 structures. USACE will review the data and advise appropriate agencies of the conditions, and the District Commander will personally consult with the Chairman prior to making a decision whether to implement changes to the S-12 operations.

7.6 CONSISTENCY WITH THE IDENTIFICATION OF WATER AND RESERVATIONS OR ALLOCATIONS FOR THE NATURAL SYSTEM

The operating criteria in this WCP are consistent with the operating criteria used to identify the water made available for the natural system during wet, average, and dry periods and also consistent with the water reservations or allocations for the natural system made by the State in accordance with section 601 of WRDA 2000.

7.7 CONSISTENCY WITH SAVINGS CLAUSE AND STATE ASSURANCE PROVISIONS

WRDA 2000 provides the framework for all structural and operational changes to the C&SF project as a result of CERP implementation. Since COP does not implement CERP, the Savings Clause Provisions do not apply.

7.8 DROUGHT CONTINGENCY PLANS

Regional Drought Contingency Plans (DCP) are written to provide a decision making process to implement water-conservation measures during droughts, review the operational flexibility of the regional system in a drought, and address the potential problems associated with an extreme drought. The DCP for WCAs, ENP, and ENP-SDCS can be found in Appendix B of this SOM. The SFWMD has established rules and regulations that establish priorities and define procedures for water conservation and restricting water use during conditions of water shortage. The “Water

Shortage Plan" published by the SFWMD is part of the DCP and can be found using the following link:

https://www.sfwmd.gov/sites/default/files/documents/40e-21_0.pdf

SFWMD's Water Supply Plan also represents the majority of the water management-related contents of the DCP and can be found using the following link:

http://www.sfwmd.gov/portal/page/portal/xweb%20-%20release%203%20water%20supply/water%20supply%20planning

7.9 FLOOD EMERGENCY ACTION PLANS

The Flood Emergency Action Plans outlines operating criteria for projects that require flood damage reduction operations. The plans include an explanation of existing and proposed operating criteria, release scheduling procedures during a flood, use of storage, downstream notification procedures, and special safety concerns. Although there are currently no Flood Emergency Action Plans in the region, it is anticipated that future CERP projects will include these plans.

7.10 DEVIATION FROM NORMAL REGULATION

The USACE Jacksonville District Commander is occasionally requested by the non-federal sponsor and other agencies to approve deviations from normal operating criteria. The USACE, Jacksonville District, Water Management Section is responsible for handling the deviation requests and transmitting them through the District Commander to the Division Engineer (USACE, South Atlantic Division (SAD)) for final decision. Prior approval for a deviation is required from USACE, SAD, except as noted below. Deviation requests usually fall into the categories emergencies, unplanned minor deviations, or planned deviations.

7.10.1 Emergencies

Examples of emergencies that may result in a need to deviate from normal operating criteria include: drowning and other accidents; failure of the operation facilities; chemical spills; treatment plant failures; and other temporary pollution problems. Water control actions necessary to abate the problem should be implemented immediately unless such action would create equal or worse conditions. USACE, Jacksonville District must be informed of the problem and the emergency operating changes as soon as practicable. A written confirmation showing the deviation and conditions will be furnished to USACE, Jacksonville District by the operating agency after the incident. USACE, Jacksonville District will communicate with USACE, SAD as appropriate. In addition, the operating agency should inform the non-federal sponsor, the State of Florida (FDEP and SFWMD), and the DOI as appropriate.

7.10.2 Unplanned Minor Deviations

There are unplanned instances that create a temporary need for minor deviations from the normal operating criteria, although they are not considered emergencies. Construction accounts for the major portion of these incidents requiring minor deviations. Examples of activities that may

require short-term deviations include construction of utility stream/canal crossings, bridge work, and major construction contract. Changes in releases are sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluating the proposed deviation, consideration is given to upstream watershed conditions, potential flood threat, the existing condition of the lake/reservoir/storage area, and possible alternative measures. In the interest of maintaining good public relations, requests for minor deviations are generally granted, providing there are no adverse effects on the overall regulation of the project for the authorized purposes. Approval for these minor deviations normally will be obtained from USACE, Jacksonville District Water Management Section by telephone. Written confirmation explaining the deviation and its cause will be furnished to the USACE, Jacksonville District Water Management Section by the operating agency. USACE, Jacksonville District will communicate with USACE, SAD as appropriate. In addition, the operating agency should inform the non-federal sponsor, the State of Florida (FDEP and SFWMD), and the DOI as appropriate.

7.10.3 Planned Deviations

Each circumstance should be analyzed on its own merits. The requesting agency will provide sufficient data on flood potential, lake/reservoir/storage area and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, letter to USACE, Jacksonville District. USACE, Jacksonville District will analyze each proposed deviation and will request approval from USACE, SAD as appropriate. In addition, the operating agency should inform the non-federal sponsor, the State of Florida (FDEP and SFWMD), and the DOI as appropriate.

7.11 RATE OF RELEASE CHANGE

Generally, a daily step change of 500 cfs is the maximum amount of change desired. Gradual transitions are intended to support the health of wildlife.

7.12 SEEPAGE CONTROL

There are many areas throughout the project area that are highly porous and overlie the Biscayne Aquifer. Seepage into the canals can reduce the conveyance capacity but the normal operations specified in **subsection 7.4** take into account seepage control.

7.13 AQUIFER STORAGE AND RECOVERY SYSTEM PLAN

This section is not applicable and the project area does not include an Aquifer Storage and Recovery System.

7.14 CONSISTENCY WITH THE ADAPTIVE MANAGEMENT PROGRAM AND PERIODIC CERP UPDATES

Adaptive management has been recognized as a critical element of CERP since promulgation of the enabling legislation (WRDA 2000). Congress authorized the use of an adaptive management approach for CERP, to allow the Plan to proceed in the face of existing uncertainties and

incomplete scientific data. Adaptive Management for the Plan is defined as the "continuous improvements to the Plan to respond to new information, new or updated modeling; information developed through the assessment principles contained in the plan; and future authorized changes to the Plan in order to ensure that the goals and purposes of the Plan are fulfilled."

The adaptive management strategy for CERP is intended to guide the implementation of the Comprehensive Plan. It will be used to assess the responses of the south Florida ecosystem, and to determine whether these responses match expectations, including anticipated performance levels. An essential element of adaptive management is the development and conduct of a scientifically rigorous assessment program to analyze and understand responses of the system to implementation of the Comprehensive Plan which includes monitoring component to address biological, hydrological, and water quality parameters. In accordance with the programmatic regulations, Restoration Coordination and Verification (RECOVER) is required to prepare a technical report, at least once every five years, that presents an assessment of whether the goals and purposes of the Comprehensive Plan are being achieved, including whether the interim goals and interim targets are being achieved or are likely to be achieved. Based upon results of the monitoring and assessment efforts, operational changes may be recommended to improve individual project performance and/or Comprehensive Plan performance. Although the MWD to ENP Project, C-111 SD Project, and COP are not part of CERP, COP developed an AMMP (Appendix C of the COP EIS) and its primary objective is to identify the monitoring necessary to inform decision-makers, COP partner agencies, and the public on achieving project success. The monitoring identified in the COP AMMP will be used by decision makers, COP partner agencies, and the public to inform water managers on opportunities to better balance meeting multiple COP objectives while avoiding constraints.

COP's planning process was based on knowledge of the Greater Everglades; understanding of the problems and opportunities; and the evaluation of alternatives and estimation of the potential project performance. However, while the WCP and EIS are based on a wealth of knowledge, some uncertainty inevitably exists in such a complex system. Such uncertainties include fine-tuning the computer models used to accurately predict performance and meet constraints under real world conditions, determining how to best optimize actions to meet the needs of competing objectives and use the water available safely to the best advantage (e.g., flood control versus flows into ENP), and how to address and adapt COP to changes in both the environment (e.g., sea level rise) and due to human activities (e.g., additional operational structures implemented through CEPP). The COP adaptive management process is a tool to help address such remaining uncertainties.

7.15 REFERENCES

http://myfwc.com/media/464652/DeerManagementPlan2008_2018.pdf

C.M. Loveless 1959. The Everglades Deer Herd: Life History and Management. Florida Game and Fresh Water Fish Commission Technical Bulletin 6. 104pp. **https://scholar.google.com/scholar_lookup?title=The+Everglades+deer+herd:+Life+history+and+management.&publication_year=1959&pages=104**

R.F. Labisky, C.C. Hurd, M.K. Oli, R.S. Barwick Southeastern Naturalist Vol. 2, Issue 2 (Jun 2003), pg (s) 261-270

Florida Fish and Wildlife Conservation Commission (FWC), 2015 A Management Plan for the Everglades Complex of Wildlife Management Areas 2015 – 2025. **https://myfwc.com/media/5367/evergladescomplexmanagementplan.pdf**

7.16 ANNEXES

This subsection addresses two uncertainties that are part of the AMMP (Appendix C of the COP EIS). These uncertainties are placed here since they define specific operational guidance that may be utilized by water managers. The table and figures in this section maintain the original Appendix C naming conventions.

7.16.1 COP AM Uncertainty #16b (Water Quality in NESRS)

Water quality concerns at S-333 and S-12D and downstream ecological response: Will there be downstream biogeochemical effects associated with modifying inflows and hydrologic conditions in ENP, that result in detrimental effects on nutrient movement, availability, and ecological responses? This includes consideration of hydrologic effects on nutrient loading, nutrient release from soils, transport, and water-quality related ecological indicators, such as periphyton tissue nutrients, cattail expansion, and algal bloom events.

COP Objective or Constraint: COP Objectives 1a, 1b, 1c, 3.

Region(s): Northeast Shark River Slough (NESRS)

Associated Features: S-12s, S-333, S-334, S-356; timing, location, and volume of deliveries

Driver or uncertainty type: Operational driver. Water quality at S-333 tends to degrade when water levels at the structure are low, resulting in spikes of nutrient, specifically total phosphorus concentrations, when these waters are delivered to NESRS. This affect is also observed at the S-12 structures with declining impacts on total phosphorus from west (S-12D) to east (S-12C). Spikes in total phosphorus delivered to NESRS result in excess phosphorus loads (above levels protective of the marsh) and thus a potential for the cascade of nutrient impacts described in this uncertainty.

What is expected to be learned by addressing this uncertainty (i.e., how will COP benefit from addressing this uncertainty)? By observing ecosystem response for this uncertainty, impacts on downstream resources in the NESRS marsh will be illuminated. If the operational deliveries for S-333 are addressed through alternative management options/strategies that are protective of the ecological values of NESRS, then COP will benefit with higher potential for improved ecological conditions within NESRS.

Expectations or hypotheses to be tested to address the uncertainty, and attribute(s) that will be measured to test each:

- Increased flow will not alter current periphyton system-wide indicator report status

- Additional flows will not result in an increase in algal bloom events (frequency, spatial extent, duration, and/or magnitude) in Florida Bay and Lower Southwest coast relative to current conditions
- No acceleration in cattail distribution expansion rate relative to current conditions
- No alteration of current spatial distribution of soil and vegetation nutrient pools relative current conditions
- Discharging through S-333 and S-12D at headwater conditions proposed by COP (stage below headwater trigger more often and for longer duration) will not result in degraded water quality and/or adverse ecological response in the marsh.

*Note For practical operations, several stage triggers shall be established for conditions when stages are declining and separately for conditions when stages are rising. Continued data collection will be used to refine these triggers.

What is expected to be learned by measuring this attribute?

- Through monitoring flow and nutrients, COP will learn about nutrient response to structure configuration (i.e., S-333 and S-334 flowing or S-333 and S-334 closed; S-333N versus S-333 operations) and operations
- Monitoring of periphyton in the downstream marsh will allow COP to learn about changes in the periphyton nutrient content or algal blooms as demonstrated in the CERP RECOVER System Status Report (see CERP RECOVER 2014, 2019).
- Monitoring of macrophytes, such as cattail, will allow COP to learn about changes in rates of sensitive macrophyte expansion/retraction relative to current rates or presence/absence.
- Monitoring of the spatial nutrient front will allow COP to learn about movement of the spatial nutrient front or changes in nutrient rates of release from soils along soil and/or vegetation transect relative to existing conditions.

What is the time frame in which changes to this attribute are expected to be measurable?

- Flow and water quality monitoring at existing frequency. Discrete total phosphorus changes can be nearly immediately detected, but determination of any statistically significant change from historic levels could take 3 to 10 years, depending on the change magnitude.
- Periphyton (TP content, biomass, composition): 3 months to 1 year
- Cattail expansion: 3 to 5 years
- Soil nutrient front: 3 to 10 years

Is this attribute complimented by other monitoring programs within and/or outside of COP?

- COP should take advantage of existing monitoring which includes monitoring performed by the South Florida Water Management District, United States Geological Survey, Everglades National Park, and cooperators.

When during COP's life cycle should this monitoring begin and end?

- It has already begun and should continue 10 years after complete implementation of COP.

Methodology for testing each expectation or hypothesis (including frequency of monitoring) and for reporting: A baseline monitoring period of 3 years for soil nutrient content (1 every year) to measure long-term nutrient trends and 3 years of bi-annual (wet/dry season) periphyton tissue nutrients in areas of concern (e.g. downstream of S-12D, NESRS NC Transects) to measure early indication of nutrient changes is recommended to adequately establish existing conditions. Monitoring of soil nutrient content annually and bi-annual periphyton tissue nutrients beginning with implementation of S-356/G-3273 Relaxation Increment 1 test and carried through operation and management is necessary to document any changes in nutrient distribution resulting from incremental increases in deliveries past Tamiami Trail with each constructed feature.

Triggers/thresholds that indicate good performance or need for adaptive management action in response to COP:

Structure monitoring:

- Need for adaptive management action: increases in nutrients above existing conditions indicates potential for adverse impacts to downstream ecology;
- Good performance: maintaining or reducing nutrient levels represents good performance

Periphyton:

- TP content
  - Need for adaptive management action: if TP content in periphyton tissue increases above baseline;
  - Good performance: if TP content in periphyton tissue remains or declines below baseline
- Biomass
  - Need for adaptive management action: if biomass decreases below baseline;
  - Good performance: if biomass remains or increases above baseline
- Composition
  - Need for adaptive management action: if species composition shifts to more cyanobacteria relative to baseline;
  - Good performance: if species composition shifts to more desmids and diatoms relative to baseline

Cattail:

- Need for adaptive management action: if cattails expansion rate increases above rates observed during the base period;
- Good performance: if cattails expansion rate reduces or remains the same as baseline

Soil:

- Need for adaptive management action: if soil nutrient front expansion rate exceeds the baseline rate;

- Good performance: if soil nutrient front expansion rate remains or reduces below baseline rate

Management options that may be chosen based on test results: Adjust operations to change spatial and/or temporal distribution of water; model refinement and coupling to improve ability to forecast effects of operations and adaptive operational changes. Specific operational options include:

1. Maintain discharges below 150 cfs through the combined S-12D and S-333 when S-333 headwater stage is below a level historically associated with elevated phosphorus concentrations; this action will cease when either a) or b) occur:
    a) S333_H stage increases to 9.2 ft. or higher or
    b) S333_H stage increases 1 ft. above the May 15th stage.
2. Shift a fraction of the S-12D discharges to S-12C, and/or
3. Reduce dry-season recession rates by reducing outflow volumes for WCA-3A through S-12s and S-333 between December and May in water years with December stage lower than 10 ft NGVD29 to maintain higher stages in L-29 coming out of the dry season and reduce frequency and/or duration of low stage conditions associated with elevated phosphorus.

Additional options that have not been tested and will require additional analysis and NEPA review for implementation include:

4. Avoid first flush events through S-333 following low stage-low flow periods at the S-333 headwater,
5. Avoid discharges greater than 150 cfs through S-333 for a period of one to two week to allow water levels at the S-333 headwater to increase above a stage historically associated with elevated phosphorus concentrations,
6. Utilize the S-333N discharge structure in place of S-333 assuming the low stage impact on phosphorus concentrations has a lower magnitude of increase.

Table C.7.16-1 summarizes the monitoring recommendations and provides funding estimates.

TABLE C.7.16-1. COP AM UNCERTAINTY ID#16B (WATER QUALITY IN NESRS) MANAGEMENT OPTION MATRIX.

Uncer-tainty Trackin g ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additiona l Annual Cost	Management Action Options Suggestions
UNC #16b – Water Quality in NESRS	TP concentrati on at structures plus additional water quality measures	Flow, TP nutrient concentratio n, turbidity and other water quality measures in water flowing into park	3 to 10 years	ENP-Northeast Shark River Slough, at structures S-12D, S-333	• Need for adaptive management action: increases if nutrients above existing conditions indicates potential for adverse impacts to downstream ecology; • Good performance: maintaining or reducing nutrient levels represents good performance	Existing	Adjust operations to change spatial and/or temporal distribution of water; model refinement and coupling to improve ability to forecast effects of operations and adaptive operational changes. 1.Maintain discharges below 150 cfs through the combined S-12D and S-333 when S-333 headwater stage is below a level historically associated with elevated phosphorus concentrations; this action will cease when either a) or b) occur: a) S333_H stage increases to 9.2 ft. or higher or b) S333_H stage increases 1 ft. above the May 15th stage. 2.Shift a fraction of the S-12D discharges to S-12C, and/or 3.Reduce dry-season recession rates by reducing outflow

Uncer-tainty Trackin g ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additiona l Annual Cost	Management Action Options Suggestions
							volumes for WCA-3A through S-12s and S-333 between December and May in water years with December stage lower than 10 ft NGVD29 to maintain higher stages in L-29 coming out of the dry season and reduce frequency and/or duration of low stage conditions associated with elevated phosphorus. Additional options that have not been tested and will require additional analysis and NEPA review for implementation include: 4.Avoid first flush events through S-333 following low stage-low flow periods at the S-333 headwater, 5.Avoid discharges greater than 150 cfs through S-333 for a period of one to two week periods to allow water levels at the S-333 headwater to increase above a stage historically associated with

Uncer-tainty Tracking ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additional Annual Cost	Management Action Options Suggestions
							elevated phosphorus concentrations, 6. Utilize the S-333N discharge structure in place of S-333 assuming the low stage impact on phosphorus concentrations has a lower magnitude of increase.
Same as above	Periphyton • TP content • Biomass • Composition	Periphyton in downstream marsh, bi-annual	3 months to 1 year	ENP-Northeast Shark River Slough, downstream of S-12D, NESRS NCTransects	• TP content o Need for adaptive management action: if TP content in periphyton tissue increases above baseline; o Good performance: if TP content in periphyton tissue remains or declines below baseline • Biomass o Need for adaptive	Existing	Same as above

Uncer-tainty Tracking ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additional Annual Cost	Management Action Options Suggestions
					management action: if biomass decreases below baseline; o Good performance: if biomass remains or increases above baseline • Composition o Need for adaptive management action: if species composition shifts to more cyanobacteria relative to baseline; o Good performance: if species composition shifts to more desmids and		

Uncer-tainty Trackin g ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additiona l Annual Cost	Management Action Options Suggestions
					diatoms relative to baseline		
Same as above	Cattail expansion	Local mapping of cattail in downstream marsh	3-5 years	Same as above	• Need for adaptive management action: if cattails expansion rate increases above rates observed during the base period; • Good performance: if cattails expansion rate reduces or remains the same as baseline	Existing	Same as above
Same as above	Soil nutrient front	Soil nutrient content in downstream marsh, annual	3-10 years	Same as above	• Need for adaptive management action: if soil nutrient front expansion rate exceeds the baseline rate;	Existing	Same as above

Uncer-tainty Trackin g ID#	Attribute or Indicator	Specific Property to be Measured and Frequency	Time-frame to detect change of attributes	Region or Specific Area (Locations to Monitor)	Decision Criteria: Trigger(s) for Management Action	Estimated Additiona l Annual Cost	Management Action Options Suggestions
					• Good performance: if soil nutrient front expansion rate remains or reduces below baseline rate		

7.16.2 COP AM Uncertainty ID #12b (Tamiami Trail Flow Formula [TTFF] and Drought)

Is there an opportunity to deliver water to NESRS in a specific manner such that the delivery enhances stages in Shark River Slough, and perhaps freshwater flows to Florida Bay by delivering more water during the dry season without harming the ecological condition of WCA-3?

COP Objectives or Constraints: The COP objectives 1a, 1b, 1c, 3.

Region(s): NESRS, WCA 3, southern Shark River Slough, and Florida Bay

Associated Features: S-333, S-12 C and D (outflow of WCA 3/inflow to Shark River Slough portion of ENP), as well as S-11A-C, S-8, and S-140 (inflows into WCA 3).

Driver or uncertainty type: Hydrology/Operations

What is expected to be learned by addressing this uncertainty (i.e., how will COP benefit from addressing this uncertainty)? We are presented with the opportunity to learn whether the style of water delivery can produce measurable responses in southern SRS, and whether these responses can contribute meaningfully to reducing salinity concentrations in the chronically hypersaline portion of central Florida Bay.

Expectations or hypotheses to be tested to address the uncertainty, and attribute(s) that will be measured to test each: Statement of hypothesis: Can delivering additional flows into NESRS during a transition from the wet season to the dry season result in measurably increased water levels in SRS without increasing detrimental low water impacts to WCA-3 ecological conditions and water supply?

What is expected to be learned by measuring this attribute, i.e., how will COP benefit from knowledge gained about this attribute?

- If the seasonal timing of delivery to NESRS can be altered to reduce salinity concentrations in central Florida Bay then water managers will have developed a new tool for protecting Florida Bay during period of moderate water scarcity.

What is the time frame in which changes to this attribute are expected to be measurable?

- During a design test, results should be identifiable during a six month period, starting November and ending in May of the following year.

Is this attribute complimented by other monitoring programs within and/or outside of COP? If so, provide reference to other monitoring. Note the monitoring paid for by others in the COP Management Options spreadsheet.

- Yes, our continuous monitoring of structure flows and water surfaces will be used to measure the effects of the field test.

When during COP's life cycle should this monitoring begin and end?

- Continuous monitoring of structure flows and water surfaces will continue throughout both COP and CERP activities. Water surface and structure flow monitoring will not end during the COP process.

Methodology for testing each expectation or hypothesis (including frequency of monitoring) and for reporting: The design test was developed in response to concerns presented during development of the TTFF to better mimic the performance of ALT-O. Within the broader context of dynamic review of the COP TTFF planned through the COP Adaptive Management process and prescribed in the COP Adaptive Management and Monitoring Plan, parameters for a design test are proposed to test the hydrological and ecological response during a transition from the wet season to the dry season. The criteria for considering a test are:

Testing only occurs during the period between November 1 – May 30. Testing only occurs after we've had at least 80 days of seasonal closure in WCA 3 in the dry season prior to the test, indicating a dry antecedent condition with likely multi-year impacts requiring special considerations (this occurs only 3 times in the 41 year period of record used in COP simulations – **Figure C.7.16-1**. Testing may occur as we move into additional seasonal closures in WCA 3, and testing is considered anytime P35 in ENP is projected to move below 1.0 ft belowground, or P33 is projected to move below 0.5 ft belowground.

Testing will be stopped if any of the following drought intensity thresholds are reached:

- 0.8 ft belowground in northern WCA-3A (WCA3_NE and WCA3-3 gages)
- 0.5 ft belowground in southern/central WCA-3A (WCA3_3A-28 and WCA3_69 gages)
- 0.8 ft belowground in WCA-3B (WCA-3B_71 gage)

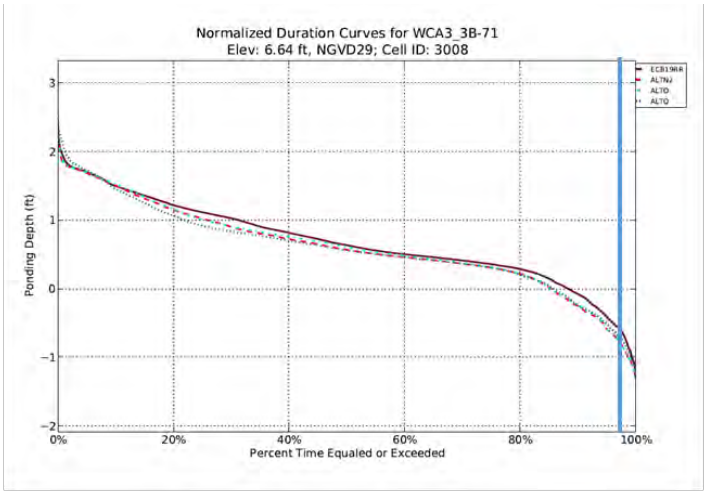
These thresholds correspond to the 93th-98th percentile low stage levels of these gages as defined by Alt Q and Alt O of the COP simulation models (**Figure C.7.16-2**). The triggers are rarely reached in the simulations of COP performance and are important because soil consuming peat fires become a risk when water levels are more than 1.0 ft belowground, and risk rises significantly after 1.5 ft belowground threshold is crossed (Smith et al. 2003). Simulations indicate that these thresholds are unlikely to be a concern during the November –January period that would typically be the "early" portion of the design test, but would become critically relevant during March – typically the peak of drought intensity in the system.

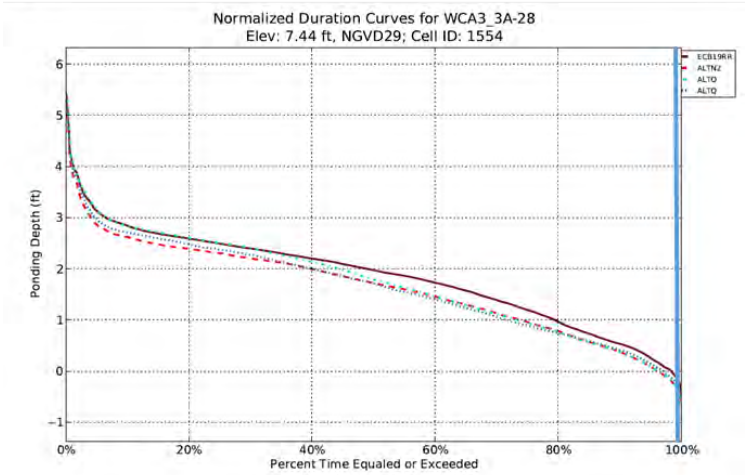
When the criteria for the design test have been met, the test period will allow general flexibility to increase the TTFF prescribed deliveries up to 400 cfs above the TTFF recommended flows for significant portions of the period, also allowed to introduce nonlinearities in lowest flow conditions (sometimes lower flows than suggested by the TTFF – during the driest of conditions, sometimes tripling-quadrupling very low - 25-100 cfs flows – perhaps during the early onset of the wet season). The ultimate design decisions should be described during the operational period based on comparison of modeled analogous conditions. Although our modeling provides the basis for the design of this field test, the actual implementation of the test must be done in the specific context that occurs, with specific physical limits and constraints imposed upon the test. Because there are strong limits on our ability to accurately forecast rainfall, the designed test is limited in duration to 6-8 week intervals and must be re-evaluated to ensure safe operating conditions every 6-8 weeks.

MONTHLY COUNT OF LOW WATER CLOSURE DAYS in WCA3A
COP ALTQ

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Year													
1965	0	0	0	0	17	15	0	0	0	0	0	0	32
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	1	31	6	0	0	0	0	0	0	38
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	24	31	13	0	16	5	0	0	0	89
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	20	31	30	1	0	0	0	0	0	82
1974	0	0	25	30	31	24	0	0	0	0	0	0	110
1975	0	0	15	30	31	30	1	0	0	0	0	0	107
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	13	20	0	2	4	0	0	0	0	39
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	31	30	20	0	0	0	0	0	81
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	7	19	31	22	0	0	0	0	0	0	79
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	4	20	14	30	17	0	0	0	0	0	85
1990	0	0	9	30	31	20	0	0	0	0	0	0	90
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	8	24	0	0	0	0	0	0	0	32
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	3	3	0	0	0	0	0	0	6
2005	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	60	195	326	223	41	20	5	0	0	0	870

FIGURE C.7.16-1. MONTHLY COUNT OF LOW WATER CLOSURE DAYS IN WCA3 – COP ALT Q, WITH YEARS WHEN TTFF DROUGHT CONDITIONS TEST WOULD BE IMPLEMENTED INDICATED BY HEAVY BLACK OUTLINE. DESIGN TEST IMPLEMENTABLE ONLY IN 1973-1974, 1989-1990, AND 1990-1991.





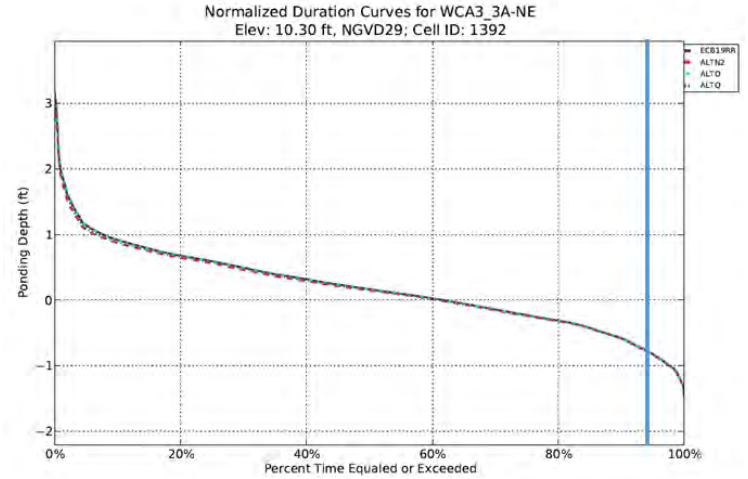


FIGURE C.7.16.2. NORMALIZED DURATION CURVES OF DEPTHS AT SPECIFIC GAGES IN WCA3. A) GAGE WCA3_3B_71 (TOP), B) WCA3_3A_28 (MIDDLE), AND C) WCA3_3A-NE (LOWER). CURVES FOR WCA_3_3-69 AND WCA3-3 GAGES ARE SIMILAR BUT NOT SHOWN.

Review of representative years from the modeling indicates that that the field test will increase expected deliveries by 32,000 – 80,000 acre feet over the entire November-May period above the level of delivery by the Tamiami Trail Flow Formula identified in Alt Q (which delivered 75,000 acre ft in 1973-74, 50,000 acre ft in 1989-90, and 180,000 acre ft in 1990-91 respectively during the November 1 – May 30 period). These additional deliveries correspond to the differences in deliveries observed in Alt O and Alt Q during these three specific years identified in **Figure C.7.16-1** (1973-1974, 1989-1990, and 1990-1991), and the anticipated effect of the design test may result in a minor-negligible effect on WCA-3A, in addition to a minor benefit realized by the SRS portion of ENP. A comparison between alternatives O and Q indicate that maximum effect of the design test would reduce stages in WCA 3A 0.1-0.5 ft over roughly 35% of WCA 3A. Stage level reductions no more than 0.3-0.5 ft occur within the first 0.5 miles upstream of the L29 canal, 2-4 miles upstream of the L-67 canal, while 0.1-0.3 ft stage reductions occur 0.5-3 miles upstream of the L29 canal and 4-10 miles upstream of the L67 canal respectively. Since our ability to predict rainfall volumes over a seasonal drydown is a significant uncertainty, water managers may stop the test if less than 2 inches of basin-wide average rain of WCA3 in any month and forecast rains present a significant risk of drying WCA-3A beyond the constraint thresholds outlined above.

Triggers/thresholds that indicate good COP performance or need for adaptive management action. These are described in the methodology of the test provided above, since the constraints and thresholds are central to the methodology of the design test.

At each PDT+ meeting the team will identify if a field test is possible in the upcoming wet-dry season transition (based upon closures in WCA-3A during the previous season and anticipated water levels in WCA3). If suitable conditions appear likely, the managers will be notified of intent to further investigate whether conditions warrant initiation of the field test, and a series of monthly meetings will be used to formulate the specific field test strategy. Results from the test will be summarized in a report and delivered to resource managers no later than 6 months after the completion of the field test, to ensure availability of this information in advance of the next dry season. The report will document the proposed design, the actual operations utilized, the hydrologic and ecologic effects on ENP and WCA3 (in terms of depth duration effects at key gages identified above).

Management options that may be chosen based on test results.

Option 1: Adopt operational strategy that provides a moderate increase to TTFF inflows into Central and Southern Shark River Slough during seasonal transitions.

Option 2: Based on consideration of constraints and forecast conditions, maintain adherence to the COP TTFF based delivery strategies.

This uncertainty is further defined in a management option matrix below in **Table C.2-17.**

TABLE C.7.16.-2. COP AM UNCERTAINTY ID #12B (TAMIAMI TRAIL FLOW FORMULA AND DROUGHT) MANAGEMENT OPTION MATRIX.

1) Uncertainty Tracking ID#	2) Attribute or Indicator	3) Specific Property to be Measured and Frequency	4) Timeframe to detect change of attributes	5) Region or Specific Area (Locations to Monitor)	6) Decision Criteria: Trigger(s) for Management Action	7) Estimated Additional Annual Cost	8) Management Action Options Suggestions
1. UNC #12b – Tamiami Trail Flow Formula (TTFF) and Drought	2. Seasonal timing of delivery of flows to NESRS	3. Daily averages of stage	4. Event driven when criteria for conducting test occur. Duration of test should be 6 months.	5. S-333, S-12 C and D (outflow of WCA3/inflow to Shark River Slough portion of ENP), 6. as well as 7. S-11 A-C, S-8, and S-140 (inflows into WCA3). 8.	• If test is able to be successfully implemented without unexpected violation of constraints (e.g., causes water quality concerns), then the test operational strategy (with the drought intensity threshold constraints) will become part of the regular water	9. Existing unless additional model runs are required	• Option 1: Adopt operational strategy that provides a moderate increase to TTFF inflows into Central and Southern Shark River Slough during seasonal transitions. • Option 2: Based on consideration of constraints and forecast conditions, maintain adherence to the COP TTFF based delivery strategies.

1) Uncertainty Tracking ID#	2) Attribute or Indicator	3) Specific Property to be Measured and Frequency	4) Timeframe to detect change of attributes	5) Region or Specific Area (Locations to Monitor)	6) Decision Criteria: Trigger(s) for Management Action	7) Estimated Additional Annual Cost	8) Management Action Options Suggestions
					control plan operational strategy. • If unexpected violation of constraints occur that appear unresolvable (e.g., water quality concerns or excessive drying of WCA-3A), then operations will return to using the Tamiami Trail Flow Formula as described in the Water Control Plan.		

This page intentionally left blank

8 EFFECT OF WATER CONTROL PLAN

The purpose of this chapter is to describe the effects of the Chapter 7 (WCP) operations of the WCA, ENP, ENP-SDCS component of the C&SF Project.

8.1 GENERAL

The Chapter 7 (WCP) operations balance the congressionally authorized project purposes which include flood control (flood risk management), water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, water supply for ENP, protection of fish and wildlife resources, groundwater recharge, recreation, and navigation. The multiple, varied and sometimes-conflicting goals for the regional system (i.e. flood risk management, water supply, environment, navigation, etc) add to the complexity of the day-to-day water management operations. The updated Chapter 7 (WCP) combines the 2012 WCP water management operations for WCA-1 and WCA-2 with the new water management operations for WCA-3, ENP, and ENP-SDCS that were developed in the COP. The COP is an integrated operational plan for two modifications of the C&SF Project – known as MWD to ENP and the C-111 SD Projects. The COP balances ecological restoration objectives of the MWD to ENP and C-111 SD Projects completed infrastructure by redistributing the existing WCA-3A and ENP water budget.

Anticipated changes to the existing environment are detailed in the COP EIS. Chapter 7 (WCP) operations change the amount and timing of releases from WCA-3A to ENP through implementation of the TTFF that determines the volume of flow from WCA-3A to ENP. This is anticipated to provide the following benefits compared to the modeled existing condition baseline.

1. Increase the availability of water deliveries from WCA-3A to ENP through NESRS and improve hydrologic conditions in Taylor Slough, the Rocky Glades, and the eastern panhandle of ENP.

2. Increase the annual inflow to ENP by approximately 162,000 acre feet per year on average, an increase of 28%.

3. Increase the proportion of the water that enters ENP east of S-333 by 19%. This changes to the spatial distribution of the water delivered into ENP across Tamiami Trail (U.S. Highway 41) which helps restore NESRS as a functioning component of the Everglades hydrologic system.

4. Increase the annual inflow to Taylor Slough by approximately 6,000 acre feet per year on average (an increase of 7%) to maximize progress toward restoring historic hydrologic conditions in Taylor Slough.

5. Increase the annual inflow to the Eastern Panhandle of ENP by approximately 30,000 acre feet per year on average (an increase of 27%).

6. Reduce the releases to Manatee Bay and Barnes Sound through S-197 by 41,000 acre feet per year on average (a decrease of 69%). Average number of days with non-zero deliveries through S-197 would also be reduced by 78% (from 223 to 48 days per year).

The additional water flowing into ENP would help to restore pre-drainage vegetative communities and habitat for fish and wildlife while providing incremental restoration of natural processes critical for the development of peat soils and tree islands, which are essential features of the Everglades ridge and slough landscape. Increased freshwater flows to Florida Bay would reduce salinities, resulting in better conditions for the diversity of seagrasses and other estuarine plant and animal species that inhabit the Bay.

Potential unavoidable adverse effects as discussed in the COP EIS that may occur as a result of Chapter 7 (WCP) are summarized below and include;

1. Increased risk to accessibility of tree islands for cultural and religious practices by the MTIF; decreases in water levels in WCA-3A may limit airboat access to tree islands during extremely dry periods. Access during these times may be limited to walking and/or use of swamp buggies.

2. Increased risk to soils in WCA-3 due to the potential for reduced water levels; however hydrologic modeling conducted in support of the COP, indicated that the majority of WCA-3 is expected to be above the threshold to maintain peat accumulation in the Everglades marsh relative to the existin condition baseline.

3. Increased risk to recreational access in WCA-3 during extremely dry periods; differences in the number of days the FWC considers closure in the EWMA due to low water stages was modeled to be less than a 2% period of record change relative to the existing condition baseline.

4. Increased risk for phosphorous loading in ENP and exceedance of the Consent Decree's Appendix A Shark River Slough annual phosphorus concentration limit; however, due to the trend of improving water quality delivered to ENP and the expectation that the SFWMD Restoration Strategies (RS) will accelerate the improvement trend, it is expected that the potential risk for increased phosphorus concentrations delivered to the ENP will no longer exist in the future.

5. Potential for high volume releasereleases through S-197 to Barnes Sound/Manatee Bay associated with the Extreme High Water Line (EHWL). Under this condition releases at S-197 may be increased up to a maximum of 2400 cfs as summarized in Chapter 7 - WCP. This operational flexibility is not expected to be triggered frequently and is intended to be available if needed to help reduce risks to the WCA-3A perimeter levee system, a population at risk of 70,600 people, hurricane evacuation routes, and wildlife and tree islands from extreme high water conditions.

Concerns expressed by stakeholders included the performance of the TTFF during regional droughts in the WCAs, ENP, and Florida Bay, the effects of the EHWL on flood risk in agricultural areas of Miami-Dade County, and potential effects of S-197 releases to the Eastern Panhandle and Manatee Bay and Barnes Sound. The COP Adaptive Management and Ecological Monitoring Plan (AMMP) was developed to identify the monitoring necessary to inform decision-makers, partner agencies, and the public on progress towards achieving restoration success, as well as address uncertainties related to potential adverse effects to avoid and/or minimize those effects.

The Chapter 7 (WCP) operations povide a significant increase in freshwater needed for the restoration of NESRS and Taylor Slough, however, additional actions are needed such as the completion of CERP components that would increase freshwater flows to achieve Everglades restoration. The COP is anticipated to be in place until construction of new CERP infrastructure, including features which would enable increased flow delieveries into the WCAs, ENP, and Florida Bay. If new information becomes available through implementation of Chapter 7 (WCP) and/or the AMMP that would necessitate a need to modify water management operations, this information will be incorporated as appropriate in accordance with laws and regulations including the NEPA.

8.2 FLOOD RISK MANAGEMENT

The main design function of the project canals and structures in the WCAs, ENP, ENP-SDCS areas is flood risk management. Hydraulic design of these water management structures conform with the standard design criteria and procedures established in EM 1110-2-1602, Engineering and Design Hydraulic Design of Reservoir Outlet Works, and EM 1110-2-1603, Engineering and Design Hydraulic Design of Spillways. Descriptions of the water management structures are found in Appendix A of this SOM.

The WCAs provide a detention reservoir for excess water from the EAA and parts of the east coast region, and for releases from Lake Okeechobee. Levees associated with the WCAs prevent Everglades floodwaters from inundating the east coast urban areas and provide flood protection to MTIF lands. The ENP-SDCS provides flood protection to developed areas in Miami-Dade County adjacent to the eastern boundary of ENP.

For Chapter 7 (WCP) operations (based on the recommended plan identified in the COP EIS), the hydrologic modeling indicated no significant increases to regional groundwater stages during normal to wet conditions which would impact the levels of service for flood control within the Lower East Coast Service Areas (LECSAs), as detailed in Section 4.14 and Section 4.15 of the COP EIS. The EIS flood risk management evaluation is focused principally on the urban and agricultural basins east of the WCAs and ENP (east of the East Coast Protective Levee), including LECSA 1 (Palm Beach County), LECSA 2 (Broward County), LECSA 3 (Miami-Dade County), and the 8.5 SMA. Flood risk management performance for the urban and agricultural parcels adjacent to the L-31N and C-111 primary canals is principally based on the water level controls along these primary SDCS canals. The recommended plan lowers the frequency and duration of high water stages in WCA-3A, which corresponds to further reduced public health

and safety risk associated with the WCA-3A perimeter levee system. As part of the MWD to ENP Incremental Field Tests, South Dade canal operations for reaches along the L-31N (south of S-331) and C-111 canals were generally lowered with the additional inclusion of seasonal criteria at the S-332 pump stations, compared to the long-term operational paradigms prescribed within the previous WCPs under the IOP (2002-2012) and ERTP (2012-2015). The MWD to ENP Incremental Field Tests started in 2015, to simultaneously promote both increased deliveries to Taylor Slough and the hydraulic ridge and reduced flood risk for the adjacent agricultural and urban areas. Extensive analyses during the COP iterative modeling rounds, including specifically crafted sensitivity simulations, demonstrated there is no significant trade-off between ecological performance benefits within ENP and the lowering of the normal canal operating ranges with the COP.

Compared to the existing condition baseline (ECB19RR) identified in the COP EIS, no notable changes to groundwater stages were indicated within LECSA 1, consistent with the COP not modifying the Regulation Schedules for WCA-1 and WCA-2. LECSA 2 groundwater stages are slightly reduced by less than 0.05 feet along the Miami canal immediately east of WCA-3B, resultant from increased utilization of the L-30 canal and eastern WCA-3B to provide additional water deliveries to the SDCS to extend ENP hydroperiods adjacent to the C-111 SD NDA and SDA and to increase deliveries to Taylor Slough and toward Florida Bay. The L-30 canal stages (north of S-335) indicate a moderate reduction (0.1-0.2 feet) to flood control stages during normal to extreme wet conditions. Minor increases to groundwater stages, up to 0.05 feet, are evident across most of western LECSA 3, extending up to 3 miles east of the East Coast Protective Levee proximal to the water control structures along the C-1W canal (S-338), C-102 canal (S-194), and C-103 canal (S-196). The L-31N canal stages (north of G-211) indicate no significant change during normal to wet conditions. The L-31N canal stages (between G-211 and S-331) indicate a moderate reduction (0.1-0.2 feet) to flood control stages across during normal to extreme wet conditions. No increase to groundwater stage results from the reduced utilization of the S-331 pump station to provide flood mitigation to the adjacent 8.5 SMA and the concurrent increased utilization of the S-357 pump station because COP includes revised flood control operations at S-331 to maintain L-31N stages between 4.5 to 5.0 during the CSSS nesting window (14 February – 15 July) and between 4.3 to 4.6 during other times of the year. During wet years, such as 1995 and 1999, moderately increased stages up to 0.4 feet are indicated north and east of the S-331 pump station along the C-1W canal. The L-31N canal stages east of the C-111 SD NDA and SDA (between S-331 and S-176) indicate a minor stage increase during moderately wet conditions, with no increase for extreme wet conditions or during normal to wet conditions. Further south along the C-111 canal, for normal to wet hydrologic conditions, no significant changes are observed for the canal reach east of the SFWMD C-111 Spreader Canal Project (between S-176 and S-177) or for the canal reach between S-177 and S-18C. For the 8.5 SMA, hydrologic conditions are not unchanged for all areas, but circumstances are generally improved. The 8.5 SMA congressionally authorized Flood Mitigation constraint compliance is achieved for all interior 8.5 SMA locations. The COP modeling indicated that 1-2% of the 8.5 SMA will experience an increase in peak stage but received a flood risk reduction resultant from reduced inundation duration of 66-74%.

The SBC Project WCPs (located in Appendix G) include WRAs, ISCs, levees, water management structures, and pump stations which are designed to improve flood risk management on the Seminole Big Cypress Reservation.

8.2.1 Spillway Design Flood (SDF)

The basic purpose of the spillway is to provide a means of controlling the flow and providing conveyance from reservoir to tailwater for all flood releases up to the SDF. The standard project flood (SPF) is a minimum value used for terminal structure design release. The SPF for the WCAs, ENP, ENP-SDCS project area is defined as the most severe storm or sequence of storms considered reasonably characteristic of south Florida. The SPF rainfall is the 100-year rainfall for the period of record with values increased by 25 percent. Design criteria for structures were developed by using the SPF and considering various other factors such as wind setup, wave run-up, and vegetation characteristics.

The S-10s, S-11s, and S-12s were sized to pass the SPF. Thus for them the SDF is the SPF. Rapid removal of flood storage in the WCAs is limited due to the slow movement of water in the densely vegetated WCAs, relative to the potentially high rates of inflows that come from the combination of upstream structures and rainfall.

The C&SF Project features in ENP-SDCS maintain optimum stages for the purpose of flood risk management and also provide water supply, groundwater recharge, and prevent saltwater intrusion. The C-111 Basin structures (S-196, S-194, S-176, S-177, S-18C, and S-197) were designed to pass 40 percent of the SPF without exceeding design stages, and to control releases during floods in excess of design to prevent damaging velocities at the structures and in the canal. Thus for these structures, the SDF is 40 percent of the SPF.

8.2.2 Inflow Design Flood (IDF)

The USACE is currently nearing completion of an updated WCA flood routing analysis study, the Baseline and Modification Model (BAMM), with intended completion of May 2020. The intent of the BAMM study is to identify and quantify the cumulative changes to design stage and flow conditions within the WCAs (WCA-1, WCA-2, and WCA-3) due to infrastructure and operational changes that have occurred since the originally authorized C&SF Project design. The BAMM effort includes development of a new regional flood routing model and model simulations of SPF hydraulic routings for each of the WCAs. The BAMM flood routing results will be used by the USACE to conduct comprehensive risk analysis of levees and structures within the WCAs, including hydraulic, hydrological, geotechnical, and structural engineering, if results warrant. The USACE will evaluate any substantial WCA design deficiencies and determine the resulting path forward based on human health and safety and other C&SF Project requirements. The Inflow Design Flood (IDF) details are expected to be developed as part of the BAMM effort. **Table 8-1** lists the BAMM results for SPF elevations in WCA-1, WCA-2A, WCA-2B, WCA-3A, and WCA-3A and SPF flows for the S-10s, S-11s, and S-12s.

TABLE 8-1: WCAS BAMM SPF ELEVATIONS AND FLOWS

WCA	**BAMM SPF Elevations (NGVD)**
WCA-1	19.3 feet
WCA-2A	16.6 feet
WCA-2B	11.5 feet
WCA-3A	14.2 feet
WCA-3B	10.4 feet
Structure	**BAMM SPF Flows (cfs)**
S-10s	13,100
S-11s	9,850
S-12s	7,800

8.2.3 Reservoir Design Flood (RDF)

The WCA Reservoir Design Flood (RDF) details are the same as discussed in section 8.2.2.

8.2.4 Other Floods

Not applicable

8.3 RECREATION

Recreational activities such as sightseeing, wildlife viewing, photography, hiking, bicycling, boat touring, boating, kayaking, canoeing, camping and fishingare popular in the WCAs and ENP. The largest remaining subtropical wilderness in the continental United States, ENP is a unique and highly diverse wetland system which attracts visitors from around the world. There are information centers/nature observation sites, primitive camp sites, walking trails, boat ramps and other day use facilities in ENP and the EWMA. The water levels within these areas impact recreation and public access both directly and indirectly. FWC considers recreational closures in the EWMA due to both high and low water stages as outlined in Chapter 7 (WCP).

Due to lowering of water levels in WCA-3, the operations developed in Chapter 7 (WCP), may potentially reduce airboat access and recreational fishing within the marsh during extremely dry periods; however access to canals for recreation would not change relative to the modeled existing condition baseline. Specific access points along Tamiami Trail west of the L-67 Extension canal face an increased risk of being inaccessible for recreational finishing, air boating, and paddling to an estimated average of 5% period of record change.

8.4 WATER QUALITY

Hydrological and environmental conditions within the Everglades have changed a great deal in comparison to conditions that existed during the mid-19th century. Before construction of the C&SF Project, water moved freely across the shallow Everglades, miles of sawgrass, wet prairies and open water sloughs from Lake Okeechobee southward to the coastal estuaries of Florida Bay. Disruption of historical flow patterns due to the regional drainage improvements of the C&SF Project and the development of agriculture south of Lake Okeechobee has caused major changes in the quality of water released south to the Everglades. With the exception of rainfall and flows into the system from the eastern BCNP, the Everglades are regulated by a man-made water management system (C&SF Project) and water is routed more quickly through a complex network of canals and impoundments.

Water quality delivered to the WCAs and ultimately ENP has significantly improved due to the mandatory Best Management Practices (BMPs) imposed on the EAA and a series of STAs and Flow Equalization Basins (FEBs) treating EAA runoff and some Lake Okeechobee water, prior to flowing into the WCAs. Restoration Strategies (RS), a State of Florida funded effort, is expected to result in further reduction of nutrients and/or nutrient spikes released to the WCAs. The interior marsh nutrient conditions in the WCAs has significantly improved since the passage of the 1994 Everglades Forever Act, as demonstrated by the reduction of nutrient concentrations measured at the numerous marsh monitoring stations within the WCAs. There are still significant soil nutrient loads in the WCAs that will slowly improve as compared to the surface water conditions. Very significant improvements have occurred but further improvements are still needed. RS features are expected to continue this improvement trend of reduced deliveries of high nutrient concentration water to the WCAs.

Because Chapter 7 (WCP) operations will significantly alter the timing and distribution of flows into ENP, while also increasing the volume of water delivered to SRS, there is the potential for adverse impacts on water quality. However, due to the trend of improving water quality delivered to ENP and the expectation that the SFWMD Restoration Strategies (RS) will accelerate the improvement trend, it is expected that the potential risk for increased phosphorus concentrations delivered to the ENP will no longer exist in the future. During the interim period of potential increased risk to water quality, the COP analysis indicates that with the implementation of water quality AMMP (Appendix C of the COP EIS) strategies included in Chapter 7 (WCP), the short term-risk can be diminished. By 2023, independent of improvements expected from Restoration Strategies and CEPP, phosphorus concentrations delivered to the ENP can be improved over the existing condition baseline. The AMMP (Appendix C of the COP EIS) water quality strategies may reduce the quantity of water delivered to ENP, but they were developed and designed to avoid any net reduction of water volumes delivered to the ENP during a given water year. The intent is that any temporary reduction in volumes delivered to the ENP due to the implementation of the water quality strategies will be accounted for/tracked and that volume will be made/released to the ENP later in the water year when water is available in the system (typically during the wet season).

8.5 FISH AND WILDLIFE

The effects of recession rates, ascension rates, water levels and hydroperiods on fish, wildlife and vegetation in the WCAs are important considerations in determining and developing the regulation schedule water levels. There are two primary environments which support Everglades fish in the WCAs, ENP, ENP-SDCS project area. They are the vast expanse of open water aquatic sloughs and wet prairies and the deep water canal environments within the WCAs and ENP-SDCS. While canals contain water throughout the year, the extant marsh areas experience seasonal drying. As a result, marsh fish populations will vary from season to season and year to year in response to the changing water levels. Besides supporting a valuable recreational fishery for the region, fish communities provide a major food source for Everglades wading birds, alligators, and other carnivorous reptiles and mammals. Fish community structure and abundance is highly dependent on water levels. A potential increase in foraging conditions for wading birds is expected to improve in portions of ENP due to increases in the availability of water; however, implementation of Chapter 7 (WCP) may increase the probability that wading bird colonies in northern WCA-3A would experience drier conditions due to reduced water depths in WCA-3A.

Terrestrial wildlife, such as deer, marsh rabbits, bobcats, and raccoons, are native and common within the WCAs. Forty-Five Federally listed threatened and endangered species are either known to exist or potentially exist within the Everglades (WCAs, ENP, coastal areas) including the Florida panther, Florida manatee, Cape Sable Seaside Sparrow, Everglade snail kite, wood stork, American alligator, American crocodile, and Eastern indigo snake. State listed species in the Everglades include the, Everglades mink, black skimmer, least tern, white-crowned pigeion, little blue heron, tricolored heron, reddish egret, roseate spoonbill, Florida sandhill crane, and Southeastern American kestrel. The Everglades contain some of the largest and most important wading bird colonies in North America.

The COP is being pursued to address the mandated Reasonable and Prudent Alternative (RPA) of the July 22, 2016 Everglades Restoration Transition Plan (ERTP) Biological Opinion (BO) and subsequent coordination between the USFWS and the USACE, which requires the USACE to proceed as scheduled, and as allowable by law, for completing NEPA analysis for the COP by August of 2020. The RPA identified operational modifications and proposed expediting restoration initiatives for some of the structures in the southern portion of the Everglades ecosystem to provide suitable nesting habitat for the endangered Cape Sable Seaside Sparrow (CSSS). The implementation of the COP is expected to influence wetland hydroperiods causing changes in nesting and marl prairie suitability for the CSSS and other federally listed threatened and endangered species under the purview of the USFWS. Consultation under the Endangered Species Act (ESA) has been initiated with the USFWS with submittal of a Biological Assessment. A BO will be included upon receipt in the 2020 COP Final EIS.

8.6 WATER SUPPLY

The WCAs, ENP, ENP-SDCS project features provide water supply benefits for municipal and industrial users, water supply for irrigation of agriculture, water supply for ENP, and and to prevent saltwater intrusion and dilution of pollutants in project canals. In addition, water is

delivered to coastal spillways through project canals to prevent saltwater intrusion into nearby groundwater wells. When there is insufficient water available in the WCAs, water is transferred from Lake Okeechobee through the WCAs and/or between the WCAs to meet water supply demands.

The surficial aquifer system, including the water table and Biscayne aquifers, underlies approximately 3,000 square miles of Miami-Dade, Broward, and southern Palm Beach counties. It is a surficial, highly permeable, wedge-shaped aquifer that is approximately 200 feet thick at the coast but thins to a few feet thick near its western boundary 35 to 40 miles inland. The surficial aquifer system provides water for six water use categories established by the FDEP (public water supply, domestic self-supply, industrial and power generation water supply, agricultural and landscape irrigation) along the southeast coast. Seepage and water supply releases from the WCAs prevent saltwater intrusion along the coast and recharge the surficial aquifer system. Due to the high degree of connectivity between the surficial aquifer system and surface water, changes in surface water elevations have a direct impact on groundwater levels and saline water intrusion. A prolonged reduction in canal stages will affect groundwater levels, which could result in movement of saline water into the Biscayne aquifer, causing harmful impacts to water supply well fields during drought conditions. Maintaining canal stage elevations for water supply and prevention of saline water intrusion are essential purposes of the C&SF Project. Analysis of the model results for COP indicated that Chapter 7 (WCP) operations maintain the pre-project levels of service for water supply.

8.7 HYDROELECTRIC POWER

There are no hydroelectric power plants within the C&SF Project.

8.8 NAVIGATION

There are no authorized project features for commercial navigation within the WCAs, ENP, ENP-SDCS project area. However, the many miles of canals in the project also offer excellent fishing and boating opportunities. In WCA-2A, the L-38E, L-38, and L-35B borrow canals offer approximately 21 miles of unrestricted access for watercraft. Navigation is generally unobstructed in the canals except during low water periods when rocks are often exposed or when areas become clogged with aquatic vegetation. Decreases in water levels in WCA-3A may limit airboat access to tree islands by the MTIF during extremely dry periods. Independent of implementation of the Chapter 7 (WCP), tribal airboat access is currently limited during the dry season; however durations of limited access would be expected to be extended during periods of below average annual rainfall.

8.9 DROUGHT CONTINGENCY PLANS

The Drought Contingency Plan for the WCAs, ENP, ENP-SDCS component of the C&SF Project is found in Appendix B. SFWMD's Water Shortage Plan is codified in Chapter 40E-21 (Water Shortage Plan) and Chapter 40E-22 (Regional Water Shortage Plan), Florida Administrative Code. This plan is required under Subsection 373.246(1) Florida Statutes. The purposes of the plan are to protect the water resources of the SFWMD from harm; to assure equitable distribution of

available water resources among all water users during times of shortage, consistent with the goals of minimizing adverse economic, social and health-related impacts; to provide advance knowledge of the means by which water apportionments and reductions will be made during times of shortage, and to promote greater security for water use permittees. The Water Shortage Plan includes rules that outline priorities and define procedures for restricting water use during water shortages under direction of the SFWMD Governing Board. Water shortage activities are managed through the SFWMD Emergency Operations Center.

8.10 FLOOD EMERGENCY ACTION PLAN

Although there are currently no Flood Emergency Action Plans for the WCAs, ENP, ENP-SDCS region, it is anticipated future CERP Projects will include these plans. Additionally, the USACE Jacksonville District All-Hazards Plan should be consulted for related emergency preparation and actions. The SFWMD maintains a Comprehensive Emergency Management Plan (CEMP) which provides overall guidance using an all-hazard approach for managing disasters and emergencies. The CEMP describes the policies, strategies, operational goals and objectives through which the SFWMD will mobilize resources and conduct response and recovery activities after a large-scale disaster. The SFWMD CEMP follows the framework of the National Incident Management System (NIMS). The use of NIMS is a nationwide effort that is federally mandated for local, state, and federal agencies per Homeland Security Presidential Directive 5.

8.11 FREQUENCIES

The following sections contain plots and tables that are from the COP modeling effort that informed Chapter 7 (WCP) operations. The plots compare the existing condition baseline (ECB19RR) to the proposed plan (ALTQ) as defined in the COP EIS.

8.11.1 Inflow Probability

The determination of SPF inflows into the WCAs used in BAMM was based on an evaluation of structure inflow design capacity, historical maximum inflows, and Standard Project Storm (SPS) runoff from contributing WCA areas.

8.11.2 Pool Elevation Duration and Frequency

The figures in this section show the average stages and duration curves for WCA-1, WCA-2A, WCA-2B, WCA-3A and WAC-3B (**Figure 8-1-Figure 8-10**). The tables in this section show the peak stage elevations for each year for the period of record modeled (1965-2005) for WCA-1, WCA-2A, WCA-2B, WCA-3A and WAC-3B (**Table 8-2–Table 8-6**).

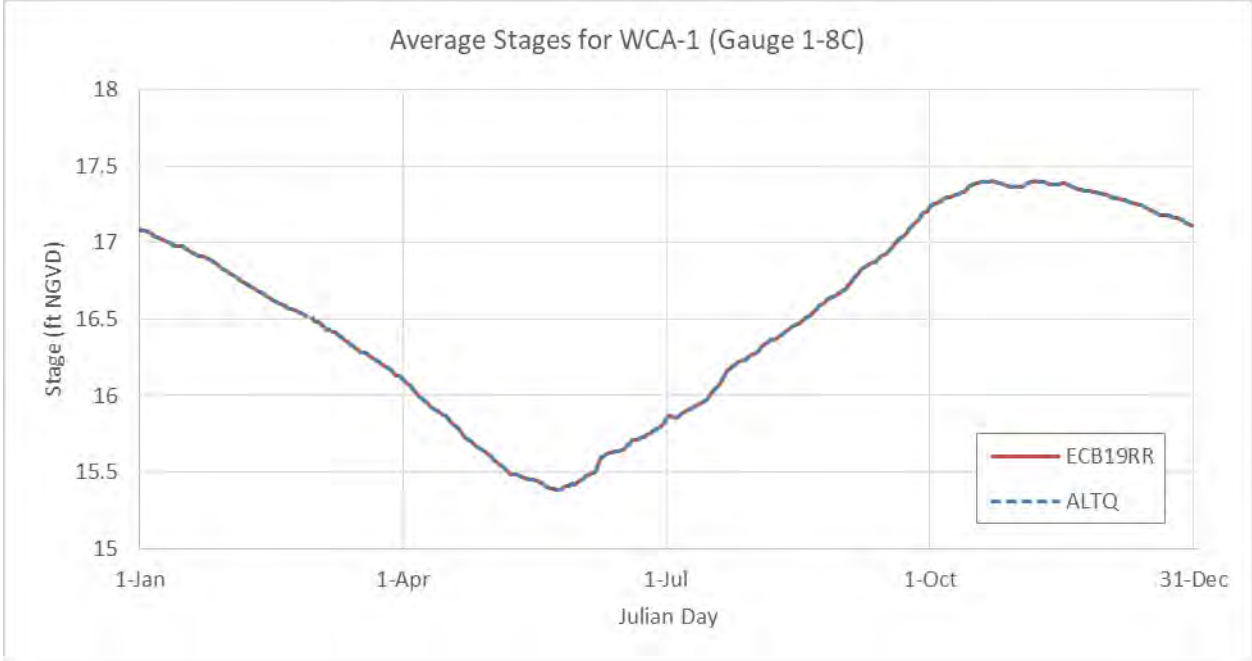


FIGURE 8-1. WCA-1 AVERAGE STAGE

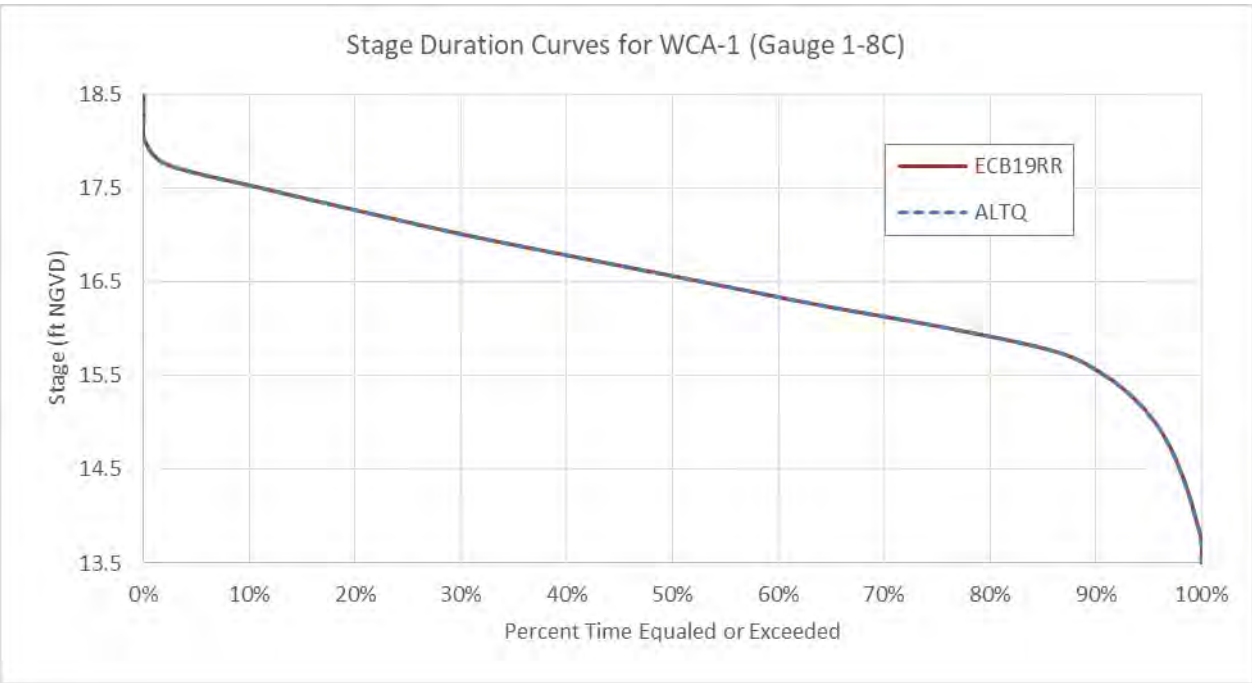


FIGURE 8-2. WCA-1 STAGE DURATION CURVE

TABLE 8-2: WCA-1 PEAK STAGE ELEVATIONS (1965-2005)

	WCA-1	**(feet NGVD)**
Year	ALTQ	ECB19RR
1965	17.95	17.95
1966	17.95	17.95
1967	17.72	17.72
1968	17.77	17.77
1969	18.04	18.04
1970	17.29	17.29
1971	17.59	17.59
1972	17.36	17.36
1973	17.68	17.68
1974	17.76	17.76
1975	17.72	17.72
1976	17.13	17.13
1977	17.67	17.67
1978	17.89	17.89
1979	17.81	17.81
1980	17.30	17.30
1981	17.79	17.79
1982	17.78	17.78
1983	18.05	18.05
1984	17.50	17.50
1985	17.89	17.89
1986	17.65	17.65
1987	17.86	17.86
1988	17.38	17.38

	WCA-1	(feet NGVD)
1989	16.63	16.63
1990	17.01	17.01
1991	17.28	17.28
1992	17.94	17.94
1993	17.72	17.72
1994	18.29	18.29
1995	18.09	18.09
1996	17.66	17.66
1997	17.78	17.78
1998	18.04	18.04
1999	18.03	18.03
2000	17.35	17.35
2001	17.85	17.85
2002	17.35	17.35
2003	17.50	17.50
2004	17.82	17.82
2005	17.62	17.62

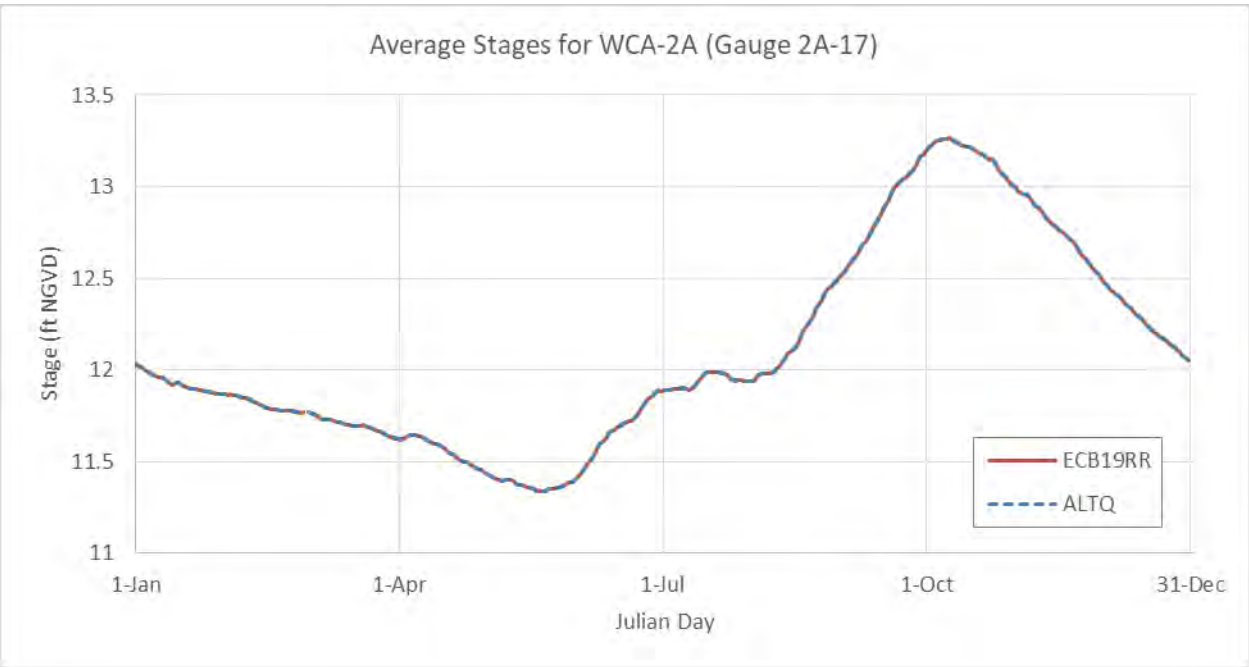


FIGURE 8-3. WCA-2A AVERAGE STAGE

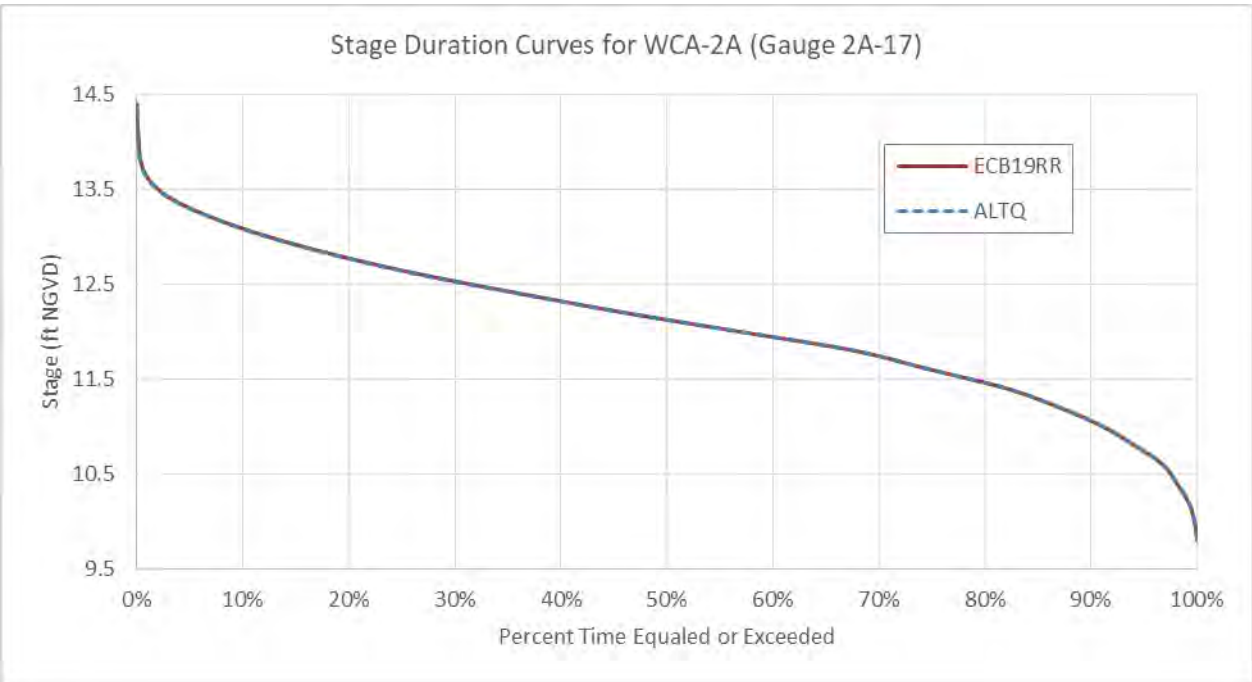


FIGURE 8-4. WCA-2A STAGE DURATION CURVE

TABLE 8-3: WCA-2A PEAK STAGE ELEVATIONS (1965-2005)

	WCA-2A	**(feet NGVD)**
Year	ALTQ	ECB19RR
1965	13.51	13.51
1966	13.67	13.67
1967	13.50	13.50
1968	13.64	13.65
1969	13.69	13.69
1970	13.19	13.19
1971	13.36	13.36
1972	13.11	13.11
1973	13.20	13.20
1974	13.41	13.41
1975	13.77	13.77
1976	13.41	13.42
1977	13.30	13.30
1978	13.25	13.25
1979	13.79	13.78
1980	13.22	13.22
1981	13.47	13.47
1982	13.77	13.77
1983	13.57	13.57
1984	12.99	12.99
1985	13.74	13.74
1986	13.21	13.18
1987	13.15	13.15
1988	13.12	13.12

	WCA-2A	**(feet NGVD)**
1989	12.77	12.77
1990	12.98	12.98
1991	13.35	13.35
1992	13.79	13.78
1993	13.60	13.60
1994	14.18	14.23
1995	13.91	13.97
1996	13.35	13.36
1997	13.41	13.41
1998	13.49	13.49
1999	13.93	13.93
2000	13.53	13.53
2001	13.68	13.68
2002	13.25	13.25
2003	13.30	13.30
2004	13.57	13.57
2005	13.38	13.38

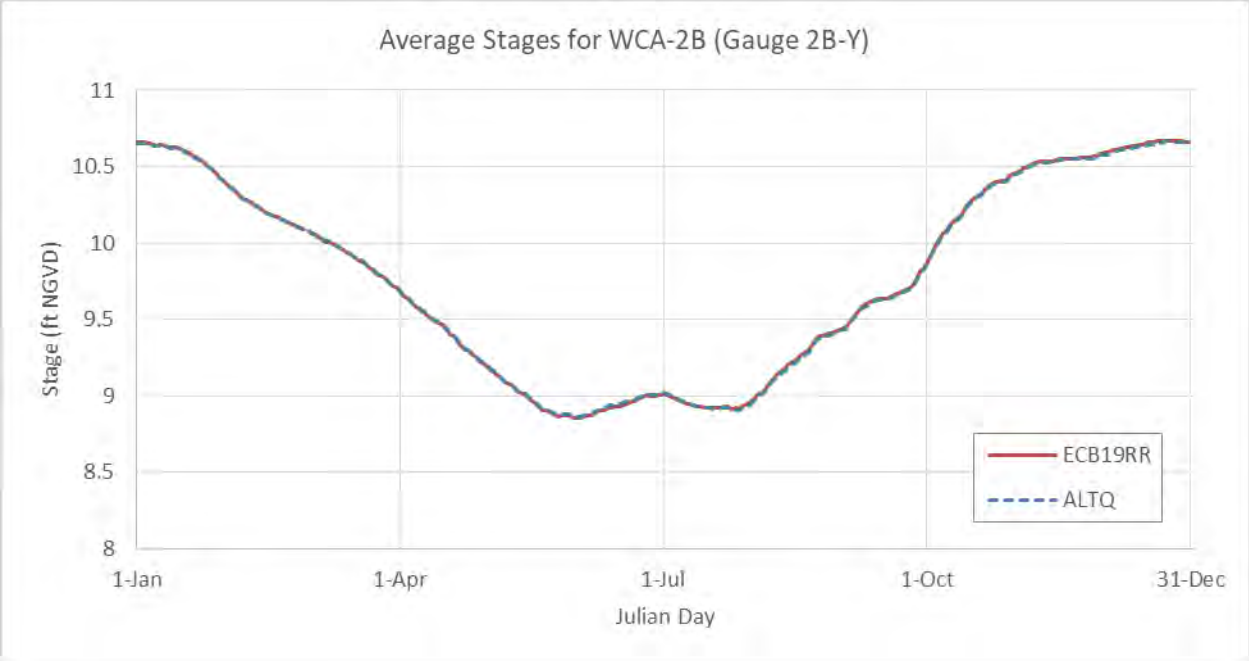


FIGURE 8-5. WCA-2B AVERAGE STAGE

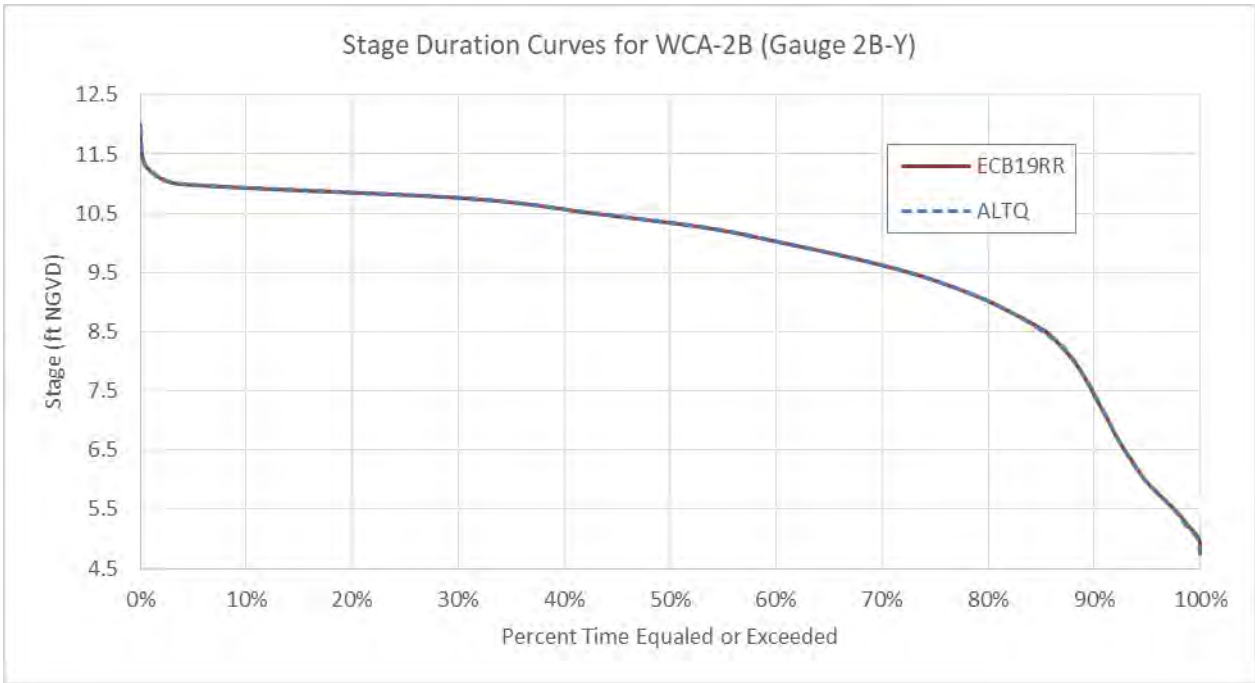


FIGURE 8-6. WCA-2B STAGE DURATION CURVE

TABLE 8-4: WCA-2B PEAK STAGE ELEVATIONS (1965-2005)

	WCA-2B	**(feet NGVD)**
Year	ALTQ	ECB19RR
1965	10.95	10.95
1966	11.33	11.33
1967	10.94	10.95
1968	11.18	11.18
1969	11.81	11.81
1970	11.30	11.32
1971	10.99	10.99
1972	11.02	11.02
1973	10.97	10.97
1974	10.95	10.95
1975	10.90	10.90
1976	10.92	10.92
1977	10.91	10.91
1978	11.01	11.01
1979	10.99	10.99
1980	10.90	10.90
1981	11.00	11.00
1982	11.21	11.22
1983	11.13	11.12
1984	11.01	11.01
1985	10.95	10.95
1986	11.07	11.04
1987	10.96	10.95
1988	10.67	10.69

	WCA-2B	(feet NGVD)
1989	9.24	9.32
1990	9.85	9.85
1991	11.15	11.15
1992	11.34	11.33
1993	11.05	11.05
1994	11.57	11.57
1995	11.27	11.28
1996	10.89	10.89
1997	11.18	11.18
1998	11.33	11.33
1999	11.59	11.62
2000	10.84	10.84
2001	10.97	10.97
2002	10.89	10.89
2003	11.10	11.10
2004	10.88	10.88
2005	10.97	10.97

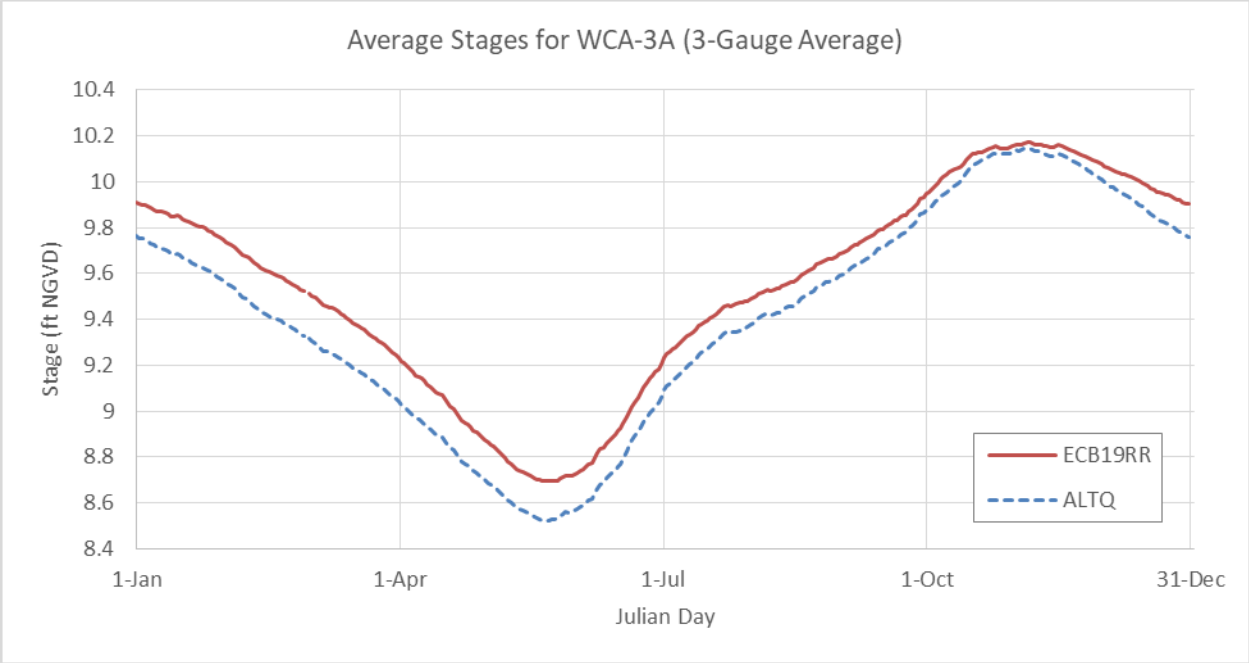


FIGURE 8-7. WCA-3A AVERAGE STAGE

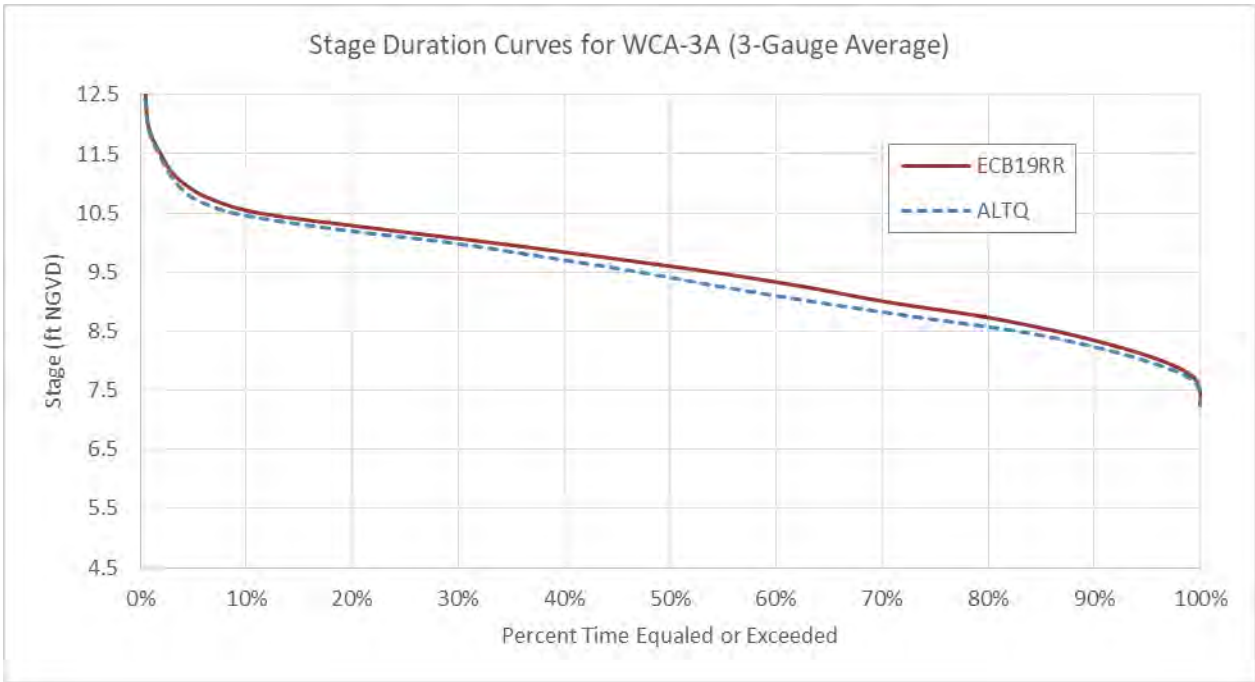


FIGURE 8-8. WCA-3A STAGE DURATION CURVE

TABLE 8-5: WCA-3A PEAK STAGE ELEVATIONS (1965-2005)

	WCA-3A	**(feet NGVD)**
Year	ALTQ	ECB19RR
1965	10.72	10.60
1966	10.93	10.79
1967	10.34	10.31
1968	11.48	11.37
1969	11.76	11.68
1970	11.19	11.04
1971	9.72	9.59
1972	10.38	10.22
1973	8.97	9.11
1974	10.01	9.98
1975	10.12	10.24
1976	10.28	10.33
1977	9.49	9.34
1978	10.39	10.40
1979	10.46	10.48
1980	10.40	10.41
1981	10.13	10.18
1982	11.21	11.11
1983	11.20	11.02
1984	10.49	10.43
1985	10.46	10.52
1986	10.41	10.27
1987	10.39	10.22
1988	10.30	10.18

	WCA-3A	(feet NGVD)
1989	8.94	8.80
1990	9.11	9.11
1991	10.57	10.55
1992	10.74	10.60
1993	11.23	11.19
1994	13.13	13.02
1995	13.08	12.98
1996	10.74	10.59
1997	10.66	10.57
1998	10.96	10.86
1999	11.98	11.91
2000	10.75	10.61
2001	10.72	10.60
2002	10.17	10.07
2003	10.40	10.50
2004	10.13	10.21
2005	10.38	10.53

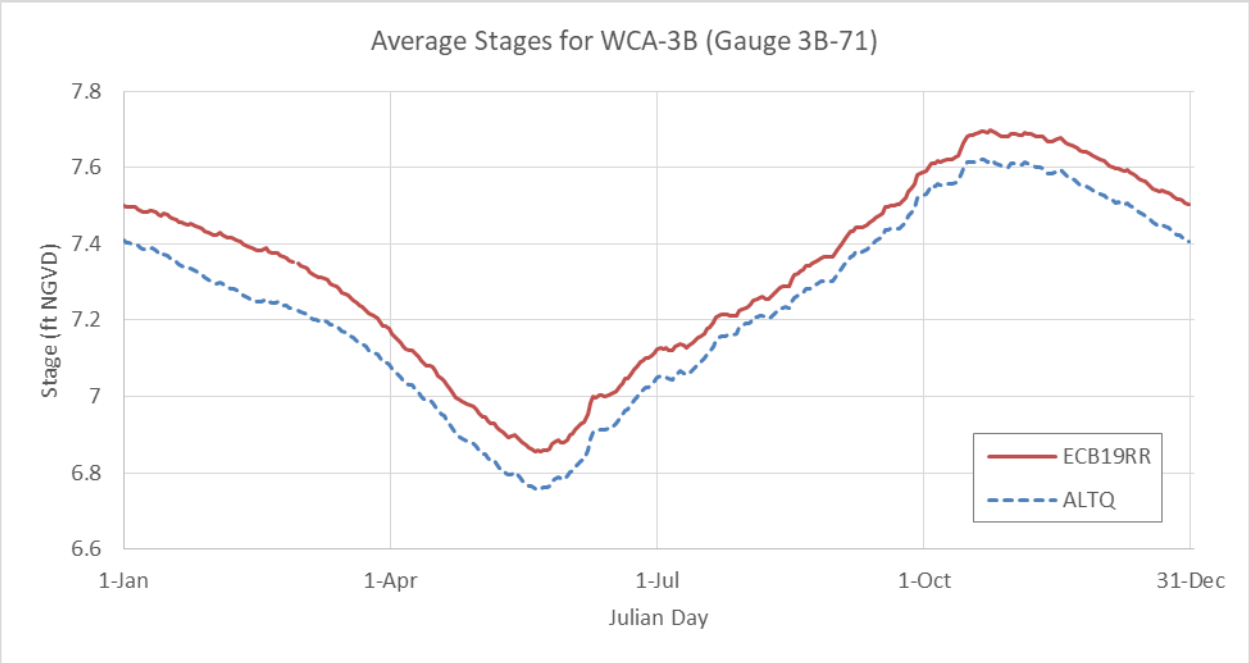


FIGURE 8-9. WCA-3B AVERAGE STAGE

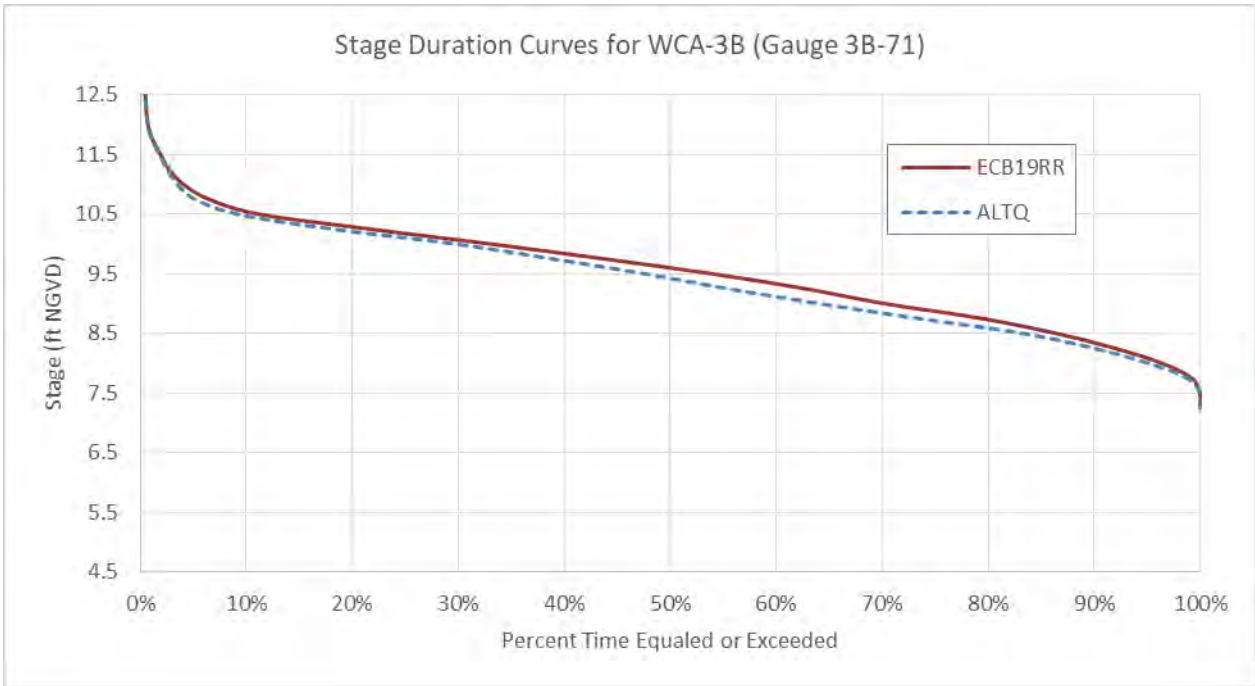


FIGURE 8-10. WCA-3B STAGE DURATION CURVE

TABLE 8-6: WCA3B PEAK STAGE ELEVATIONS (1965-2005)

	WCA-3B	**(feet NGVD)**
Year	ALTQ	ECB19RR
1965	7.80	8.12
1966	8.52	8.50
1967	7.62	7.94
1968	8.79	8.79
1969	8.82	8.96
1970	8.48	8.42
1971	7.31	7.32
1972	8.02	8.04
1973	7.22	7.20
1974	7.29	7.33
1975	7.49	7.52
1976	7.64	7.68
1977	7.14	7.15
1978	7.75	8.02
1979	7.61	7.86
1980	7.54	7.93
1981	7.69	7.77
1982	8.58	8.61
1983	8.43	8.47
1984	7.71	7.78
1985	7.58	7.83
1986	7.98	8.08
1987	7.58	7.80
1988	7.54	7.70
1989	6.99	7.02

	WCA-3B	(feet NGVD)
1990	6.81	6.84
1991	8.26	8.35
1992	8.21	8.29
1993	8.40	8.42
1994	9.21	9.07
1995	9.11	8.93
1996	8.44	8.39
1997	8.21	8.35
1998	8.48	8.45
1999	8.92	8.99
2000	8.39	8.32
2001	7.66	7.98
2002	7.61	7.76
2003	7.68	7.69
2004	7.31	7.33
2005	7.65	7.79

8.11.3 Key Control Points

The figures in this section show the flow duration curves for the S-10s, S-11s, S-12s and S-333s (**Figure 8-11**–**Figure 8-14**). The tables in this section show the peak flow for each year for the period of record modeled (1965-2005) for the S-10s, S-11s, S-12s and S-333s (**Table 8-7**–**Table 8-10**)

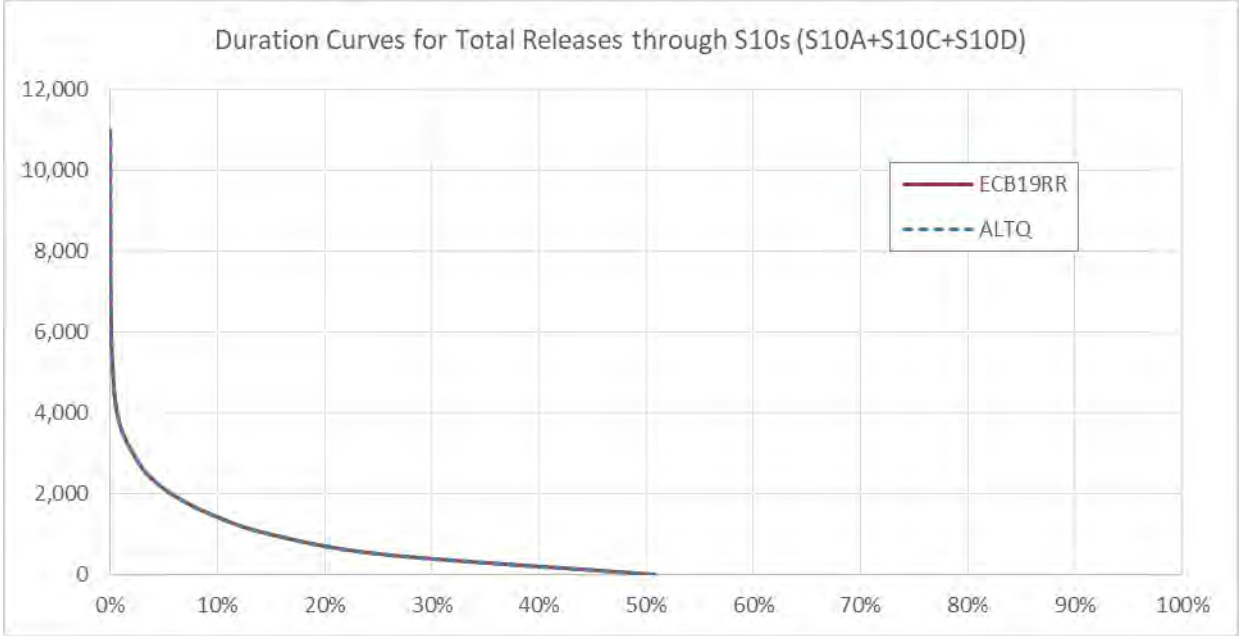


FIGURE 8-11. S-10S FLOW DURATION CURVE

TABLE 8-7: S-10S PEAK FLOW (1965-2005)

	S10s	(cfs-day)
Year	ALTQ	ECB19RR
1965	4,322	4,321
1966	7,351	7,350
1967	2,744	2,744
1968	5,341	5,340
1969	5,804	5,804
1970	5,850	5,850
1971	1,025	1,026
1972	4,399	4,400
1973	627	627
1974	4,426	4,426
1975	1,674	1,674
1976	2,762	2,762
1977	2,931	2,931
1978	3,556	3,555
1979	2,643	2,643
1980	2,985	2,985
1981	3,445	3,445
1982	5,135	5,130
1983	6,018	6,017
1984	5,153	5,153
1985	3,234	3,234
1986	5,409	5,409
1987	3,976	3,976
1988	2,840	2,840
1989	-	-
1990	-	-
1991	2,983	2,986
1992	5,750	5,743
1993	3,355	3,355
1994	10,638	10,636
1995	6,588	6,587
1996	3,032	3,028
1997	4,045	4,045
1998	5,966	5,966
1999	5,311	5,311
2000	3,076	3,076
2001	3,391	3,391
2002	3,744	3,741
2003	1,668	1,669
2004	2,175	2,175
2005	2,630	2,630

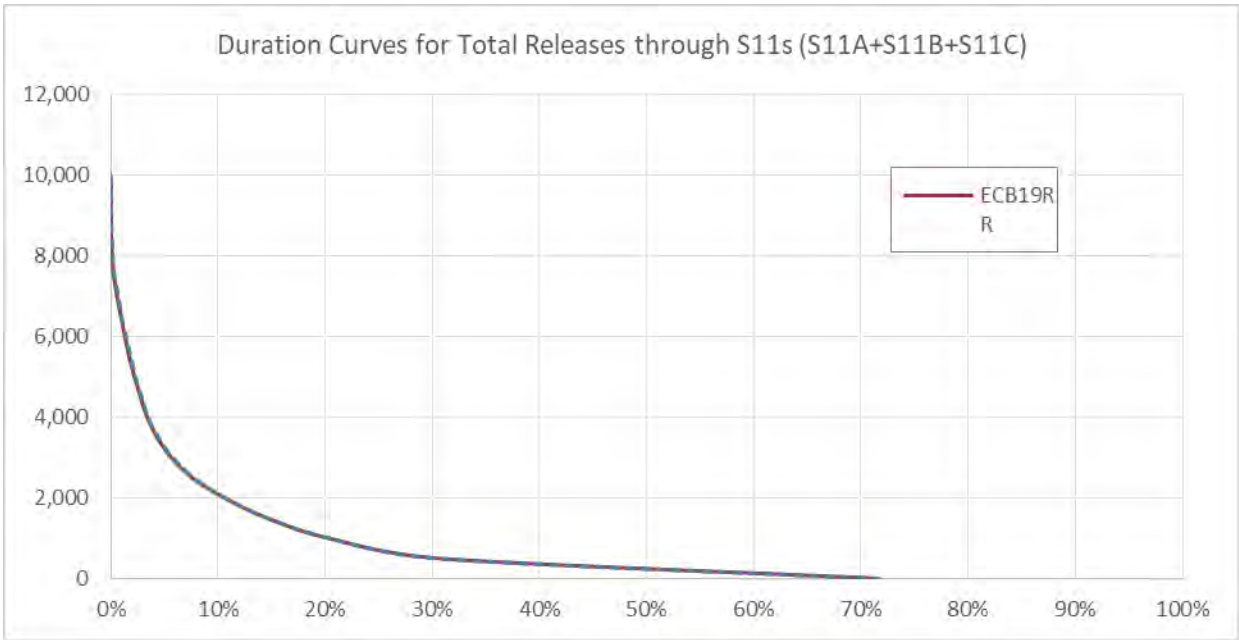


FIGURE 8-12. S-11S FLOW DURATION CURVE

TABLE 8-8: S-11S PEAK FLOW (1965-2005)

	S11s	(cfs-day)
Year	ALTQ	ECB19RR
1965	5,250	5,219
1966	8,656	8,619
1967	5,499	5,667
1968	8,651	8,657
1969	8,172	8,136
1970	5,830	5,567
1971	1,938	1,938
1972	7,499	7,507
1973	1,236	1,266
1974	5,286	5,357
1975	7,451	7,406
1976	7,540	7,526
1977	6,131	6,374
1978	7,944	7,700
1979	4,322	4,289
1980	5,885	5,868
1981	8,860	8,933
1982	8,195	8,064
1983	7,299	7,329
1984	7,324	7,435
1985	5,316	5,349
1986	8,425	8,224
1987	5,780	4,886
1988	4,654	4,392
1989	25	26
1990	511	488
1991	7,034	6,843
1992	7,815	7,547
1993	5,486	5,219
1994	8,185	8,531
1995	7,833	7,694
1996	7,018	6,814
1997	7,163	6,909
1998	8,019	8,009
1999	9,903	9,858
2000	1,765	1,801
2001	4,551	4,462
2002	5,155	5,130
2003	5,702	5,765
2004	1,810	1,807
2005	6,018	5,945

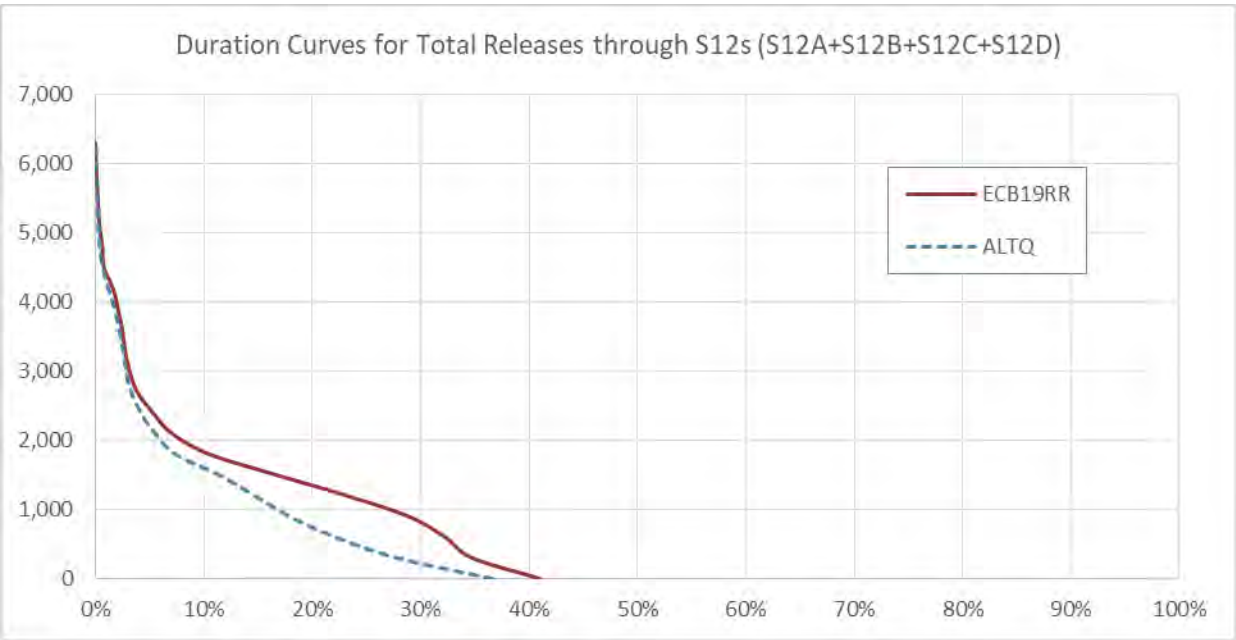


FIGURE 8-13. S-12S FLOW DURATION CURVE

TABLE 8-9: S-12S PEAK FLOW (1965-2005)

	S12s	(cfs-day)
Year	ALTQ	ECB19RR
1965	1,602	1,713
1966	2,517	2,950
1967	274	1,377
1968	4,218	4,480
1969	4,139	4,436
1970	2,514	2,742
1971	-	-
1972	1,525	1,795
1973	-	307
1974	-	446
1975	-	1,137
1976	1,963	1,829
1977	-	-
1978	1,704	1,846
1979	653	1,442
1980	1,195	1,368
1981	482	1,506
1982	3,371	3,646
1983	2,021	2,380
1984	1,098	1,558
1985	1,521	1,489
1986	1,807	2,045
1987	749	1,467
1988	1,584	1,657
1989	-	-
1990	-	-
1991	2,018	2,189
1992	2,253	2,575
1993	3,575	3,830
1994	5,640	5,730
1995	5,943	6,300
1996	1,696	2,060
1997	2,277	2,459
1998	1,752	2,082
1999	5,481	5,759
2000	1,723	1,981
2001	1,530	1,731
2002	737	1,531
2003	2,411	2,108
2004	-	1,080
2005	1,852	1,823

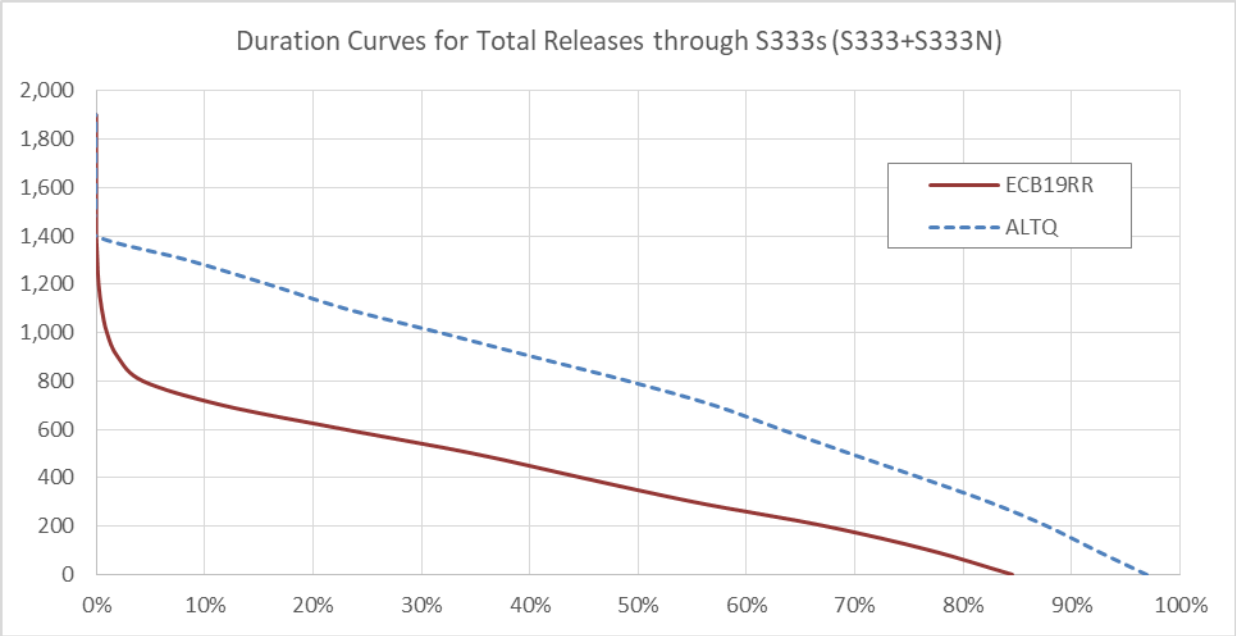


FIGURE 8-14. S-333S FLOW DURATION CURVE

TABLE 8-10: S-333S PEAK FLOW (1965-2005)

	S333s	(cfs-day)
Year	ALTQ	ECB19RR
1965	1,350	1,350
1966	1,350	887
1967	1,350	1,038
1968	1,350	994
1969	1,350	918
1970	1,350	898
1971	950	714
1972	1,350	1,195
1973	492	930
1974	1,152	1,350
1975	1,330	1,087
1976	1,350	1,139
1977	775	815
1978	1,350	1,306
1979	1,350	857
1980	1,350	836
1981	1,295	756
1982	1,623	1,048
1983	1,350	1,314
1984	1,350	866
1985	1,350	1,350
1986	1,350	785
1987	1,350	949
1988	1,350	892
1989	394	742
1990	567	975
1991	1,350	1,264
1992	1,350	1,074
1993	1,350	773
1994	1,350	847
1995	1,816	620
1996	1,350	1,045
1997	1,350	682
1998	1,350	811
1999	1,350	995
2000	1,328	1,070
2001	1,350	924
2002	1,350	980
2003	1,350	828
2004	1,291	995
2005	1,350	926

8.12 OTHER STUDIES

The COP EIS includes proposed water management operating criteria intended to address the identified effects of water management. These effects are addressed within the COP EIS through the following planning objectives:

1. Improve water deliveries (timing, location, volume) into ENP and take steps to restore natural hydrologic conditions in ENP given current C&SF infrastructure and features expected to be completed by the time of implementation, to the extent practicable by
    a. Changing schedule of water deliveries so that it fluctuates in consonance with local meteorological conditions, including providing for long term and annual variation in ecosystem conditions in the Everglades (Timing) (P.L. 101-229, Section 101b)
    b. Restoring NESRS as a functioning component of the Everglades hydrologic system (Location) (P.L. 101-229, Section 101b)
    c. Adjusting the magnitude of water released to ENP to minimize effects of too much or too little water (Volume) (1992 MWD GDM, Section 44)
2. Maximize progress toward restoring historic hydrologic conditions in the Taylor Slough, Rocky Glades, & eastern Panhandle of ENP.
3. Protect the intrinsic ecological values associated with WCA 3A and ENP.
4. Minimize the damaging freshwater flows to Manatee Bay/Barnes Sound through the S197 structure and increase flows through Taylor Slough and coastal creeks (1994 C-111 GRR, Section 5.2)
5. Include consideration of cultural values and tribal interests & concerns within WCA-3A and ENP.

A listing of the historical documents intended to address effects related to WCA, ENP, ENP-SDCS water management activities since 1983 are shown in **Table 8-11**.

TABLE 8-11: SIGNIFICANT MILESTONES PRECEDING COP

Year	Milestone
1983	Authorization of the Experimental Program
1989	ENP Protection and Expansion Act of 1989
1990	Draft GDM on MWD
1990	BO on MWD
1992	Final GDM on MWD
1993	BO and EA for Test 6 of the Experimental Program - Taylor Slough Iteration
1994	C-111 GRR
1995	Implement Test 6 of the Experimental Program
1995	Extension of Test 6
1995	EA for Test 7 of the Experimental Program

Year	Milestone
1995	Implement Test 7, Phase I of the Experimental Program
1995	Initiate Test 7 Hydrologic and Ecological Monitoring
1997	FWS Request USACE to Reinitiate Section 7 Consultation
1998	Implement 1998 Emergency Deviation from Test 7, Phase I
1999	BO on the Experimental Program, MWD, and C-111 Project
1999	Implement Emergency Deviation from Test 7, Phase I
2000	Implement ISOP 2000 Emergency Deviation
2000	8.5 SMA Plan GRR, Final Supplemental EIS and ROD
2001	Completion of Test 7 Hydrologic and Ecological Monitoring Report
2001	Implementation of ISOP 2001 Emergency Deviation
2001	Draft EIS for IOP for Protection of CSSS
2001	Supplemental Draft for IOP for Protection of CSSS
2002	Amended BO on IOP
2002	Final EIS for IOP for Protection of CSSS
2002	ROD for IOP for Protection of CSSS
2003	8.5 SMA Plan 2nd ROD for Alternative 6D
2005	Final Revised GRR and Supplemental EIS for Tamiami Trail Modifications
2006	ROD for Tamiami Trail Modifications
2006	Draft Supplemental EIS for IOP for Protection of CSSS
2006	New BO on IOP
2006	Final Supplemental EIS for IOP for Protection of CSSS
2007	Design Modifications for C-111 Project EA and Engineering Documentation Report (EDR)
2007	Critical Habitat Revised Designations for the CSSS
2008	Tamiami Trail Modifications LRR/EA/Finding of No Significant Impact (FONSI)
2008	8.5 SMA S-357 Water Control Plan Draft EA
2009	Canal-111 Spreader Canal Project Implementation Report (PIR)
2009	Canal-111 Spreader Canal BO
2009	USACE Initiates Consultation on ERTP
2010	ERTP Biological Assessment (BA) and BO
2011	C-111 Spreader Canal Western Project Final EIS
2011	8.5 SMA Interim Operation Criteria EA
2011	8.5 SMA Design Refinement EA
2012	Expansion C-111 Detention Area EA
2012	ERTP Final EIS

Year	Milestone
2015	G-3273 Constraint Relaxation/S-356 Field Test & S-357N Operational Strategy EA
2016	Modifications to the C-111 South Dade NDA and SDA EA FONSI
2016	Modifications to the C-111 South Dade, L-31W EA
2016	C-111 South Dade Final Limited Reevaluation Report
2016	L-29 Canal and SDCS Temporary Emergency Deviation EA
2016	L-29 Canal and SDCS Temporary Emergency Deviation Supplemental EA
2016	S-344 Temporary Emergency Deviation EA
2017	G-3273 Constraint Relaxation/S-356 Field Test & S-357N Operational Strategy: Increment 1 Plus (Increment 1.1 and 1.2) Supplemental EA
2017	MWD to ENP: Removal of Unconstructed Conveyance and Seepage Control Features EA
2017	WCA-3A Planned Temporary Deviation EA
2017	WCA-2A Planned Temporary Deviation EA
2017	WCA-3A & SDCS Emergency Deviation and WCA-3A Planned Deviation EA
2018	L-29 Canal and G-3273 Constraint Relaxation (Revised Increment 2)

9 WATER MANAGEMENT

9.1 RESPONSIBILITIES AND ORGANIZATION

Section 208.10 of Title 33 of the Code of Federal Regulations (33 CFR § 208.10, included in Appendix D) requires that all structures and facilities constructed by the United States for local flood protection be continuously maintained and operated to obtain the maximum benefit of the project by an appropriate local entity. Section 208.11 of Title 33 of the Code of Federal Regulations (33 CFR § 208.11, included in Appendix D) prescribes the responsibilities and general procedures for regulating reservoir projects that are capable of flood control or navigation and the use of the storage allocated for such purposes. The intent of the regulation is to establish an understanding between project owners, operating agencies, and the USACE. All WCAs, ENP, ENP-SDCS components of the C&SF Project other than the S-10s, S-11s, S 12s, and S-355s are maintained and operated by the non-federal sponsor in accordance with 33 CFR § 208.10, 33 CFR § 208.11, and approved water management operating criteria (WCPs, POMs, SOMs) prescribed by the Secretary of the Army to ensure that congressionally authorized project purposes are met.

9.1.1 U.S. Army Corps of Engineers (USACE)

The USACE serves in an advisory capacity to the non-federal sponsor regarding the inspection, operation, regulation, maintenance, improvements or alterations to any of the structures or facilities associated with the WCAs, ENP, ENP-SDCS components of the C&SF Project. Under the terms of the local cooperation agreement, the non-federal sponsor (SFWMD, STOF) is required to "Maintain and operate all the completed works (C&SF Project features), and all the works that are completed in the future, in accordance with the regulations prescribed by the Secretary of the Army." The role of the USACE is to ensure that the non-federal sponsor (SFWMD, STOF) follows these regulations and that the WCAs, ENP, ENP-SDCS components of the C&SF Project are operated to meet the congressionally authorized project purposes.

The major outlets of the WCAs (S-10s, S-11s, S-12s) and the S-355s are operated by the USACE Jacksonville District Water Management Section. The USACE Jacksonville District Water Management Section also serves in an oversight and advisory capacity to the SFWMD and STOF during their implementation of the WCPs (Chapter 7 and Appendix G). The Jacksonville District is responsible for processing requests for deviation from normal operation (Section 7-10) and for transmitting deviation requests to the USACE South Atlantic Division for approval. The Jacksonville District is responsible for developing/updating this document and WCP (Chapter 7) and South Atlantic Division is responsible for providing approval of the document/water control plan. Communications and data transfer related to SFWMD or STOF water management decisions and activities shall be between the Jacksonville District Water Management Section and the SFWMD Office of Operations or the STOF Environmental Resource Management Department, respectively. A list of pertinent Jacksonville District Water Management Section staff positions is found in **Table 9-1**, shown on the next page.

TABLE 9-1: PERTINENT JACKSONVILLE DISTRICT WATER MANAGEMENT SECTION PERSONNEL

Position	Area of Responsibility	Phone Number
Jacksonville District Water Manager	Water Management – WCAs, ENP, ENP-SDCS	XXX-XXX-XXXX
Jacksonville District Water Control Data System Manager	Hydrometeorological Data - Data Transfer, Database Management	XXX-XXX-XXXX
Jacksonville District Chief, Water Management Section	Supervisor Water Management	XXX-XXX-XXXX

9.1.2 South Florida Water Management District (SFWMD)

As a non-federal sponsor of the C&SF Project, the SFWMD has the responsibility of operating and maintaining the majority of the water management features of the WCAs, ENP, ENP SDCS components of the C&SF Project. SFWMD is not responsible for the: S 10s, S 11s, S-12s, S 355s or those under the responsibility of the STOF. Day-to-day water management activities are determined by the SFWMD Office of Operations. Communications and data transfer relating to water management decisions and activities shall be between the SFWMD Office of Operations and the Jacksonville District Water Management Section. Pertinent SFWMD Office of Operations staff positions are listed in **Table 9-2**. The SFWMD Office of Operations is located at SFWMD Headquarters in West Palm Beach, Florida.

The SFWMD employs meteorologists who produce daily and weekly (7-day) quantitative precipitation forecasts (QPF) for locations within the WCAs, ENP, ENP-SDCS Project area. The forecasts as well as hydrometeorological data is made available via the internet. The SFWMD water managers use the SFWMD generated QPF, with consideration of NWS products, in the water management decision making process. The SFWMD meteorologists also monitor the tropics and evaluate tropical cyclone products issued by the National Hurricane Center (NHC) and the Weather Prediction Center (WPC). The meteorologists advise the SFWMD Operations Office of tropical systems which require enhanced monitoring over the next 120 hours as well as of specific tropical cyclones with the potential to bring tropical storm strength winds within the next 72 hours.

TABLE 9-2: PERTINENT SFWMD OFFICE OF OPERATIONS PERSONNEL

Position	Area of Responsibility	Phone Number
SFWMD, Office of Operations Chief	Supervisor - Water Management	XXX-XXX-XXX
SFWMD, Office of Operations Assistant Chief	Supervisor - Water Management	XXX-XXX-XXXX

SFWMD, Office of Operations Operations Control Center	Water Management	Via SFWMD Main Line: XXX-XXX-XXXX

9.1.3 Seminole Tribe of Florida (STOF)

As a non-federal sponsor of the C&SF Project, the STOF is a federally recognized tribe of Native Americans that has the responsibility of operating and maintaining the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration (SBC) Project water management features of the WCAs, ENP, ENP-SDCS components of the C&SF Project. Day to-day water management activities are determined by the STOF Environmental Resource Management Department. Communications and data transfer relating to water management decisions and activities shall be between the STOF Environmental Resource Management Department and the Jacksonville District Water Management Section. The Director of the STOF Environmental Resource Management Department is listed in **Table 9-3**. The STOF Environmental Resource Management Department is located in Hollywood, Florida.

TABLE 9-3: PERTINENT STOF ENVIRONMENTAL RESOURCE MANAGEMENT DEPARTMENT PERSONNEL

Position	Area of Responsibility	Phone Number
Director, Environmental Resource Management Department	Water Management	XXX XXX-XXXX

9.1.4 Other Federal Agencies

The NPS and the USFWS manage ENP and the LNWR, respectively. ENP and LNWR provide input to the Jacksonville District Water Management Section for use in the decision making process for proposed, ongoing, and future water management activities. Several other Federal agencies are indirectly involved within the WCAs, ENP, ENP-SDCS region or adjacent areas. These agencies include the: EPA, USGS, NOAA, Bureau of Indian Affairs, and Natural Resources Conservation Service (NRCS). The NWS is a part of NOAA and disseminates weather, water, and climate data, forecasts and warnings for locations within the WCAs, ENP, ENP-SDCS region as well as adjacent areas through the Miami Weather Forecast Office. The USGS disseminates various data including but not limited to hydrometeorological data for locations within the WCAs, ENP, ENP-SDCS region as well as adjacent areas through the Fort Lauderdale and Miami USGS Offices.

9.1.5 State and County Agencies

Other than the SFWMD, no other State or County agencies are responsible for operation or maintenance of the WCAs, ENP, ENP-SDCS components of the C&SF Project. However, other State or County agencies may have interest in the effects of the implemented water management

activities or may be responsible for aspects of the water resource or related flora and fauna. These State and County agencies may include but are not limited to: FDEP, FWC, Florida Department of Agriculture and Consumer Services (FDACS), and numerous local governments. These various agencies may provide input to the Jacksonville District Water Management Section for use in the decision making process for proposed, ongoing, or future water management activities.

9.1.6 Other Native American Tribes

The MTIF is a federally recognized tribe of Native Americans that occupy land within or near the WCAs, ENP, ENP-SDCS components of the C&SF Project. The MTIF is not responsible for operation or maintenance of the WCAs, ENP, ENP-SDCS components of the C&SF Project. However, they and the STOF may have interest in the effects of the implemented water management activities or may be responsible for aspects of the water resource or related flora and fauna. The MTIF and the STOF may provide input to the Jacksonville District Water Management Section for use in the decision making process for proposed, ongoing, or future water management activities.

9.1.7 Private Organizations

Private organizations are not responsible for operation or maintenance of any of the WCAs, ENP, ENP-SDCS components of the C&SF Project. Private organizations may provide input to the Jacksonville District Water Management Section for use in the decision making process for proposed, ongoing, or future water management activities.

9.2 INTERAGENCY COORDINATION

In addition to making water management related information available through the Internet or electronic data transfer, coordination may occur on an as needed basis between the Jacksonville District, SFWMD, or STOF and the press, community leaders, or Federal, State, County and local agencies. The frequency of coordination and content of water management related information presented is based upon the level of importance. High water or drought events are examples which would involve more active interagency coordination efforts with detailed, specific water management related information. There is also coordination between the Jacksonville District Water Management Section and the STOF as well as the MTIF. Specific coordination meetings are addressed in the COP AMMP (Appendix C in COP EIS).

9.2.1 Local Press and USACE Bulletins

Both the USACE Jacksonville District and SFWMD have a dedicated staff responsible for dissemination of water management related information to the public and other agencies through various means including the Internet, press releases, and regularly scheduled meetings with government agencies and the public. The Jacksonville District Water Management Section may also provide for similar dissemination of any water management related information related to water management activities throughout the WCAs, ENP, ENP-SDCS components of the C&SF Project, as appropriate. Depending upon the subject matter, coordination between the non-

federal sponsors (SFWMD, STOF), other Federal agencies (ENP, USFWS, USGS, NWS, etc.) and the USACE may occur to ensure consistent information is presented.

9.2.2 National Weather Service (NWS)

Through the Miami Weather Forecast Office and the NHC, the NWS is the federal agency responsible for making precipitation and other weather related forecasts for locations within the WCAs, ENP, ENP-SDCS Project area. The NWS makes regional and local weather related forecasts as well as regional hydrometeorological data available to the USACE, SFWMD, and STOF through the Internet. Coordination of water management related information and hydrometeorological data for the WCAs, ENP, ENP-SDCS components of the C&SF Project occurs between the NWS and the USACE as well as the SFWMD and STOF on an as needed basis.

9.2.3 U.S. Geological Survey (USGS)

The USGS utilizes the Internet and electronic data transfer to provide and retrieve water management related data. The data reporting procedure between USACE and USGS is described in Chapter 5. Coordination of water management related information and hydrometeorological data occurs between the USGS and the USACE as well as USGS and SFWMD on an as needed basis.

9.2.4 Power Marketing Agency

This subsection is not applicable to the WCAs, ENP, ENP-SDCS components of the C&SF Project.

9.2.5 Other Federal, State, and Local Agencies

Jacksonville District Water Management Section, SFWMD, and STOF coordinate with many agencies to ensure that the WCAs, ENP, ENP-SDCS C&SF Project congressionally authorized project purposes are met. In addition, periodic discussions occur between the Jacksonville District Water Management Section, the non-federal sponsors, and the various stakeholders within and adjacent to the region potentially affected by water management activities associated with the WCAs, ENP, ENP-SDCS components of the C&SF Project. These agencies may include but are not limited to the: ENP, USFWS, EPA, NOAA, FDEP, and FWC.

9.3 INTERAGENCY AGREEMENTS

The MTIF and the STOF, are federally recognized tribes that have land within the WCAs, ENP, ENP-SDCS region of the C&SF Project. The STOF, the state, and SFWMD entered into an agreement, the 1987 Water Rights Compact Among The Seminole Tribe of Florida, The State of Florida And The South Florida Water Management District, which follows the provisions of substantive Florida water law. The Water Rights Compact is the sole source of regulation of water resources on STOF lands. Through a Memorandum of Agreement, the MTIF and SFWMD have obligated themselves to structuring and implementing a comprehensive Water Rights Compact governing state/tribal cooperative water management.

The USGS, through the Cooperative Streamgaging Program, also performs operation and maintenance at various gage locations within the WCAs, ENP, ENP-SDCS region as well as adjacent areas on behalf of the Jacksonville District Water Management Section. As part of the Program, USGS conducts gage maintenance, streamflow measurements, as well as hydrometeorological data collection and dissemination to support water management activities within the WCAs, ENP, ENP-SDCS region.

9.4 COMMISSIONS, RIVER AUTHORITIES, COMPACTS, AND COMMITTEES

This subsection is not applicable to the WCAs, ENP, ENP-SDCS components of the C&SF Project.

9.5 NON-FEDERAL HYDROPOWER

This subsection is not applicable to the WCAs, ENP, ENP-SDCS components of the C&SF Project.

9.6 REPORTS

The reporting of hydrometeorological data and information that affects water management activities in the WCAs, ENP, ENP-SDCS components of the C&SF Project occurs through several different forms. These reports are produced by the SFWMD, USACE, NWS, NHC, as well as USGS and typically are accessible through the Internet. A sample of available reports is listed in **Table 9-4**, shown on the next page.

TABLE 9-4: HYDROMETEOROLOGICAL REPORTS

Title	Agency	Contents
SAJ Water Management Daily Report	USACE	Hydrometeorological Conditions Pertinent to the C&SF Project
WCAs, ENP, ENP-SDCS Morning Report	USACE	Daily Water Stages
C&SF Project Status Update	USACE	Daily Operations Update for the C&SF
SDCS Status Update	USACE	Daily Operations Update for the South Dade Conveyance System
National Drought Mitigation Center U.S. Drought Monitor	NDMC	Weekly Drought Information
NHC Graphical Tropical Weather Outlook	NHC	Active Tropical Weather Information
Drought Severity Index	NWS	Palmer Drought Index
U.S. Quantitative Precipitation Forecast	NWS	5 and 7-day Quantitative Precipitation Forecast
U.S. Monthly & Seasonal Outlooks	NWS	Long Range Weather Forecast
USGS Water Data for Florida	USGS	Water Resources Data collected throughout Florida
Current Weather Conditions Radar Loop	SFWMD	Hydrometeorological Data
SFWMD Daily QPF	SFWMD	Daily Quantitative Precipitation Forecasts
SFWMD Monthly Historical Rainfall	SFWMD	Monthly Historical Rainfall Maps
SFWMD Real-Time Site Status Reports	SFWMD	Real-time Water Levels and Flow Volumes for Water Control Structures throughout the SFWMD Water Management System
DBHYDRO	SFWMD	Hydrologic, Meteorologic, Hydrogeologic, and Water Quality Data
South Florida Environmental Report (SFER)	SFWMD	Annual Report Documenting Restoration scientific and engineering accomplishments in the Kissimmee Basin, Lake Okeechobee, Everglades, and South Florida coastal areas.

This page intentionally left blank.

DRAFT

SYSTEM OPERATING MANUAL

VOLUME 4

WATER CONSERVATION AREAS,

EVERGLADES NATIONAL PARK,

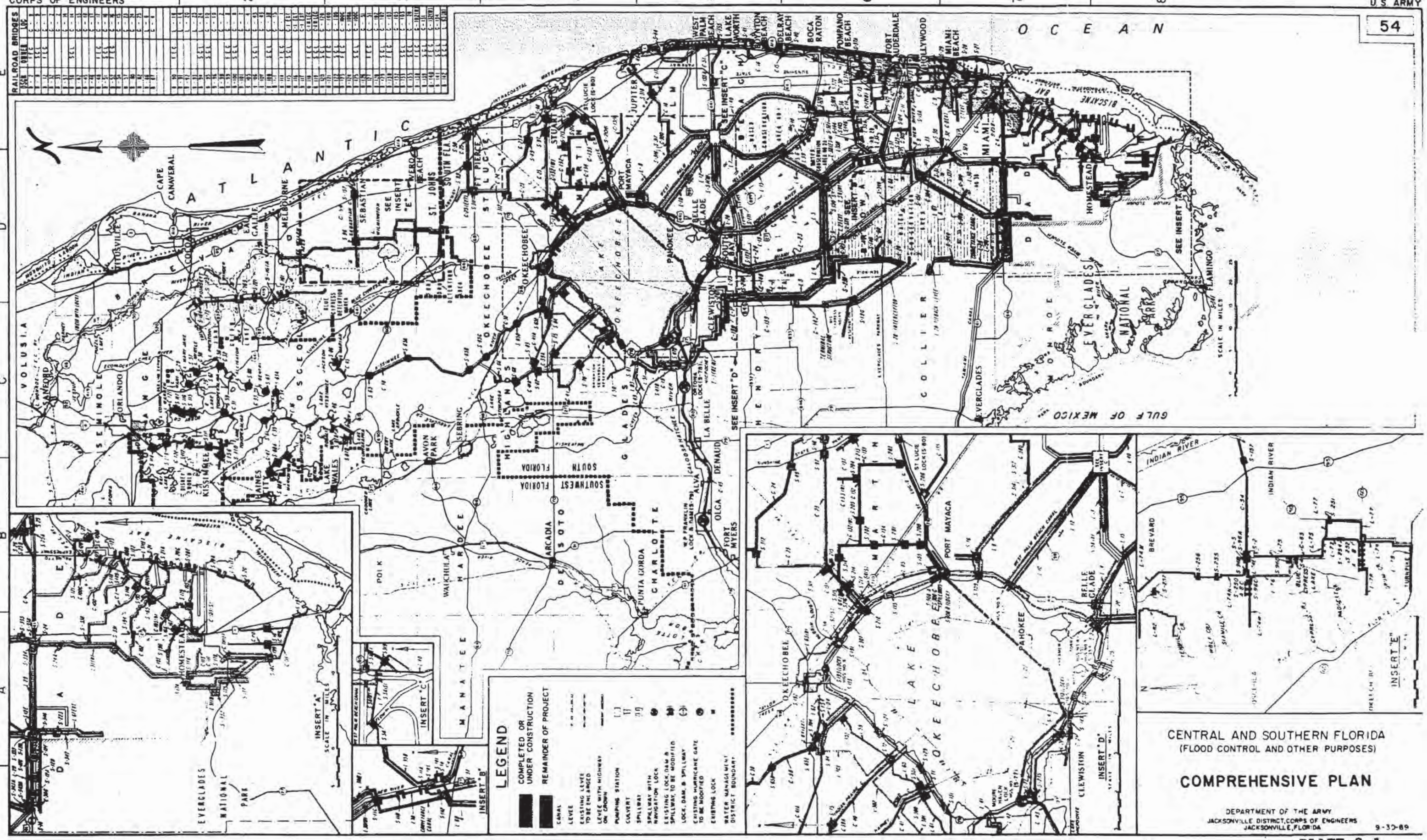
AND ENP-SOUTH DADE CONVEYANCE SYSTEM

PLATES

JACKSONVILLE DISTRICT

U.S. ARMY CORPS OF ENGINEERS

JANUARY 2020



CENTRAL AND SOUTHERN FLORIDA
(FLOOD CONTROL AND OTHER PURPOSES)

COMPREHENSIVE PLAN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
9-30-69

PLATE 2-1

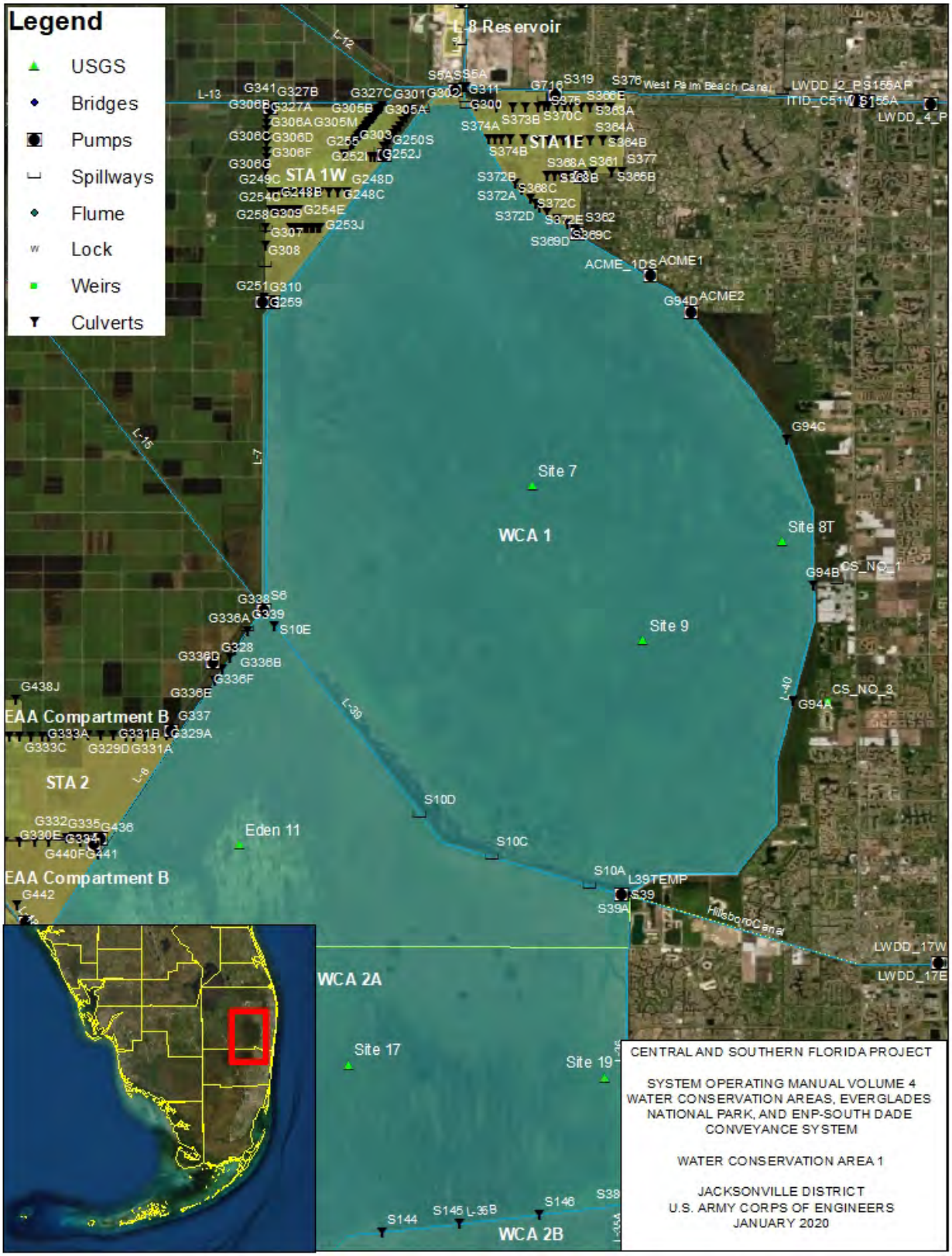

Legend
USGS
Bridges
Pumps
Spillways
Flume
Lock
Weirs
Culverts
L-8 Reservoir
STA 1W
STA 1E
WCA 1
WCA 2A
WCA 2B
STA 2
EAA Compartment B
EAA Compartment B
West Palm Beach Canal
Hillsboro Canal
Site 7
Site 8T
Site 9
Eden 11
Site 17
Site 19
ACME1
ACME2
CS_NO_1
CS_NO_3
L39TEMP
LWDD_17W
LWDD_17E
CENTRAL AND SOUTHERN FLORIDA PROJECT
SYSTEM OPERATING MANUAL VOLUME 4
WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM
WATER CONSERVATION AREA 1
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

PLATE 2-2

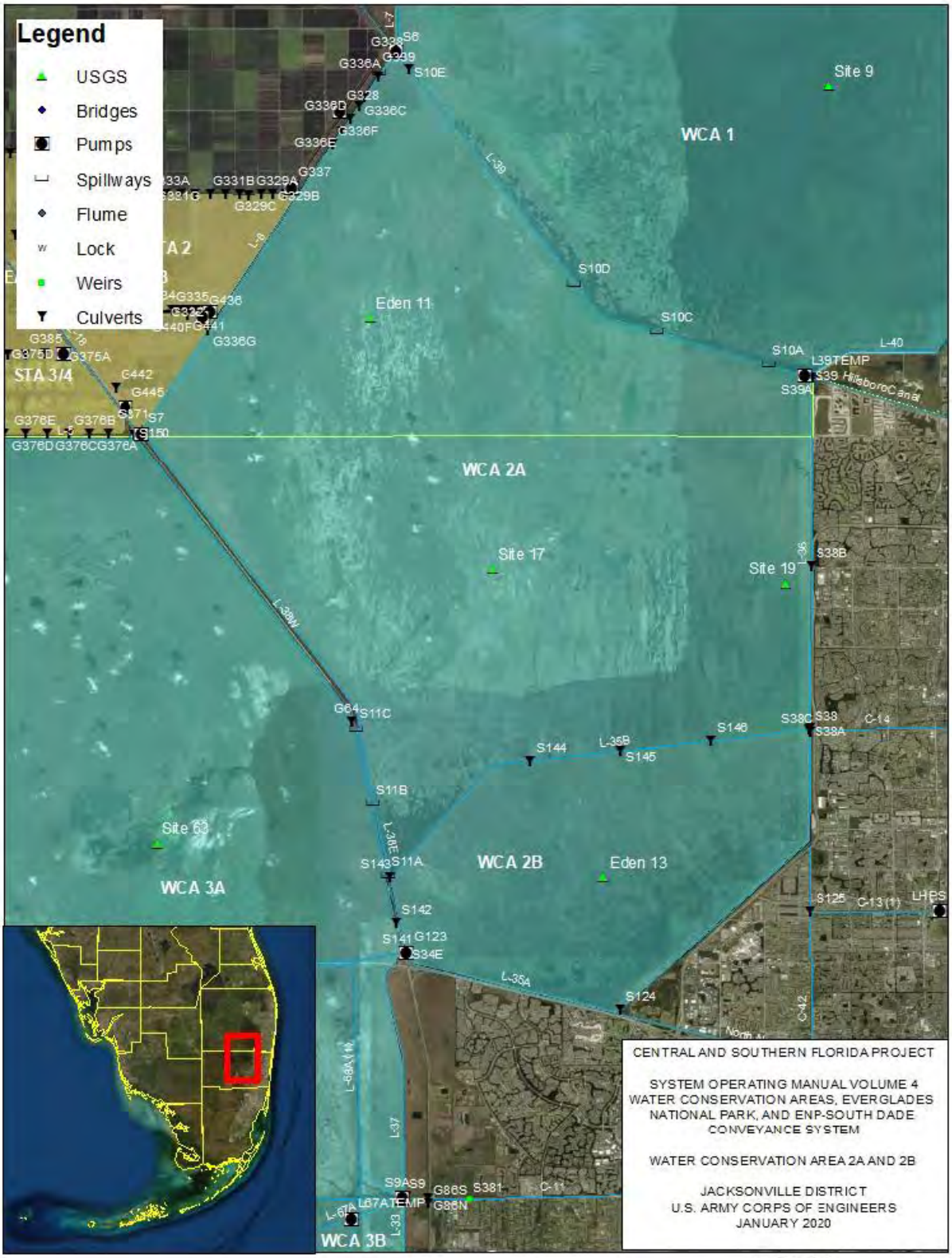

Legend
USGS
Bridges
Pumps
Spillways
Flume
Lock
Weirs
Culverts
WCA 1
WCA 2A
WCA 2B
WCA 3A
WCA 3B
STA 3/4
Site 9
Eden 11
Site 17
Site 19
Site 63
Eden 13
L-39
L-40
L-7
L-8
L-38W
L-38E
L-35B
L-35A
L-36
L-37
L-33
L-67A
L-67A(1)
C-14
C-13(1)
C-11
C-42
Hillsboro Canal
S10E
S10D
S10C
S10A
S39
S39A
S38B
S38C
S38
S38A
S146
S144
S145
S11C
S11B
S11A
S143
S142
S141
G123
S34E
S124
S125
LHPS
S9A
S9
G86S
S381
G86N
L67ATEMP
L39TEMP
G64
G336A
G339
G338
G336D
G328
G336C
G336F
G336E
G337
G331B
G329A
G329B
G329C
G335
G436
G441
G336G
G385
G375D
G375A
G442
G445
G371
S7
S150
G376E
G376B
G376D
G376C
G376A
CENTRAL AND SOUTHERN FLORIDA PROJECT
SYSTEM OPERATING MANUAL VOLUME 4
WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM
WATER CONSERVATION AREA 2A AND 2B
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

PLATE 2-3

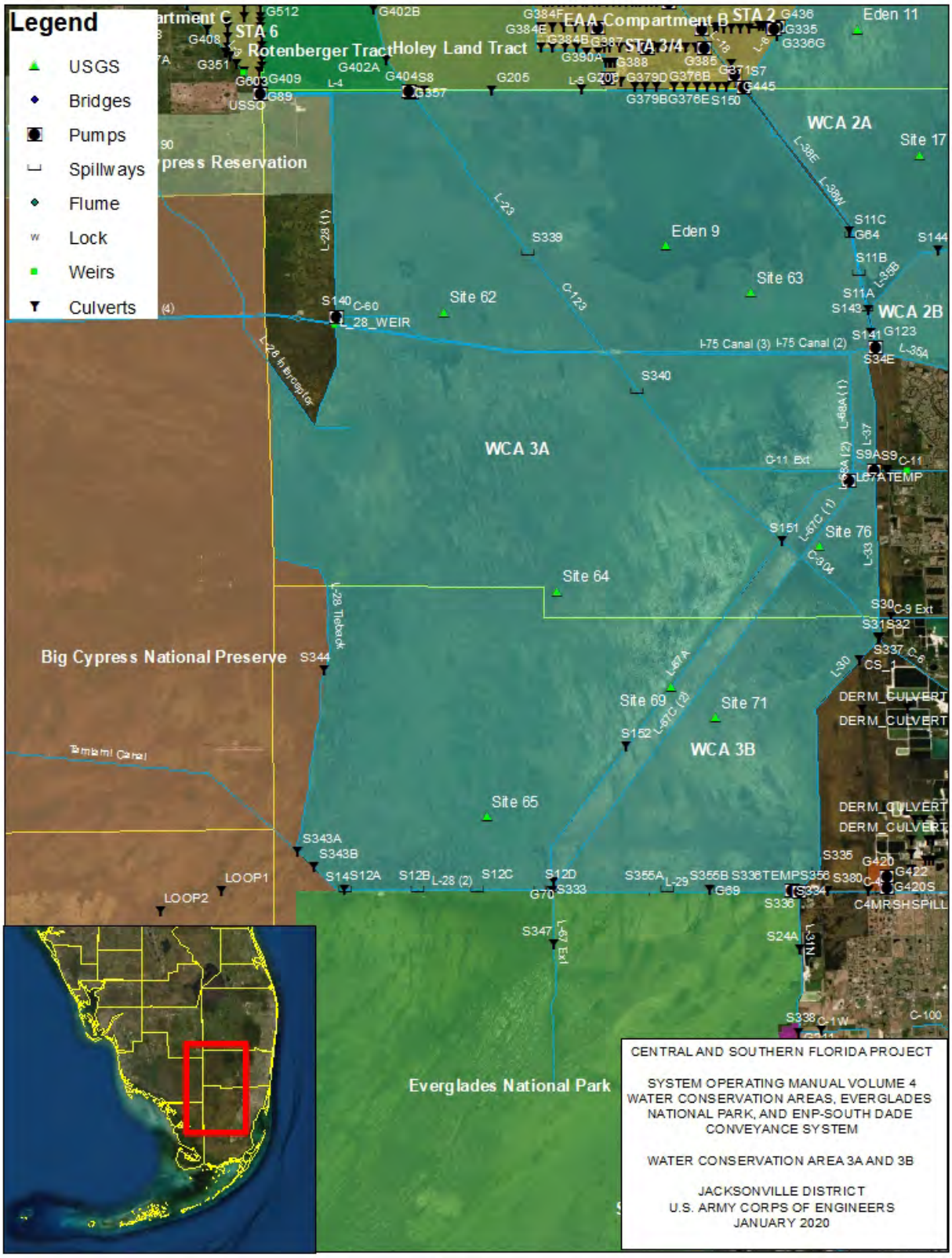

Legend
USGS
Bridges
Pumps
Spillways
Flume
Lock
Weirs
Culverts
STA 6
Rotenberger Tract
Holey Land Tract
EAA Compartment B
STA 2
STA 3/4
Eden 11
WCA 2A
Site 17
Eden 9
Site 63
Site 62
WCA 2B
WCA 3A
Site 76
Site 64
Big Cypress National Preserve
Site 69
Site 71
WCA 3B
Site 65
Everglades National Park
I-75 Canal (3)
I-75 Canal (2)
Tamiami Canal
C-11 Ext
DERM_CULVERT
CENTRAL AND SOUTHERN FLORIDA PROJECT
SYSTEM OPERATING MANUAL VOLUME 4
WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM
WATER CONSERVATION AREA 3A AND 3B
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

PLATE 2-4

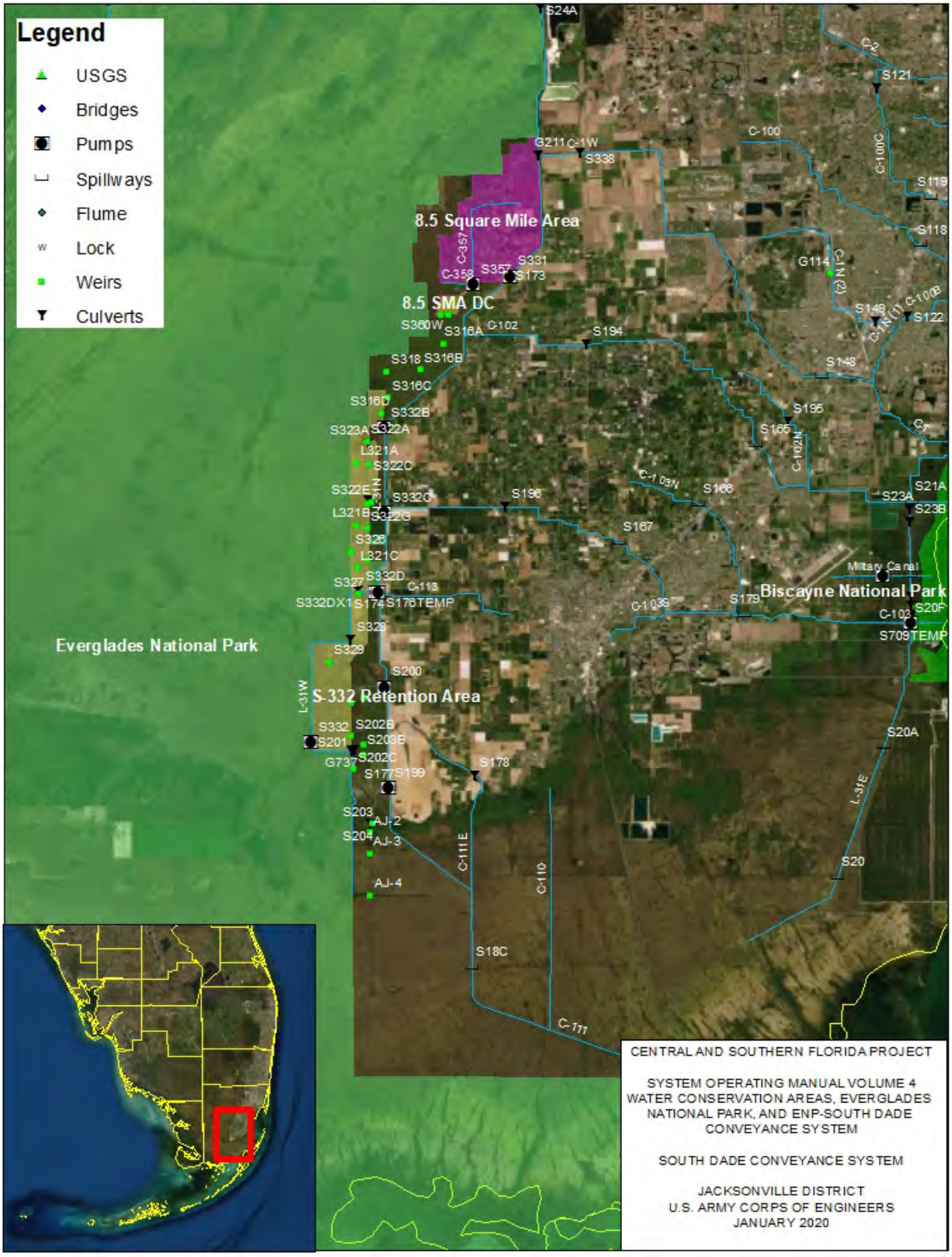

Legend
USGS
Bridges
Pumps
Spillways
Flume
Lock
Weirs
Culverts
8.5 Square Mile Area
8.5 SMA DC
S-332 Retention Area
Everglades National Park
Biscayne National Park
Military Canal
S24A
S121
C-100
C-100C
S119
S118
G211
C-1W
S338
C-357
C-358
S357
S331
S173
G114
C-1N (2)
S149
C-100B
S122
S360W
S316A
C-102
S194
S318
S316B
S148
S316C
S316D
S332B
S195
S323A
S322A
S165
C-102N
L321A
S322C
C-103N
S166
S322E
S321N
S332C
S196
S21A
S23A
L321B
S322G
S23B
S326
S167
L321C
S332D
S327
C-113
S332DX1
S174
S176TEMP
C-103S
S179
S20F
C-103
S709TEMP
S328
S329
S200
L-31W
S332
S202B
S201
S203B
S20A
G737
S202C
S177
S199
S178
L-31E
S203
AJ-2
S204
AJ-3
C-111E
C-110
S20
AJ-4
S18C
C-111
CENTRAL AND SOUTHERN FLORIDA PROJECT
SYSTEM OPERATING MANUAL VOLUME 4
WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM
SOUTH DADE CONVEYANCE SYSTEM
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

PLATE 2-5

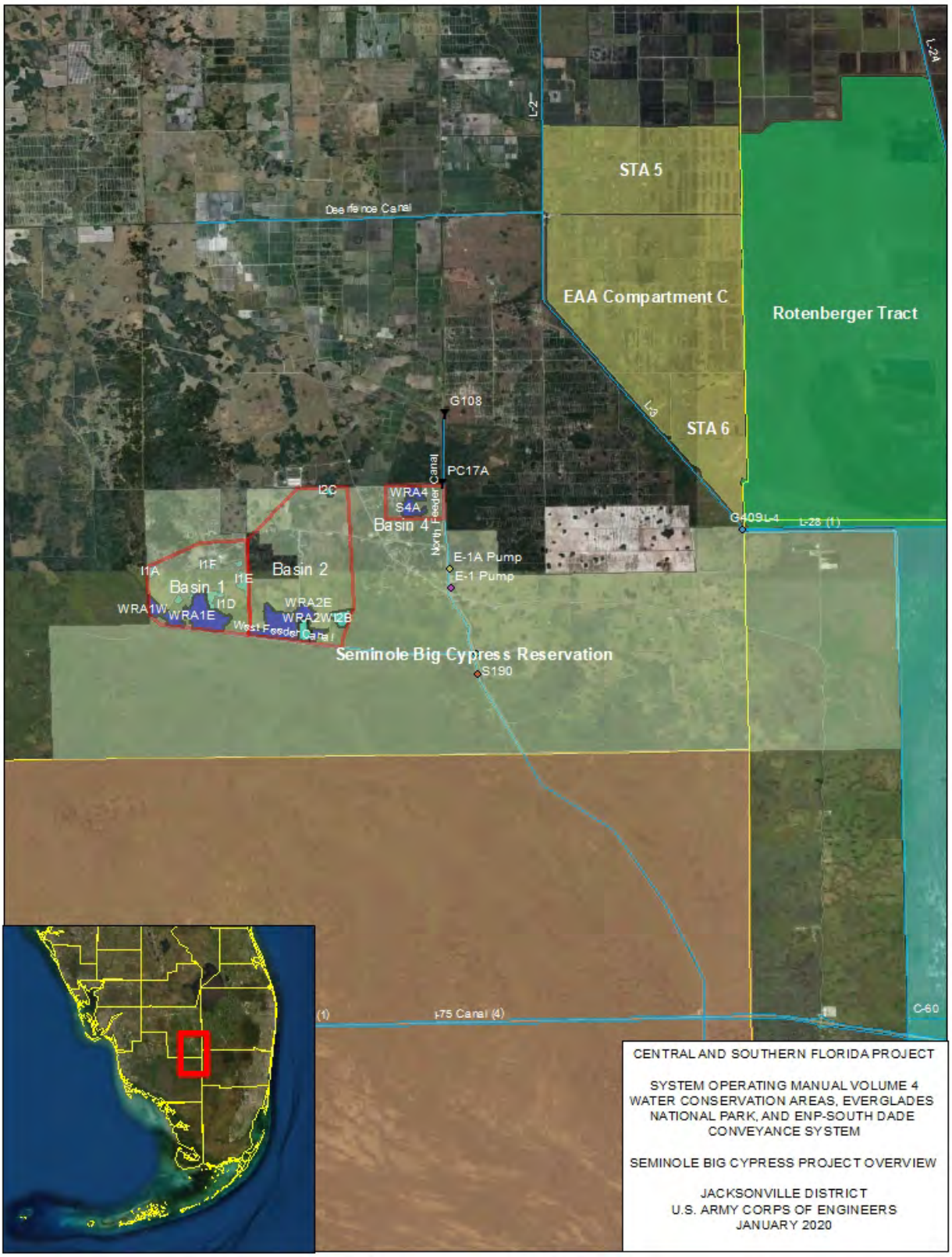

STA 5
EAA Compartment C
Rotenberger Tract
STA 6
Deer Fence Canal
L-2
L-3
L-28
G108
PC17A
North Feeder Canal
WRA4
S4A
Basin 4
I2C
Basin 2
I1A
I1F
I1E
Basin 1
I1D
WRA1W
WRA1E
WRA2E
WRA2W
I2B
West Feeder Canal
E-1A Pump
E-1 Pump
G409
L-4
L-28 (1)
Seminole Big Cypress Reservation
S190
(1)
I-75 Canal (4)
C-60
CENTRAL AND SOUTHERN FLORIDA PROJECT
SYSTEM OPERATING MANUAL VOLUME 4
WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM
SEMINOLE BIG CYPRESS PROJECT OVERVIEW
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

PLATE 2-6

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDICES

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

This page intentionally left blank

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX A

STRUCTURE DESCRIPTIONS

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

S-34E - STRUCTURE [NAVD88 = NGVD29 + (-1.49)]

S-34E is located in the North New River Canal, where the L38E canal meets the L35 canal, just northeast of the I-75 and US-27 intersection in west Broward County. This area is formerly known as Andy town, FL.

PURPOSE

This structure permits release of water from Conservation Area 2A or 3A to supply water needs along the North New River Canal during the dry season. It also can be used to discharge excess water from Conservation Area 2A, 3A and/or 2B when capacity is available in the North New River Canal and when the water is not needed in Conservation Area 3.

OPERATION

Note: All elevations reference National Geodetic Vertical Datum (NGVD), 1929. This structure is manually operated under either flood or normal conditions. The structure is operated together with S-141, S-142 or S-143.

Flood Conditions

The gates of this structure are opened whenever:

1. Excess storage is present in Conservation Area 2A and/or 2B prior to hurricane season; that is, when the stage in Conservation Area 2A is above the Regulation Schedule.
2. The excess water in Conservation Area 2A is not needed in Conservation Area 3.
3. The tailwater elevation will not exceed 6.0 feet.
4. Water Conservation Area 3A is above the regulation schedule.

NORMAL CONDITIONS

When operations are not required under Flood Conditions, releases shall be made, as necessary, to supply downstream water requirements so as to maintain an optimum stage at Sewell's Lock, between elevation 3.5 and 4.5.

S-39A –STRUCTURE [NAVD88 = NGVD29 - 1.53 FEET]

DESCRIPTION

The structure is a rectangular double-barrel, 10 feet wide x 8 feet high reinforced-concrete, gated culvert, located in southern Palm Beach County at the northern end of the L-36 borrow canal near its junction with the Hillsboro Canal. S-39A is adjacent to Water Conservation Areas (WCA) 1 and 2A. The structure replaced a deteriorated three-barrel, 72-inch diameter corrugated metal pipe culvert with flashboards mounted on a steel frame.

S-39A gates can either be remotely operated from the SFWMD Operation Control Center or controlled on-site. The structure is currently maintained by the West Palm Beach Field Station.

PURPOSE

The S-39A structure, together with water control structure S-38B, controls the seepage rate from WCA-2A by regulating the water level in the north half of the L-36 borrow canal. S-39A also passes discharges from North Springs Improvement District (NSID) to the Hillsboro Canal and ultimately to tide via G-56. The size of the structure was increased to better accommodate flow from NSID.

OPERATION

Normally the structure will operate to maintain a stage range which moderates seepage from WCA-2A and will open to release excess water arising from seepage or NSID discharges or a combination of both.
The stage range maintained will consider the NSID's L-36 stage limits for pumping into the L-36 and the availability of water. Based on the operational range of 7.5/7.0 feet NGVD29 in the Master Water Control Manual Volume 4, the lowest range for normal operations will be 7.5/7.0 feet NGVD29. The range may be raised if analysis indicates that the higher range will not impact NSID pumping. Based on the expected state in the Hillsboro Canal, the stage may be raised one foot (8.5/8.0 feet NGVD29) without impacting NSID. During tropical events, automatic control can be turned off and the gate left fully open.

DRAFT

DRAFT

STRUCTURE 141

This structure is a sheet pile overflow section in Levee 38E located at the southwest corner of Conservation Area No. 2B, about 20 miles west of Fort Lauderdale, at Andytown. Control is effected by timber flash boards set in the six bays of the structure.

PURPOSE

This structure affords the sole means of releasing water from Conservation Area 2B. It discharges into the North New River Canal between S-143 and S-34. It can be used to discharge excess water from Conservation Area 2B when capacity is available in the North New River Canal.

OPERATION

S-150 – CONTROL STRUCTURE [NAVD88 = NGVD29-1.46]

DESCRIPTION

The original five-barrel corrugated metal pipe (CMP) culvert, connecting L-5 Canal to L-38W Canal on the northeast perimeter of Water Conservation Area 3A (WCA-3A) and along the county lines of Palm Beach and Broward County, was replaced. The new structure is a (3) three-barrel cast-in-place reinforced concrete box culvert with automatically operated single leaf slide gates on the upstream of the structure. The gate can be controlled by either the on-site control or remotely from the SFWMD Operation Control Center. The new S-150 structure was commissioned in April 2015. The structure is currently maintained by the Ft. Lauderdale Field Station.

PURPOSE

This structure, together with S-8 Pump station, permits release of water from Lake Okeechobee and the agricultural area south of the lake, and Stormwater Treatment Area (STA) 3/4 into WCA-3A. S-150 functions in this capacity only under gravity conditions (headwater elevation exceeds the tailwater).

OPERATION

DRAFT

S-194 – CONTROL STRUCTURE [NAVD88 = NGVD29 - 1.55 FEET]

DESCRIPTION

This structure was a double-barreled reinforced concrete pipe culvert with manually operated sluice gates that was replaced in 2019. The replacement structure has two concrete box culverts, located on C-102 (Princeton) Canal west of Krome Avenue (SR 997), about 6 miles upstream from S-165 and 7 miles north of Homestead. Control is effected by remotely controlled dual-leaf slide gates mounted on a reinforced concrete structure.

PURPOSE

This structure operates as a drainage divide and controls stages in C-102 to the west. It is sized to convey either water supply or excess water from the L-31N Canal to the east when capacity is available.

OPERATION

DRAFT

S-197 – STRUCTURE [NAVD88 = NGVD29 - 1.55 FEET]

DESCRIPTION

Structure S-197 is a four (4) barrel cast-in-place concrete box culvert located upstream of the mouth of the C-111 Canal about 3 miles from the shore of Manatee Bay and 750 ft east of U.S. Highway 1 in Southern Miami-Dade County. Flow through the culvert is controlled by vertical slide gates. The gates are manually operated by the Homestead field station (remote and local automatic control is being added to this structure and should be completed before the 2020 wet season).

The structure was originally built in 1969 by the COE with three (3) gates. In 1980, ten (10) additional culverts were constructed to increase the total design capacity to 2,400 cfs. In 2012, the structure was replaced with a four-barrel box culvert. The design capacity of the replaced structure remains at 2,400 cfs.

PURPOSE

The S-197 releases water to tide through the C-111 outlet, maintains optimum water control stages upstream in the C-111 Canal, prevents saltwater intrusion during high tides and blocks reverse flow during storm surges. This structure usually remains closed to divert discharges from S-18C overland to the panhandle of the Everglades National Park (ENP). S-197 is opened for flood control when the overland flow capacity, with S-197 closed, is insufficient. The testing of small releases (e.g. 400 cfs or less) while holding the C-111 stages high enough to maintain overland flow to the ENP pan handle was initiated with the Increment 1 Test (2015).

OPERATIONS

DRAFT

S-332B – PUMP STATION [NAVD88 = NGVD29 - 1.57 FEET]

DESCRIPTION

S-332B is a five-unit pump station with a design capacity of 575 cfs. It is equipped with four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pump with flap gates on downstream (discharge) side. The structure is located on the west bank of the L-31N, in Miami-Dade County.
Construction of S-332B began on January 29, 2000 and was completed on April 12, 2000. This is a pump station authorized by the USACE. This structure is currently maintained by the Homestead Field Station.

PURPOSE

The S-332B, S-332C, and S-332D pump stations along with the S-176 gated spillway, are operated to maintain the L-31N Canal reach between S-331 and S-176 in accordance with Increment 2.0 (Appendix A, Part 1). S-332B is a component of the Modified Water Delivery (MDW) to Everglades National Park (ENP) project, which is used to manage increased seepage anticipated from increased deliveries to ENP as a result of the MWD to ENP project.

OPERATION

DRAFT

S-332C – PUMP STATION [NAVD88 = NGVD29 - 1.55 FEET]

DESCRIPTION

S-332C is a five-unit pump station with a design capacity of 575 cfs. It is equipped with four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pump with flap gates on downstream (discharge) side. The structure is located on the west bank of the L-31N, in Miami-Dade County.
S-332C detention area and a connector cell was completed in 2003. The hydraulic design parameters for the S-332C pump station are the same as the S-332B pump station. This structure is currently maintained by the Homestead Field Station.

PURPOSE

S-332C discharges into the middle section of the South Detention Area (SDA). The S-332B, S-332C, and S-332D pump stations along with the S-176 gated spillway, are operated to maintain the L-31N Canal reach between S-331 and S-176 in accordance with Increment 2.0 (Appendix A, Part 1). S-332C is a component of the Modified Water Delivery (MDW) to Everglades National Park (ENP) project, which is used to manage increased seepage anticipated from increased deliveries to ENP as a result of the MWD to ENP project.

OPERATION

DRAFT

S-332D – PUMP STATION [NAVD88 = NGVD29 - 1.55 FEET]

DESCRIPTION

S-332D is a five-unit pumping station with a design capacity of 575 cfs. It is equipped with four (4) 125 cfs diesel engine-driven pumps, and one (1) 75 cfs electric motor driven pumps with flap gates on downstream (discharge) side. The structure is located is located at the junction of the L-31N and the L-31W canal, near the S-176 gated spillway, about 5 miles west of Homestead. Construction of S-332D was completed in December 1997 and the SFWMD began operating it in July of 2000. The pump station is currently maintained by the Homestead Field Station.

PURPOSE

The primary purpose for the S-332D station is to pump water from the L-31N canal, upstream of S-176, into a S-332D Detention Area to facilitate flows to Florida Bay via Taylor Slough.
S-332D is a component of the Modified Water Delivery (MDW) to Everglades National Park (ENP) project, which will be used to manage increased seepage anticipated from increased deliveries to ENP as a result of full implementation of the MWD to ENP project. The S-332B, S-332C, and S-332D pump stations along with the S-176 gated spillway, are operated to maintain the L-31N Canal reach between S-331 and S-176 in accordance with Increment 2.0 (Appendix A, Part 1).

OPERATION

DRAFT

S-333N SPILLWAY [NAVD88 = NGVD29 + (-1.54)]

DESCRIPTION

The S-333N structure is a two-bay, reinforced concrete, gated spillway, located adjacent to existing S-333 structure at the intersection of the L-67A and L-29 Canals in the Miami-Dade County. The structure consists of two (2) 14.6 feet high and 14.0 feet wide gates with sill elevations of -3.06 feet NGVD29. The discharge from the structure is controlled by two (2) cable operated, vertical lift roller gates, operated remotely through District telemetry or with local control.

The structure allows the District to more efficiently and effectively convey surface water from the L-67A to L-29 Canal, where it will be able to flow south, under Tamiami Trail (US41) and through the bridges and into the Everglades National Park's (ENP) Northeast Shark River Slough (NESRS). The S-333N can also supply water to S-334.

PURPOSE

The purpose of the S-333N structure is to provide additional operational flexibility by increasing the available discharge capacity from Water Conservation Area 3A (WCA-3A) to the NESRS. S-333N can convey an additional 1,150 cfs flow along with S-333 (1,350 cfs design capacity) to provide a combined design capacity of 2,500 cfs from Water Conservation Area 3A (WCA-3A) to NESRS.

OPERATIONS

DRAFT

S-344 – CONTROL STRUCTURE [NAVD88 = NGVD29 - 1.48 FEET]

DESCRIPTION

S-344 is a two (2) barrel aluminum gated culvert with risers and is located about 9.0 miles north of U.S. Highway 41 (Tamiami Trail), in the northwest part of Miami-Dade County. The structure is located on the L-28 canal in the south-west corner of Water Conservation Area 3A (WCA-3A). The structure receives water from WCA-3A and discharges to the L-28 canal in the Big Cypress National Preserve (BCNP), which ultimately outlets to Everglades National Park (ENP) further south. The original gated CMP culvert built in 1963 was replaced by an in-kind gated pipe culvert with risers by the South Florida Water Management District (SFWMD) in March 2018. The structure is operated and maintained by the SFWMD Miami Field Station.

The structure is controlled by two (2) 6.0 feet (H) x 8.0 feet (W) vertical slide gates. In addition, there are wooden extension boards on top of the gates to prevent overtopping.

PURPOSE

S-344 permits discharge from WCA-3A during periods of excessively high stages and extends the hydroperiod in the BCNP during dry periods.

OPERATION

DRAFT

DRAFT

STRUCTURE S-356 – [NAVD = NGVD - 1.56 FEET]

Structure S-356 is a pump station consisting of four (4) diesel engine-driven pumps and is located along L-29 Canal (Tamiami Canal) adjacent to the S-334 gated spillway, in Miami Dade County. The original structure was constructed in June 2002 by the United States Army Corps of Engineers (USACE), which was transferred to the South Florida Water Management District (SFWMD) in August 2017. The pump station is currently maintained by the Miami Field Station. It consists of a platform with four pumps, four discharge pipes, an outlet structure, and a control house. Each discharge pipe is approximately 300 feet long and they are located west of the station. Each pipe is 48-inches in diameter and is made of steel. The pump collects water from the confluence of the L-30 and L-31N Canals, east of the S-356 structure and discharges into the L-29 Canal, west of the S-356 structure.

PURPOSE

The pump station is intended to manage water stages in the L-31N and L-30 Canals between S-334 and G-211. It is a component of the Modified Water Delivery (MDW) to Everglades National Park (ENP) project, which will increase deliveries to ENP once the project is fully implemented.

OPERATION

DRAFT

STRUCTURE S-357N – [NAVD = NGVD - 1.56 FEET]

Structure S-357N is a three (3) barrel High Density Polyethylene (HDPE), circular gated structure located on the C-358 seepage collection canal, which is just south and runs parallel to Richmond Drive. It is upstream of the S-357 Pump Station and immediately west of the intersection of C-357 and C-358 canals in the southern end of 8.5 Square Mile Area (8.5 SMA) in Miami-Dade County. Each pipe is 7.0 feet in diameter and is equipped with tie-down anchor blocks, handrails, access hatch and lightning protection system. The control structure consists of three manually operated double leaf slide gate systems which were designed to accommodate variable flow regimes: (1) weir flows by lowering the top gate; (2) orifice flows by raising the lower gate; or (3) submerged or un-submerged, uncontrolled flows by raising both the top and bottom gates above the top (crown) of the culvert.

The construction of the structure was completed in March 2018 by the US Army Corps of Engineers. the operation and maintenance responsibilities of the structure is expected to be handed over to the SFWMD In April 2018.

The culvert is located at the southern end of 8.5 SMA, east of Everglades National Park, and is an important component of 8.5 SMA Flood Mitigation Plan due to increased waterflows and stages in Northeast Shark River Slough (NESRS), as a result of the Modified Water Deliveries (MWD) to the Everglades National Park (ENP) project.

PURPOSE

The S-357N control structure hydraulically connects the C-358 Seepage Canal to the C-357 Canal in order to provide flood mitigation for 8.5 SMA by discharging groundwater inflows from the southwest corner of 8.5 SMA into the upstream side of S-357 pump station via C-358, which is then pumped south by the S-357 pump station to a flow way leading to L-359 Detention area.

OPERATION

EXHIBIT A

TABLE OF CONTENTS

WATER CONSERVATION AREAS - EVERGLADES NATIONAL PARK - ENP-SOUTH DADE CONVEYANCE SYSTEM STRUCTURES

Structure	Description	Page No.	Pertinant Data Page No.
S-5A	Pumping Station	A-S5A-1	A-S5A-3
S-5A(S)	Spillway	A-S5A(S)-1	A-S5A(S)-2
S-5A(E)	Culvert	A-S5A(E)-1	A-S5A(E)-2
S-5A(W)	Culvert	A-S5A(W)-1	A-S5A(W)-2
S-6	Pumping Station	A-S6-1	A-S6-3
S-7	Pumping Station	A-S7-1	A-S7-4
S-8	Pumping Station	A-S8-1	A-S8-4
S-9	Pumping Station	A-S9-1	A-S9-3
S-9A	Pumping Station	A-S9A-1	A-S9A-1
S-10A	Spillway	A-S10A-1	A-S10A-3
S-10C	Spillway	A-S10C-1	A-S10C-3
S-10D	Spillway	A-S10D-1	A-S10D-3
S-10E	Culvert	A-S10E-1	A-S10E-2
S-11A	Spillway	A-S11A-1	A-S11A-3
S-11B	Spillway	A-S11B-1	A-S11B-3
S-11C	Spillway	A-S11C-1	A-S11C-3
S-12A	Spillway	A-S12A-1	A-S12A-3
S-12B	Spillway	A-S12B-1	A-S12B-3
S-12C	Spillway	A-S12C-1	A-S12C-3
S-12D	Spillway	A-S12D-1	A-S12D-3
S-12E	Culvert	A-S12E-1	A-S12E-2
S-14	Culvert	A-S14-1	A-S14-2
S-18	Spillway	A-S18-1	A-S18-2
S-18C	Spillway	A-S18C-1	A-S18C-2
S-24	Culvert	A-S24-1	A-S24-2
S-24A	Culvert	A-S24A-1	A-S24A-2
S-31	Culvert	A-S31-1	A-S31-2
S-32	Culvert	A-S32-1	A-S32-2
S-32A	Culvert	A-S32A-1	A-S32A-2
S-34	Culvert	A-S34-1	A-S34-2
S-38	Culvert	A-S38-1	A-S38-2
S-38A	Culvert	A-S38A-1	A-S38A-2
S-38B	Culvert	A-S38B-1	A-S38B-2
S-39	Spillway	A-S39-1	A-S39-2
S-39A	Culvert	A-S39A-1	A-S39A-2
S-124	Culvert	A-S124-1	A-S124-2

TABLE OF CONTENTS (Continued)

WATER CONSERVATION AREAS - EVERGLADES NATIONAL PARK - ENP-SOUTH DADE CONVEYANCE SYSTEM STRUCTURES

Structure	Description	Page No.	Pertinant Data Page No.
S-140	Pumping Station	A-S140-1	A-S140-2
S-141	Spillway	A-S141-1	A-S141-2
S-142	Culvert	A-S142-1	A-S142-2
S-143	Culvert	A-S143-1	A-S143-2
S-144	Culvert	A-S144-1	A-S144-2
S-145	Culvert	A-S145-1	A-S145-2
S-146	Culvert	A-S146-1	A-S146-2
S-150	Culvert	A-S150-1	A-S150-2
S-151	Culvert	A-S151-1	A-S151-2
S-173	Culvert	A-S173-1	A-S173-2
S-174	Spillway	A-S174-1	A-S174-3
S-175	Culvert	A-S175-1	A-S175-3
S-176	Spillway	A-S176-1	A-S176-3
S-177	Spillway	A-S177-1	A-S177-2
S-178	Culvert	A-S178-1	A-S178-2
S-190	Spillway	A-S190-1	A-S190-2
S-194	Culvert	A-S194-1	A-S194-2
S-196	Culvert	A-S196-1	A-S196-2
S-197	Culvert	A-S197-1	A-S197-3
S-199	Spillway	A-S199-1	A-S199-2
S-331	Pump Station	A-S331-1	A-S331-3
S-332	Pump Station	A-S332-1	A-S332-3
S-332DX1	Culvert	A-S332DX1-1	A-S332DX1-1
S-333	Spillway	A-S333-1	A-S333-3
S-334	Spillway	A-S334-1	A-S334-2
S-335	Spillway	A-S335-1	A-S335-2
S-336	Culvert	A-S336-1	A-S336-2
S-337	Culvert	A-S337-1	A-S337-2
S-338	Culvert	A-S338-1	A-S338-2
S-339	Spillway	A-S339-1	A-S339-2
S-340	Spillway	A-S340-1	A-S340-2
S-341	Culvert	A-S341-1	A-S341-2
S-343A	Culvert	A-S343A-1	A-S343A-2
S-343B	Culvert	A-S343B-1	A-S343B-2
S-344	Culvert	A-S344-1	A-S344-2
S-345A,B, & C	Culvert	A-S345-1	A-S345-2
S-346	Culvert	A-S346-1	A-S346-2
S-347	Culvert	A-S347-1	A-S347-2
S-355A	Spillway	A-S355A-1	A-S355A-2
S-355B	Spillway	A-S355B-1	A-S355B-2
S-357	Pumping Station	A-S357-1	A-S357-2

TABLE OF CONTENTS (Continued)

Rating Curves

Structure		Title	Page No.
S-5A		Operation Chart	A-S5A-4
		Siphon Rating	A-S5A-5
S-5A(S)		Submerged Controlled	A-S5A(S)-3
		Submerged Uncontrolled	A-S5A(S)-4
S-5A(E)		Submerged Uncontrolled	A-S5A(E)-3
~~S-5A(W)~~	REMOVED	~~Submerged Uncontrolled~~	~~A-S5A(W)-3~~
~~S-6~~	REMOVED	~~Discharge Rating Curve~~	~~A-S6-4~~
		~~Operation Chart~~	~~A-S6-5~~
		~~Back Siphoning~~	~~A-S6-6~~
~~S-7~~	REMOVED	~~Submerged Controlled~~	~~A-S7-5~~
		~~Operation Chart~~	~~A-S7-6~~
		~~Submerged Controlled For:~~	
		~~8.5 ft. MSL Tailwater~~	~~A-S7-7~~
		~~10.0 ft. MSL Tailwater~~	~~A-S7-8~~
		~~11.5 ft. MSL Tailwater~~	~~A-S7-9~~
~~S-8~~	REMOVED	~~Submerged Controlled~~	~~A-S8-4~~
		~~Operation Chart~~	~~A-S8-5~~
		~~Submerged Controlled For:~~	
		~~8.5 ft. MSL Tailwater~~	~~A-S8-6~~
		~~10.0 ft. MSL Tailwater~~	~~A-S8-7~~
		~~11.5 ft. MSL Tailwater~~	~~A-S8-8~~
S-9		Operation Chart	A-S9-4
S-10A		Submerged Controlled	A-S10A-4
	REMOVED	~~Submerged Uncontrolled~~	~~A-S10A-5~~
S-10C		Submerged Controlled	A-S10C-4
	REMOVED	~~Submerged Uncontrolled~~	~~A-S10C-5~~
S-10D		Submerged Controlled	A-S10D-4
	REMOVED	~~Submerged Uncontrolled~~	~~A-S10D-5~~
S-11A		Submerged Controlled	A-S11A-4
		Submerged Uncontrolled	A-S11A-5
S-11B		Submerged Controlled	A-S11B-4
		Submerged Uncontrolled	A-S11B-5
S-11C		Submerged Controlled	A-S11C-4
		Submerged Uncontrolled	A-S11C-5
S-12A		Tailwater Rating Table	A-S12A-4
		Partial Gate Opening	A-S12A-5
S-12B		Tailwater Rating Table	A-S12B-4
		Partial Gate Opening	A-S12B-5
S-12C		Tailwater Rating Table	A-S12C-4
		Partial Gate Opening	A-S12C-5
S-12D		Tailwater Rating Table	A-S12D-4
		Partial Gate Opening	A-S12D-6
S-12E		Discharge Rating Curve	A-S12E-3
		Headwater vs Discharge	A-S12E-4

TABLE OF CONTENTS (Continued)

WATER CONSERVATION AREAS - EVERGLADES NATIONAL PARK - ENP-SOUTH DADE CONVEYANCE SYSTEM STRUCTURES

Structure	Description	Page No.
S-14	Discharge Rating Curve	A-S14-3
	Headwater vs Discharge	A-S14-4
S-18C	Discharge Rating Curve	A-S18C-3
	Partial Gate Opening	A-S18C-4
S-31	Discharge Rating Curve	A-S31-3
	Partial Gate Opening	A-S31-4
~~S-32A~~ REMOVED	~~Discharge Rating Curve~~	~~A-S32A-3~~
S-34	Discharge Rating Curve	A-S34-3
S-38	Uncontrolled Flow	A-S38-3
	Partial Gate Opening	A-S38-4
S-38B	Discharge Rating Curve	A-S38B-3
S-39	Submerged Uncontrolled	A-S39-3
S-39A	Submerged Controlled	A-S39A-3
S-124	Discharge Rating Curve	A-S124-3
S-140	Submerged Uncontrolled	A-S140-3
	Partial Gate Opening	A-S140-4
	Operation Chart	A-S140-5
S-141	Uncontrolled Discharge	A-S141-3
S-142	Discharge Rating Curve	A-S142-3
S-143	Discharge Rating Curve	A-S143-3
S-144	Discharge Rating Curve	A-S144-3
	Partial Gate Opening	A-S144-4
S-145	Discharge Rating Curve	A-S145-3
	Partial Gate Opening	A-S145-4
	Maximum Allowable Gate Opening	A-S145-5
S-146	Discharge Rating Curve	A-S146-3
	Partial Gate Opening	A-S146-4
	Maximum Allowable Gate Opening	A-S146-5
S-150	Discharge Rating Curve	A-S150-3
	Uncontrolled Flow	A-S150-4
S-151	Discharge Rating Curve	A-S151-3
	Partial Gate Opening	A-S151-4
S-173	Uncontrolled Flow	A-S173-3
S-174	Submerged Uncontrolled Flow	A-S174-4
	Partial Gate Opening	A-S174-5
S-175	Discharge Rating Curve	A-S175-3
S-176	Discharge Rating Curve	A-S176-4
	Partial Gate Opening	A-S176-5
S-177	Discharge Rating Curve	A-S177-3
	Partial Gate Opening	A-S177-4

TABLE OF CONTENTS (Continued)

WATER CONSERVATION AREAS - EVERGLADES NATIONAL PARK - ENP-SOUTH DADE CONVEYANCE SYSTEM STRUCTURES

Structure	Description	Page No.
S-178	Discharge Rating Curve	A-S178-3
	Partial Gate Opening	A-S178-4
	Submerged Flow	A-S178-5
S-190	Limiting Gate Opening	A-S190-3
	Controlled Flow Nomograph	A-S190-4
	Submerged Controlled	A-S190-5
	Uncontrolled	A-S190-6
S-194	Uncontrolled Flow	A-S194-3
S-196	Submerged Flow	A-S196-3
S-197	Discharge Rating Curve	A-S197-4
S-199	Submerged Controlled	A-S199-3
	Free Controlled Flow	A-S199-4
	Uncontrolled Flow	A-S199-5
S-331	Siphon Rating Curve	A-S331-4
S-332	Operation Chart Pumps 1 & 2	A-S332-4
	Operation Chart Pump No. 3	A-S332-5
	Operation Chart Pump No. 4	A-S332-6
	Operation Chart Pump No. 5	A-S332-7
	Operation Chart Pump No. 6	A-S332-8
S-333	Discharge Rating Curve	A-S333-4
S-334	Discharge Rating Curve	A-S334-3
S-335	Discharge Rating Curve	A-S335-3
S-336	Discharge Rating Curve	A-S336-3
S-337	Discharge Rating Curve	A-S337-3
S-338	Discharge Rating Curve	A-S338-3
S-339	Submerged Controlled Flow	A-S339-3
	Operations Schedule	A-S339-4
S-340	Submerged Controlled Flow	A-S340-3
	Operations Schedule	A-S340-4

STRUCTURE 5A (S-5A)

Location. S-5A is on the south side of State Road 80 (U.S. Hwy 441) and West Palm Beach Canal (C-51) about 20 miles west of West Palm Beach, Florida. S-5A is located in the vicinity of the intersection of L-40 and the West Palm Beach Canal between C-51 and the borrow canals of Levees 7 and 40. Structure 5A is west of S-5A(W) and S-5A(S).

Description. Pump station S-5A consists of a reinforced concrete structure with a concrete superstructure. The pumping station is equipped with six horizontal propeller pumps each with a rated speed of 714 rpm. At this speed, each pump has a capacity of 800 cfs at a static head of 11.1 ft. The total capacity for the six pumps is 4,800 cfs at design head. Semi-automatic flap gates are provided at each pump discharge to assist in priming and to prevent possible backflow. A 6-foot electrically operated trash rake is located on the intake side of the structure. Needle beams for use at the pump intake bay and bulkhead sections for use at the pump discharge side are provided for dewatering or to stop backflow through any one of the pumps if necessary.

Purpose. S-5A pumps surplus water via the West Palm Beach Canal from the agricultural area northwesterly of the pumping station into WCA No.1. S-5A is designed to remove 3/4 inch agricultural runoff per day from the 230 sq. mile drainage area which includes the L-10 and L-12 basins. When the primary purpose will not be impeded, S-5A may also remove excess water from the L-8 and C-51 basins and from Lake Okeechobee when the Lake is above its regulation schedule.

Normal Regulation. Pumping should begin when the West Palm Beach Canal level exceeds 11.5 ft. during the irrigation phase or 10.5 ft. during the drainage phase. The irrigation phase generally occurs in the winter and the drainage phase in the summer. Brief periods of very wet or very dry weather at any time of year can initiate a change from one phase to the other. The water surface at the pump station should not be drawn down below 8.3 ft., NGVD. If the water surface on the intake bay falls below 6.3 ft. during pump operation, the speed of all pumps operating should be reduced to not less than 600 rpm. If the water surface elevation in the intake pool remains below 6.3 ft., then one or more pumping units should be shut down until the minimum pool elevation is re-established. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the canal. The primary S-5A drainage area (the L-10 and L-12 basins) receives surplus water primarily from pumped discharge, and secondarily by gravity discharge from adjacent lands. Just the pumped discharge alone into this area above S-5A exceeds the discharge capacity of S-5A. This can have a major impact on the operation of this pump station, especially if a major storm is imminent. An early warning agreement exists

between the South Florida Water Management District and all major interests who pump into the L-10 and L-12 basins. Each of these interests has agreed to notify SWFMD of the time and projected quantities of their intended discharge into L-10 and L-12. It is important to obtain hydrologic data frequently on rainfall, water levels, and pumping rates because the project operation is dependent upon this data.

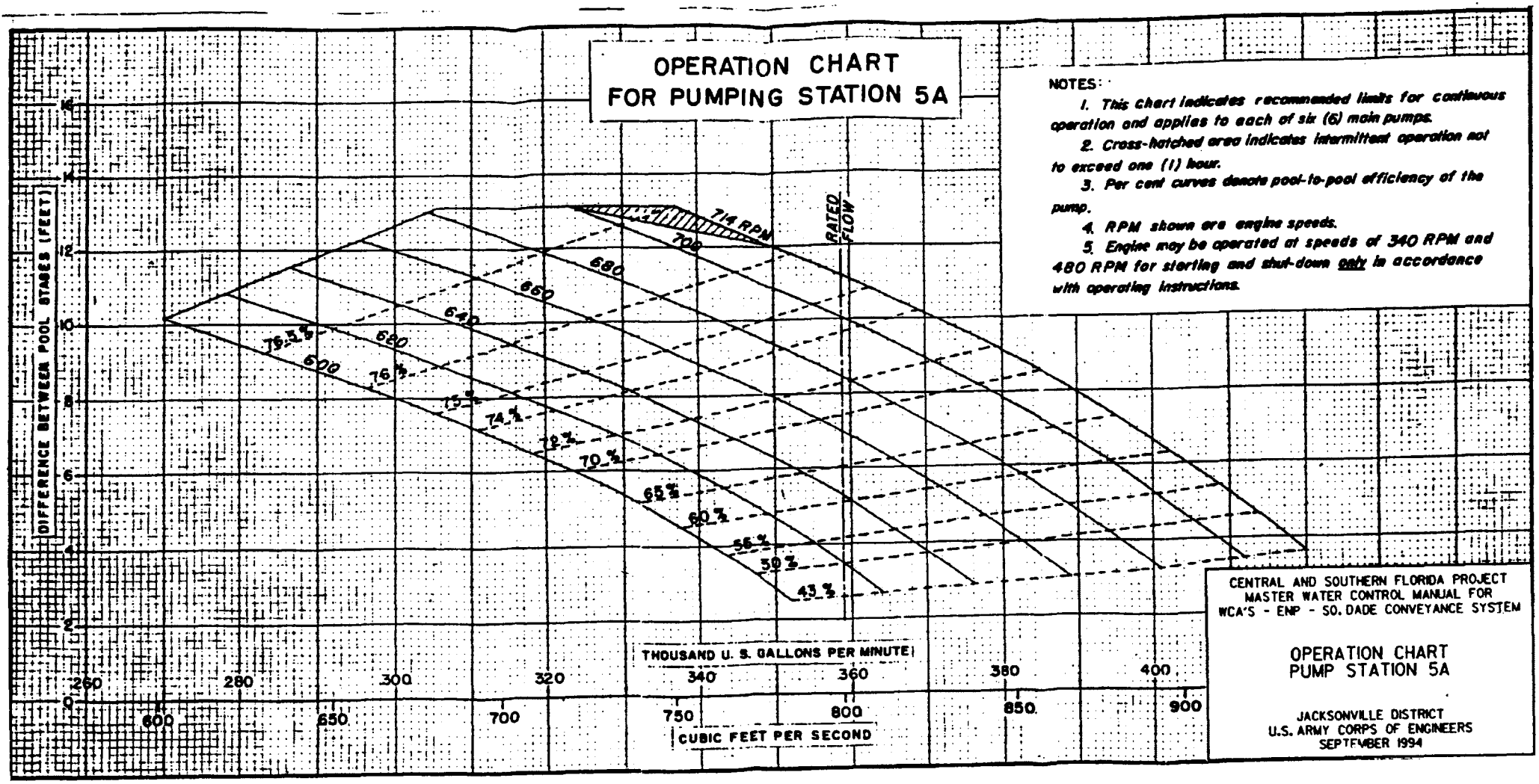
Flood Regulation. Pumping should begin when the West Palm Beach Canal level exceeds 11.5 ft. during the irrigation phase or 10.5 ft. during the drainage phase. If the tailwater elevation at Canal Point, Big Mound, or S-5A is above 12.0 ft., or there is a rise in stage of 0.5 ft. per hour and there has been no change in District pumping or hurricane operations then pumping should be initiated. When stages are above 16.0 ft. at Sand Cut or the tailwater at S-5A(E) is above 13.0 ft. and the inflows from their basins will not jeopardize flood control in the L-10 and L-12 basins then the appropriate gates should be opened and S-5A placed in operation.

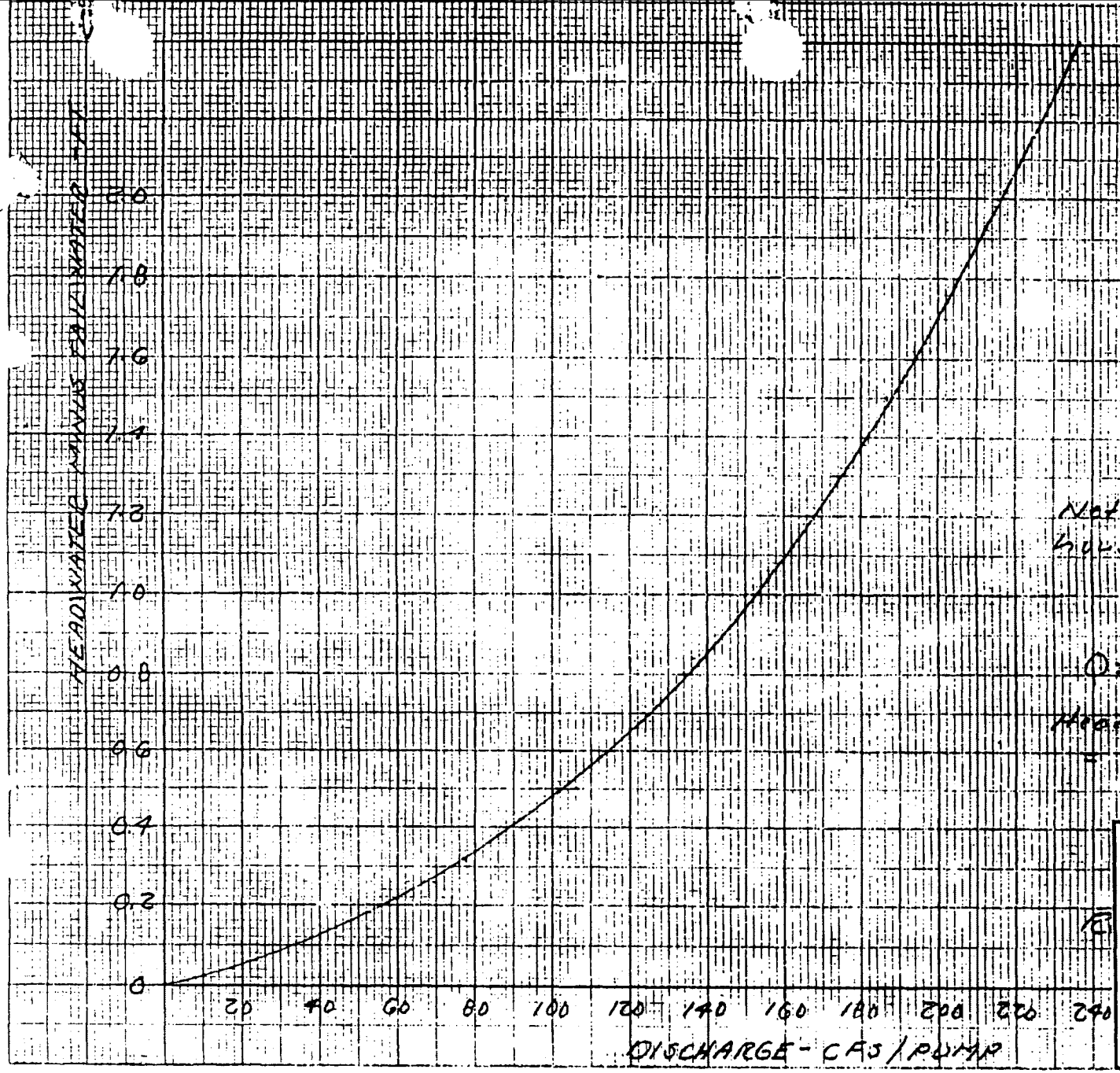
Constraints. The water surface at the pump station should not be drawn down below 6.3 ft., NGVD. The pumps should not be operated between 345 and 420 rpm and between 490 and 600 rpm as indicated on the engine tachometer. All operations through these speed zones should be done as quickly as possible. The rated speed is 714 rpm. At this speed the pumps will pump 800 cfs or greater within the following ranges of head, provided both conditions are not exceeded: (a) when the intake pool gage reads 8.3 ft., NGVD or higher; (b) when the pool gage reads 19.4 ft., NGVD or lower. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the canal. Backflow during hurricanes can be prevented by closing the gates at the end of the discharge tube.

STRUCTURE 5A (S-5A)

Summary of Hydraulic Design

Location	West Palm Beach Canal
Drainage Area (sq. miles)	230
Design Total Discharge (cfs)	4,800
Water Surface Elevation (ft.)	
Maximum, non-pumping	11.5; 10.5
Start Pumps	
Irrigation Phase	11.5
Drainage Phase	10.5
Normal Drawdown, drainage	NA
Normal Drawdown, lake regulation	Variable
Maximum Drawdown, with pumping	8.3
Discharge Pool (WCA No.1A criteria)	
Water Surface Elevation (ft.)	
Maximum, non-pumping	13.0
Maximum, pumping @ full capacity	19.4
Design Head	
Maximum	11.1
At Rated Capacity	11.1
Best Efficiency	9.2
Minimum, one pump operating	5.2
Pumps	
Type	Vertical axial flow
Number	6
Design Rating (cfs)	
Per Pump	800
Total (all pumps)	4,800
Impeller	
Speed (rpm)	125
Size (dia., inches)	116
Invert Elevation (ft.)	NA
Engine Horsepower (ea)	1600
Engine Speed (rpm)	714
Gates (per bay)	
Number	2
Location	Discharge tube
Type	Flap gate
Control	Semi-automatic
Size (width x height, ft.)	13.0 ft. x 12.0 ft.


OPERATION CHART
FOR PUMPING STATION 5A
NOTES:
1. This chart indicates recommended limits for continuous operation and applies to each of six (6) main pumps.
2. Cross-hatched area indicates intermittent operation not to exceed one (1) hour.
3. Per cent curves denote pool-to-pool efficiency of the pump.
4. RPM shown are engine speeds.
5. Engine may be operated at speeds of 340 RPM and 480 RPM for starting and shut-down only in accordance with operating instructions.
DIFFERENCE BETWEEN POOL STAGES (FEET)
THOUSAND U. S. GALLONS PER MINUTE
CUBIC FEET PER SECOND
RATED FLOW
714 RPM
700
680
660
640
620
600
79.5%
76%
75%
74.5%
72%
70%
65%
60%
55%
50%
43%
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
OPERATION CHART
PUMP STATION 5A
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

SIPHON RATING
PUMP STATION 5A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JUNE 1970

STRUCTURE 5A(S) (S-5A(S))

Location. S-5A(S) is in the L-8 Borrow Canal south of the West Palm Beach Canal where L-7 intersects the L-40 Borrow Canal. The structure is about 20 miles west of West Palm Beach, Florida.

Description. S-5A(S) is a two-bay gated spillway with vertical lift gates. The gates can be controlled at the structure or remotely controlled from Pump Station 5A.

Purpose. This spillway passes gravity flow from L-8 Canal into WCA No. 1. It functions with S-5A(E), S-5A(W), and S-5A to control flood runoff from the L-8 area and, when stages in the canals are low, it is used to make irrigation releases from WCA No. 1 to the L-10, L-12, L-8, and C-51 basins.

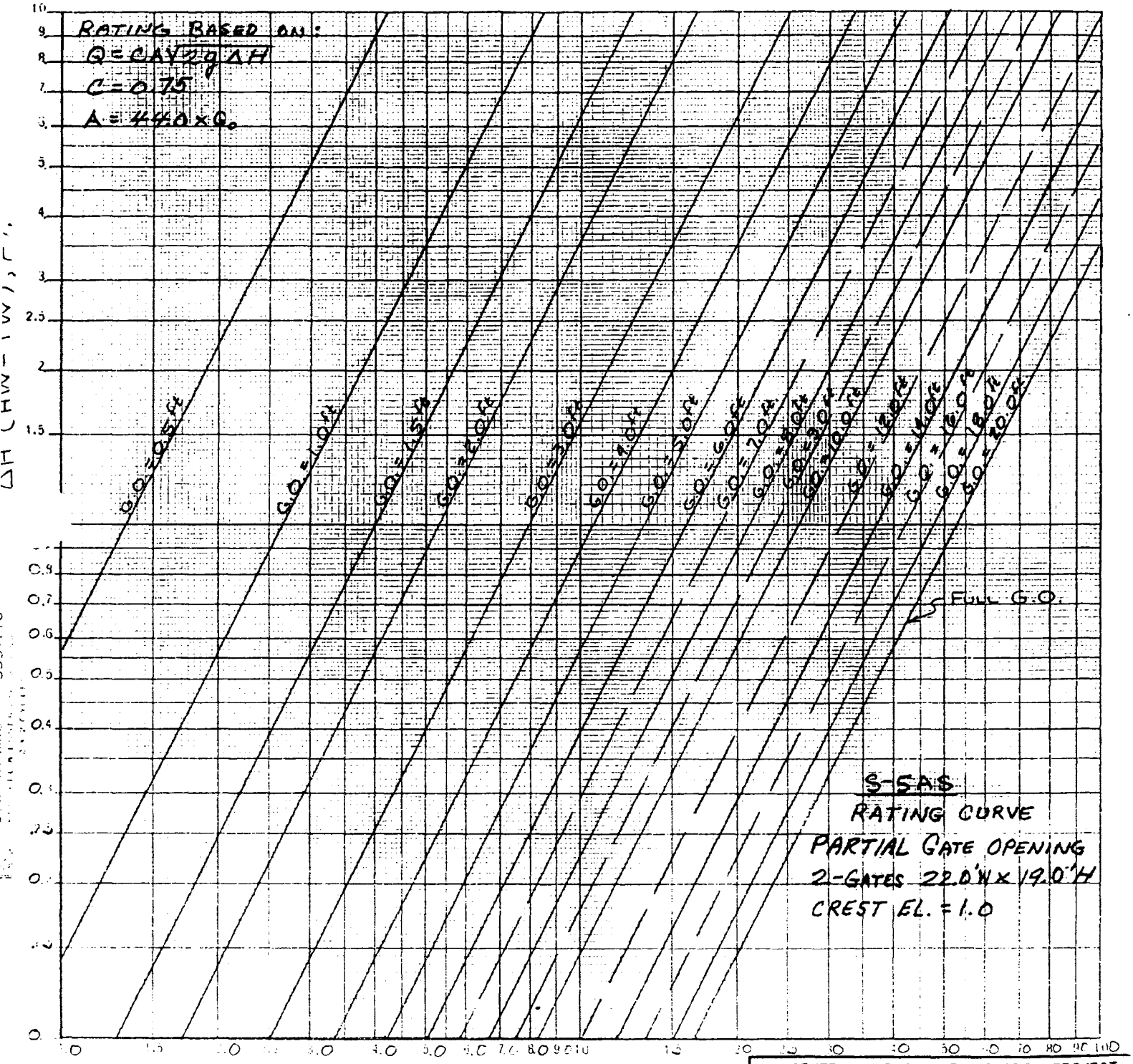
Normal Regulation. The gates at S-5A(S) are usually fully open since it is desirable to pass water from L-8 Canal into WCA No. 1 at all times (except during extreme low water) when heads are favorable. However, it is not desirable to back hurricane generated high water into the L-8 drainage system. Therefore, if during a hurricane the winds are blowing from a northeasterly direction with torrential rains the gates should remain open as long as the head remains favorable. However, if the winds shift and start blowing from the southeast or southwest quadrants and S-5A(S) becomes subject to the full wind-tide setup and wave action in WCA No. 1 then the gates should be closed remotely from S-5A.

Major Constraints. The gates are designed for an operating head of 4 ft. with a maximum differential in head of 9.0 ft. and a static head of 16 ft., which may occur if only one side of the gate is dewatered with normal pool at elevation 17.0 ft., NGVD and sill elevation at 1.0 ft., NGVD.

STRUCTURE 5A(S) (S-5A(S))

Summary of Hydraulic Design

Location	L-8 Borrow Canal
Design Conditions	
Discharge (cfs)	2000
Type	uncontrolled submerged
Headwater Elevation (ft.)	18.0
Tailwater Elevation (ft.)	17.9
Maximum Head Differential (ft.)	9.0
Optimum Conditions	
Headwater Elevation (ft.)	14.0 - 16.0
Tailwater Elevation (ft.)	14.0 - 17.0
Crest	
Shape	trapezoidal
Elevation (ft.)	1.0
Net Length (ft.)	44.0
Gates	
Type of Gate	vertical lift
Number	2
Width x Height (ft.)	22.8 x 19.33
Top of Gates Elevation (ft.)	20.33
Top of Gates Elevation (ft.)	40.8
Dewatering Capabilities	steel needle beams and aluminum needles

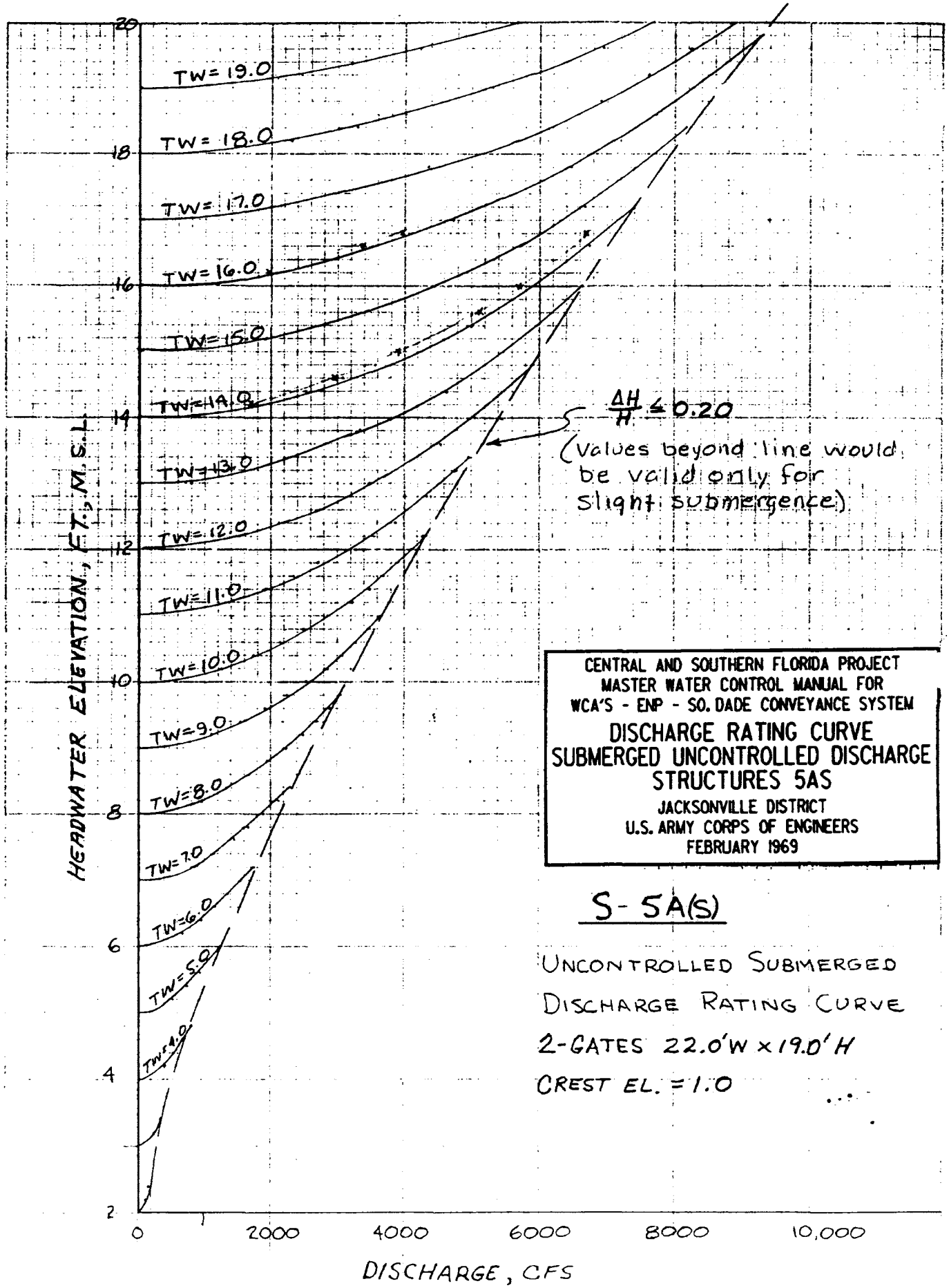


DISCHARGE (100 CFS)

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED DISCHARGE
STRUCTURES 5AS

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1969


TW= 19.0
TW= 18.0
TW= 17.0
TW= 16.0
TW= 15.0
TW= 14.0
TW= 13.0
TW= 12.0
TW= 11.0
TW= 10.0
TW= 9.0
TW= 8.0
TW= 7.0
TW= 6.0
TW= 5.0
TW= 4.0
20
18
16
14
12
10
8
6
4
2
HEADWATER ELEVATION, FT., M.S.L.
0
2000
4000
6000
8000
10,000
DISCHARGE, CFS
$\frac{\Delta H}{H} \leq 0.20$
(Values beyond line would be valid only for slight submergence)
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
SUBMERGED UNCONTROLLED DISCHARGE
STRUCTURES 5AS
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1969
S-5A(S)
UNCONTROLLED SUBMERGED
DISCHARGE RATING CURVE
2-GATES 22.0'W x 19.0'H
CREST EL. = 1.0

2-69

STRUCTURE 5A(E) (S-5A(E))

Location. S-5A(E) is located on the West Palm Beach Canal (C-51) where L-40 intersects the canal. The structure is about 20 miles west of West Palm Beach, Florida.

Description. S-5A(E) is a double-barreled reinforced concrete box culvert. Control is by motor operated sluice gates. The structure is designed to pass a maximum of 700 cfs under favorable head conditions.

Purpose. This structure functions with S-5A(W), S-5A(S), and S-5A to control irrigation releases along the West Palm Beach Canal east of Levee 40 during periods of flow deficiency and to pass flood runoff from the L-8 Canal and C-51 into Water Conservation Area No. 1 via the S-5A pumping station.

Normal Regulation. When flood conditions are not imminent, the gates will be operated, subject to water availability, to meet the agricultural needs in C-51 east of Conservation Area No. 1.

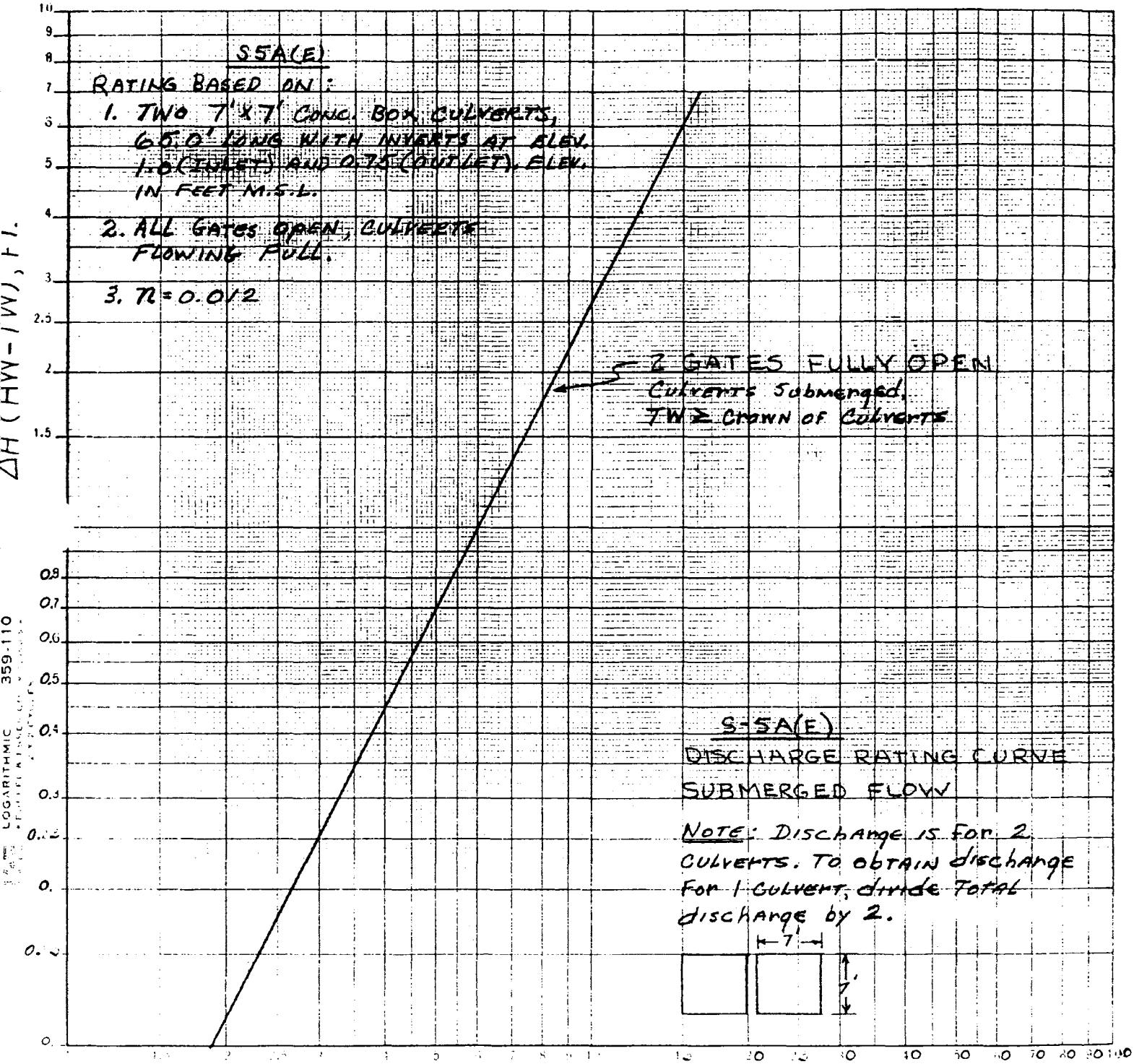
Flood Regulation. During flood conditions the gates will be closed whenever releases would aggravate flood conditions downstream. The gates will be opened whenever damage stages will not be exceeded below the structure and excess water in the West Palm Beach Canal, Levee 8 Canal, or WCA No. 1 is increasing flood potential in the Agricultural Area southeast of the lake.

Major Constraints. The maximum head on the structure when it is operated is 7.4 ft., a condition obtained during pumping at S-5A with S-5A(S) open, raising the pool level of WCA No. 1 and L-8 Canal to 19.4 ft., NGVD on the west side of the structure and with a normal water level of 12.0 ft., NGVD, on the east end of the structure.

STRUCTURE 5A(E) (S-5A(E))

Summary of Hydraulic Design

Location	West Palm Beach Canal
Design Conditions	
Discharge (cfs)	700
Type	uncontrolled submerged
Headwater Elevation (ft.)	11.5
Tailwater Elevation (ft.)	10.0
Maximum head differential, operating (ft.)	7.4
Structure	
Type	reinforced concrete box culvert
Number of barrels	2
Size (ft.)	7 x 7
Length (ft.)	65
Gates	
Type	sluice
Number	2
Width x Height (ft.)	7 x 7
Control	manual
Dewatering Capabilities	stop logs



DISCHARGE, (100 CFS)

A-S5A(E)-3

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED UNCONTROLLED
STRUCTURE 5A (E)

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 5A(W) (S-5A(W))

Location. S-5A(W) is located on the West Palm Beach Canal (C-51) west of L-40 and the L-8 canal. The structure is about 20 miles west of West Palm Beach, Florida.

Description. S-5A(W) is a double-barreled reinforced concrete box culvert. Control is by motor operated sluice gates. The gates of the structure are located on the east end of the culverts since, during pumping, the West Palm Beach Canal to the west is drawn down to 8.3 ft., NGVD developing a maximum head on the culvert equivalent to the pool to pool head of the pumping station. The structure is designed to pass a maximum of 700 cfs at such times as necessary but not during times when pumping is being conducted at S-5A.

Purpose. This structure functions with S-5A(E), S-5A(S), and S-5A to control irrigation releases along the West Palm Beach Canal east of Levee 40 during periods of flow deficiency and to pass flood runoff from the L-8 Canal and C-51 into Water Conservation Area No. 1 via the S-5A pumping station.

Normal Regulation. The gates on the structure are normally closed. When flood conditions are not imminent, the gates will be operated, subject to water availability, to meet water use requirements in C-51 east of Conservation Area No. 1 and in the L-8 basin.

Flood Regulation. During flood conditions the gates will be closed whenever the stage east of the structure exceeds that to the west. The gates will be opened whenever excess water is increasing flood potential in the developed area and the stage east of the structure is below that to the west.

STRUCTURE 5A(W) (S-5A(W))

Summary of Hydraulic Design

Location	West Palm Beach Canal
Design Conditions	
Discharge (cfs)	700
Type	uncontrolled submerged
Headwater Elevation (ft.)	13.0
Tailwater Elevation (ft.)	11.5
Maximum head differential, operating (ft.)	2.0
Structure	
Type	reinforced concrete box culvert
Number of barrels	2
Size (ft.)	7 x 7
Length (ft.)	80
Gates	
Type	sluice
Number	2
Width x Height (ft.)	7 x 7
Control	manual
Dewatering Capabilities	stop logs

STRUCTURE 6 (S-6)

Location. Pumping Station 6 is in the Hillsboro Canal at the junction of L-6 and L-7, about 20 miles southeast of Belle Glade, Florida.

Description. S-6 has three vertical axial flow pumps, each with a rated speed of 706 rpm. The total capacity for the self-priming pumps is 2,925 cfs under a design head of 8.3 ft. Each pump is provided with an individual intake bay for separate dewatering, inspection and servicing. To prevent backflow under all normal heads the siphon inverts of the vertical pumps are set at elevation 20.0 ft. To prevent backflow for tailwater elevations higher than 20.0 ft, electrically operated roller-bearing vertical lift gates are provided at the discharge end of the pump siphon to span the splitter and pier. The gates are designed for a differential head of 4.3 ft. The pump station was repowered in May 1991.

Purpose. S-6 pumps surplus water via the Hillsboro Canal from Lake Okeechobee and the Agricultural Area northwesterly of the pumping station into WCA No.1. S-6 is designed to remove 3/4 inch agricultural runoff per day from the 146 sq. mile drainage area served by the Hillsboro Canal. The pumping station can also be back-syphoned to supply irrigation water to the Agricultural Area.

Regulation. Pumping should begin when the Hillsboro Canal level exceeds 11.5 - 12.0 ft., NGVD, unless the excess water is needed to utilize conservation storage in Lake Okeechobee, and there is available pumping capacity at Pumping Station 2 or potential gravity discharge through S-351 to remove flood water from the agricultural area between S-2 and S-6 at a desirable rate. At the request of the District Engineer, U.S. Army Corps of Engineers, Jacksonville District, S-6 may be used to provide regulatory discharge from Lake Okeechobee when canal capacity is not needed for removal of surplus water from agricultural area. Under the design head the pumping station capacity is 2,925 cfs.; however, canal dimensions limit the Lake Okeechobee regulatory capacity to 800 cfs. Backflow during hurricanes can be prevented by closing the gates at the end of the discharge tube.

Constraints. The water surface at the pump station should not be drawn down below 10.0 ft., NGVD. If the water surface on the intake bay falls below 10.0 ft. during pump operation, the speed of all pumps operating should be reduced to not less than 500 rpm. If the water surface elevation in the intake pool remains below 10.0 ft. then one or more pumping units should be shut down until the minimum pool elevation is re-established. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the canal. The pumps are free of harmful criticals throughout the normal operating range

between 500 and 700 rpm inclusive.

Note: It is speculated there will be an eventual subsidence of the peat overlayer throughout the drainage area, making the desirable drawdown limit 8.0 ft. The pumping machinery has been designed to operate at rated condition of head and capacity at this lower elevation.

STRUCTURE 6 (S-6)

Summary of Hydraulic Design

Location	Hillsboro Canal
Drainage Area (sq. miles)	146
Total Design Discharge (cfs)	2,925
Intake Canal Water Surface Elevation (ft.)	
Maximum	13.0
Start Pumps	11.5 to 12.0
Normal Drawdown, drainage	10.0
Normal Drawdown, lake regulation	10.0
Maximum Drawdown, with pumping	10.0
Discharge Pool (WCA No.1A criteria)	
Water Surface Elevation (ft.)	
Minimum, non-pumping	10.0
Maximum Stage of Record, pumping	18.3
Maximum SPF, pumping	18.5
Design Head (ft.)	
Maximum	8.5
At Rated Capacity	8.3
Best Efficiency	8.3
Minimum, one pump operating	3.9
Pumps	
Type	Vertical axial flow
Number	3
Design Rating (cfs)	
Per Pump	975
Total (all pumps)	2,925
Impeller Speed (rpm)	88
Impeller Size (dia., inches)	135
Invert Elevation (ft.)	6.0
Engine Horsepower (ea)	1240
Engine Speed (rpm)	706
Gates (per bay)	
Number	1
Location	Discharge tube
Type	Vertical-lift
Control	Electrical
Size (width x height, ft.)	10.3 X 21

STRUCTURE 7 (S-7)

Location. Pumping Station 7 is located in the North New River Canal where the northeast corner of WCA No. 3A and the westernmost corner of WCA No. 2A meet. S-7 is about 28 miles southeast of Belle Glade and just east of U.S. Highway 27.

Description. Station S-7 consists mainly of (1) a reinforced concrete substructure supporting three horizontal pumps, (2) a reinforced concrete gated spillway, (3) a superstructure consisting of concrete block walls and reinforced concrete rigid frames, and (4) a three-bay reinforced concrete intake structure with a trash rake platform and service bridge. Each of the three pumps has an engine speed of 720 rpm and a design rating of 830 cfs. The total design discharge for all three pumps is 2,490 cfs. Each pump is provided with an individual intake bay for separate dewatering, inspection and servicing. The backflow and spillway gates are vertical-lift gates. The backflow gates have two rectangular flap gates each.

Purpose. S-7 pumps runoff from the agricultural area and maintains levels in the North New River Canal by pumping water from the canal into WCA No. 2A. The pumping station can also be used for regulation of Lake Okeechobee when capacity is not needed for agricultural drainage. S-7 is designed to remove 3/4-inch of runoff per day from the 125 square mile tributary drainage area. The gravity spillway controls flows which bypass the pumps. It was provided to aid in passing the large quantities of debris that accumulate at the structure and to provide for gravity discharge when stages are low in WCA No. 2A. The spillway is used primarily for irrigation releases from WCA No. 2A to the Agricultural Area during the dry season.

Regulation. Pumping begins when the New North River Canal level exceeds 11.5-12.0 ft., NGVD unless the water level in WCA No. 2A is low enough to allow gravity flow from the canal through the spillway at S-7; or the water level in WCA No. 3A is low enough to permit gravity flow through S-150 into WCA No. 3A. After initial drawdown the speed and number of pumps should be regulated to maintain the pump intake water surface elevation at 10.8 ft. The water surface at the pump station should not be drawn down below 8.7 ft. When runoff quantities exceed S-7 capacity, S-3 at the north end of North New River Canal can be used to discharge the excess runoff to the Lake. The first priority for Lake Okeechobee regulatory releases is to discharge water south through the agricultural canals as soon as local runoff is removed. As a result of Hump Removal, the design discharge for regulatory releases through the North New River Canal and S-7 is 1,600 cfs with a design pump intake water surface elevation of 9.5 ft. at S-7.

Low Flow Regulation. S-7 is capable of discharging from Lake Okeechobee, up to 800 cfs, to WCA No. 2A with the Lake stages as low as 10.8 ft.

Constraints. The water surface at the pump station should not be drawn down below 8.7 ft. If the water surface on the intake bay falls below 8.7 ft. during pump operation, the speed of all pumps operating should be reduced to not less than 640 rpm. If the water surface elevation in the intake pool remains below 8.7 ft. then one or more pumping units should be shut down until the minimum pool elevation is re-established. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the canal. During extended periods of operation, pump speed may be decreased in order to improve operating efficiency and fuel economy, although such operation will simultaneously result in a decrease in capacity. The Operation Chart defines the entire recommended range over which pumping can be accomplished. The pumps are entirely free from criticals throughout the speed range from 0 to 720 rpm.

STRUCTURE 7 (S-7)

Summary of Hydraulic Design

Location	North New River Canal
Drainage Area (sq. miles)	125
Design Total Discharge (cfs)	2,490
Intake Canal	
Run-off, based on 3/4" per day (cfs)	2,490
Water Surface Elevation (ft.)	
Maximum	13.0
Start Pumps	11.5 to 12.0
Normal Drawdown, drainage	10.8
Normal Drawdown, lake regulation	8.7
Maximum Drawdown, with pumping	8.7
Discharge Pool (WCA No.2A)	
Water Surface Elevation (ft.)	
Minimum, non-pumping	10.5
Maximum, stage of record	16.1
Maximum, SPF	17.0
Pool to Pool Heads (ft.)	
Average, for drainage	4.9
Normal, maximum for drainage	5.3
Maximum, for drainage (2% of time)	6.2
Average, for lake regulation	7.4
Maximum, for lake regulation (2% of time)	8.3
Pumps	
Type	Horizontal axial flow
Number	3
Design Rating (cfs)	
Per Pump	830
Total (all pumps)	2,490
Impeller	
Speed (rpm)	68
Size (dia., inches)	144
Invert Elevation (ft.)	16.8
Engine Horsepower (ea)	895
Engine Speed (rpm)	720
Gates (per bay)	
Number	1
Location	Pump discharge
Type	Vert.lift/flapgates
Control	manual
Size (width, ft.)	20.0
Top of Gate, (fully closed position)	12.8
Top of Flap Gate	7.8
Dewatering Capability	Yes
Gravity Spillway	
Type	Box Culvert
Number of Barrels	1
Size (width x height, ft.)	14.7 x 13.2
Length (ft.)	43.0

STRUCTURE 7 (S-7)

Summary of Hydraulic Design
(Cont'd)

Gates	
Type	Vertical-lift
Control	Manual
Number	1
Size (width x height, ft.)	15.2 x 11.0
Top of Gate (fully closed position)	13.5

STRUCTURE 8 (S-8)

Location. Structure 8 is located in the Miami Canal at the junction of Levees 4, 5 and 23 at the northwest corner of Water Conservation Area 3A.

Description. S-8 is a four bay pumping station with a gated spillway. S-8 has four axial-flow horizontal pumps, each having a rated speed of 707 rpm. At this speed, each pump has a design capacity of 1,040 cfs or greater with pool-to-pool heads not in excess of 4.5 ft. and intake pool gage between elevation 13.0 and 9.0 ft, NGVD. The total pump station capacity under design head is 4,160 cfs. The four backflow gates and the spillway gate are vertical-lift gates. The backflow gates have two rectangular flap gates each. Dewatering of any intake and discharge bay is possible while the remaining pumps operate.

Purpose. The purpose of the pumping station is to discharge excess drainage water, via the Miami Canal, from the agricultural area north of the pumping station into WCA No. 3A. The gravity spillway controls flows which bypass the pumps. The pumping station can also be used for regulation of Lake Okeechobee when capacity is not needed for agricultural drainage. S-8 is designed to remove 3/4 inch of runoff per day from the 208 sq. mile tributary drainage area.

Regulation. Pumping should begin at S-8 whenever the water level in the Miami Canal within the agricultural area tributary to the pumping station exceeds 12.5 to 13.0 ft., NGVD unless gravity flow into WCA No. 3 is possible at an adequate rate through the spillway gate. The water surface at the pump station should not be drawn down below 10 ft., NGVD. After initial drawdown the speed and number of pumps should be regulated to maintain the pump intake water surface elevation at 13.0 ft., NGVD. When runoff quantities exceed Structure 8 capacity, S-3 at the north end of Miami Canal can be used to discharge the excess runoff to the Lake. The first priority for Lake Okeechobee regulatory releases is to discharge water south through the agricultural canals as soon as local runoff is removed. As a result of Hump Removal, the design discharge for regulatory releases through the Miami Canal and S-8 is 2,000 cfs with a design pump intake water surface elevation of 9.5 ft., NGVD.

Low Flow Regulation. S-8 is capable of discharging from Lake Okeechobee, up to 1,000 cfs, to WCA No. 3A with the Lake stages as low as 10.8 ft., NGVD.

Constraints. The water surface at the pump station should not be drawn down below 10.0 ft., NGVD. If the water surface on the intake bay falls below 10.0 ft during pump operation, the speed of all pumps operating should be reduced to not less than 646 rpm. If the water surface elevation in the intake pool remains

below 10.0 ft. then one or more pumping units should be shut down until the minimum pool elevation is re-established. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the canal. During extended periods of operation, pump speed may be decreased in order to improve operating efficiency and fuel economy, although such operation will simultaneously result in a decrease in capacity. The Operation Chart defines the entire recommended range over which pumping can be accomplished. The main pumping units at Station 8 are free from severe or harmful criticals throughout the speed range from 0 to 707 rpm. However, there are minor criticals at 288 rpm and 444 rpm and these speeds should be avoided in the starting up and slowing down phases.

STRUCTURE 8 (S-8)

Summary of Hydraulic Design

Location	Miami Canal
Drainage Area (sq. miles)	208
Total Design Discharge (cfs)	4,170
Intake Canal	
Run-off, based on 3/4" per day (cfs)	4,170
Water Surface Elevation (ft.)	
Maximum, non-pumping	12.5
Start Pumps	12.0
Normal Drawdown, lake regulation	11.0
Maximum Drawdown, with pumping	10.0
Discharge Pool (WCA No. 3)	
Water Surface Elevation (ft.)	
Minimum Water Surface, non-pumping	9.5
Normal, with pumping	16.5
Pool to Pool Heads	
Normal (Maximum design), drainage	4.5
Normal for Lake Regulation	2.9
Assumed for 500 cfs flow thru gravity spillway	0.2
Pumps	
Type	Horiz. axial flow
Number	4
Design Rating (cfs)	
Per Pump	1,040
Total (all pumps)	4,160
Impeller size (approx. dia, inches)	152
Impeller speed (rpm)	67
Engine Horsepower (ea)	895
Engine Speed (rpm)	707
Gates (per bay)	
Number	1
Location	Pump discharge
Type	Vert.lift/flapgate
Control	manual
Size (width x height, ft.)	21.0 x 10.5"
Gravity Spillway	
Type	Box Culvert
Number of Barrels	1
Size (width x height, ft.)	16.5 x 14.4
Length (ft.)	78.5
Capacity with 0.2 ft. Head (cfs)	500
Invert Elevation (ft.)	0.1
Gates	
Type	Vertical-lift
Control	Manual/electric
Number	1
Size (width x height, ft.)	17.25 x 12.4
Top of Gate (fully closed position)	13.42
Sill Elevation (ft.)	1.0

STRUCTURE 9 (S-9)

Location. Pump Station 9 is located at the junction of L-37 and the South New River Canal, C-11. The structure is about 1/2 mile west of U. S. Highway 27 at the westerly end of C-11.

Description. S-9 uses three vertical-shaft axial flow pumps. All three pumps have had their engines replaced and now have a rated speed of 733 rpm. Each pump has a design capacity of 960 cfs or greater with pool-to-pool heads not in excess of 10.4 ft and intake pool gage between elevation 4.0 and 3.0 ft., NGVD. The pumps are self-priming. Each bay has 2 vertical lift gates with flap gates at the downstream end of the discharge tube for backflow protection. Bulkhead gates are used for dewatering and are stored at the site.

Purpose. The pumping station is designed to remove 3/4 inch run-off per day (1,410 cfs) from the east coast tributary area of 71 square miles. The pump station was also designed to pump seepage under Levees 33 and 37 back into WCA No. 3. The quantity of seepage is estimated to be 1,460 cfs. The pump station was therefore designed with a capacity of at least 2,870 cfs in order to be able to pump the combined run-off and seepage into WCA No. 3.

Regulation. Pumping should begin at S-9 when the stage in the South New River Canal exceeds 4.0 ft., NGVD. The rate of pumping should be regulated so the canal will be drawn down to elevation 1.0 ft., NGVD. Water surface at the pump station should not be drawn down below the maximum drawdown elevation of 0.0 ft., NGVD. During wet periods hydrologic data should frequently be obtained on rainfall, water levels and pumping rates from stations given in Part VI, General Studies and Reports, Section 11--Design Memorandum, meteorologic and Water-Level Networks, Parts I and V on the Central and Southern Florida Project.

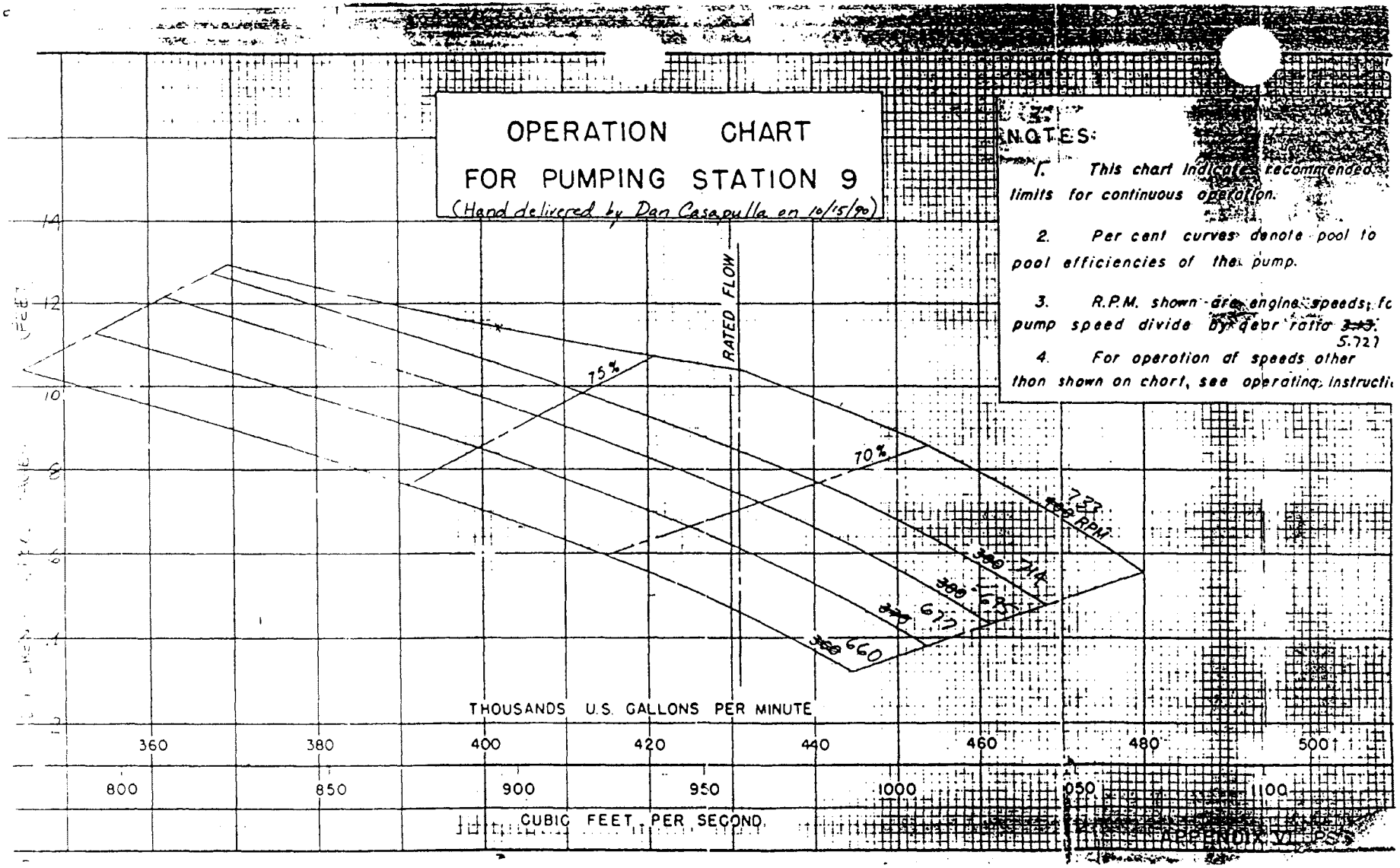
Constraints. During pump operations, the water surface elevation on the intake bay should be kept at or above 1.0 ft., NGVD. However, if the water surface on the intake bay falls below the maximum drawdown elevation of 0.0 ft., NGVD, during pump operation, the speed of all pumps operating should be reduced to not less than 660 rpm. If the water surface elevation in the intake pool remains below 0.0 ft., NGVD then one or more pumping units should be shut down until the minimum pool elevation is re-established. The pumps should be started and stopped slowly, one pump at a time to avoid high velocities and surges in the South New River Canal or the L-37 and L-33 borrow canals. The pumps are free from harmful criticals throughout the entire speed range from 275 rpm to 733 rpm. However, evidence of backlash may be audibly detected while operating in the vicinity of 275 rpm.

Therefore, the minimum speed for operation of the pumps should be established by the operator as either 275 rpm or the lowest speed found to be free from backlash, whichever speed is higher. All operation, either accelerating or decelerating, through the range between zero and the established minimum speed should be accomplished as rapidly as practicable.

STRUCTURE 9 (S-9)

Summary of Hydraulic Design

Location	C-11
Drainage Area (sq. miles)	71
Pump Design	
Discharge Rate (cfs)	2,880
Headwater Elevation (ft.)	4.0
Tailwater Elevation (ft.)	14.4
Intake Canal Data	
Run-off Based on 3/4" per day (cfs)	1,410
WCA Seepage (cfs)	1,460
Maximum Water Surface Elevation (ft.)	
Maximum, non-pumping	4.0
Normal Drawdown	1.0
Maximum Drawdown, pumping	0.0
Hydraulic Heads	
Best Efficiency Point (ft.)	8.0
Rated Capacity of Pumps (ft.)	10.4
Minimum, assuming one pump operating (ft.)	5.7
Storage in Canal and Borrow Pit, free water only (acre-ft.)	50
Pumps	
Type	Vert prop, axial flow
Number & Size (inches)	3 @ 122
Design Rating (cfs)	960
Impeller Speed (rpm)	128
Engine Horsepower (ea)	1655
Engine Speed (rpm)	733
Gates	
Number	2 per bay
Total Number	6
Location	Downstream end
Type	Vert. lift/flap gates
Size (width x height, ft.)	10.25 x 21.0
Dewatering Capabilities	Yes



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATION CHART
PUMP STATION 9

JACKSONVILLE DISTRI
U.S. ARMY CORPS OF EN RS
OCTOBER 1990

STRUCTURE 9A (S-9A)

Location. Pump station S-9A is located at the western terminus of the C-11 borrow canal in the alignment of Levee 37, approximately 0.5 miles west of U.S. Highway 27, just north of and directly adjacent to the S-9 Pump Station in Broward County. The structure is positioned immediately east of Water Conservation Area 3A (WCA-3A).

Description. This structure is a four unit pumping station with a design capacity of 500 cfs. It is equipped with two 175 cfs diesel engines driven pumps, and two 75 cfs electric motor driven pumps and a trash rack system.

Purpose. The purpose of pump station S-9A is to improve the quality and timing of stormwater discharges from the Western C-11 basin into WCA-3A by back pumping seepage lost from WCA-3A back into WCA-3A at the same approximate rate it enters the canal. The use of the S-9A reduces the operational dependency placed on the larger S-9 Pumping Station.

Operation. The structure is remotely operated to maintain optimum headwater stages in the C-11 borrow canal. Additional operational guidance for S-9A is based on best professional judgment of operating personnel; taking field condition factors into consideration such as existing water levels within the C-11 borrow canal, rainfall and seasonality.

DISCHARGE CHARACTERISTICS

Design Discharge Rate (combined):	500 cfs

DESCRIPTION OF STRUCTURE

Number of Pumps:	4
Motor Size:	
2-75-cfs electric pumps:	250 hp
2- 175-cfs diesel pumps:	650 hp
Design Headwater elevation:	3.0 feet NGVD
Design Tailwater elevation:	10.5 feet NGVD
Nominal pump operating speed:	
Electric:	rpm
Diesel 175-cfs:	1800 rpm
Motor Speed:	
Electric:	588 rpm
Diesel:	1800 rpm
Pump Manufacturer (diesel only)	Caterpillar
Model Number (diesel only)	3412C

POWER SOURCE

Prime Movers	Commercial electricity Commercial Diesel

STATION POWER

Normal	Commercial electricity

Emergency Electrical generator backup

HYDRAULIC AND HYDROLOGIC MEASUREMENTS
Stilling wells and staff gages located at upstream and downstream of structure.

ACCESS: Access to S-9A is from the C-11 canal right-of-way via Griffin Road.

STRUCTURE 10A (S-10A)

Location. Structure 10A is located in Levee 39 approximately 1 mile northwest of Structure 39 on the southwest perimeter of WCA No. 1. Levee 39 extends along the Hillsboro Canal in South Palm Beach County west of Boca Raton and State Highway No. 9.

Description. S-10A is a reinforced concrete, four-bay, U-shaped spillway with concrete wing walls and training walls. The vertical-lift gates are operated from the service bridge by a vehicular-drive mechanism. Each gate is 25.7 ft. wide by 8 ft. high and is individually operated by a separate hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber needles and structural-steel needle beams are provided for one bay only but will suit all the bays.

Purpose. S-10A (along with S-10C and S-10D) controls water levels in WCA No. 1 and permits releases from WCA No. 1 into WCA No. 2A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 14.0 to 17.0 ft., NGVD on a seasonal basis. The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. S-10A is generally operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stage to rise above 13.0 ft., NGVD. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

Flood Control. The spillways provide a means of controlling and transporting the flow from WCA No. 1 to WCA No. 2A for all flood discharges up to the Spillway Design Flood (SDF). The S-10's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 14,800 cfs. The peak SPF stage in WCA No. 1 is about 18.3 ft. with a total storage of about 494,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-10's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel for use during the alert period.

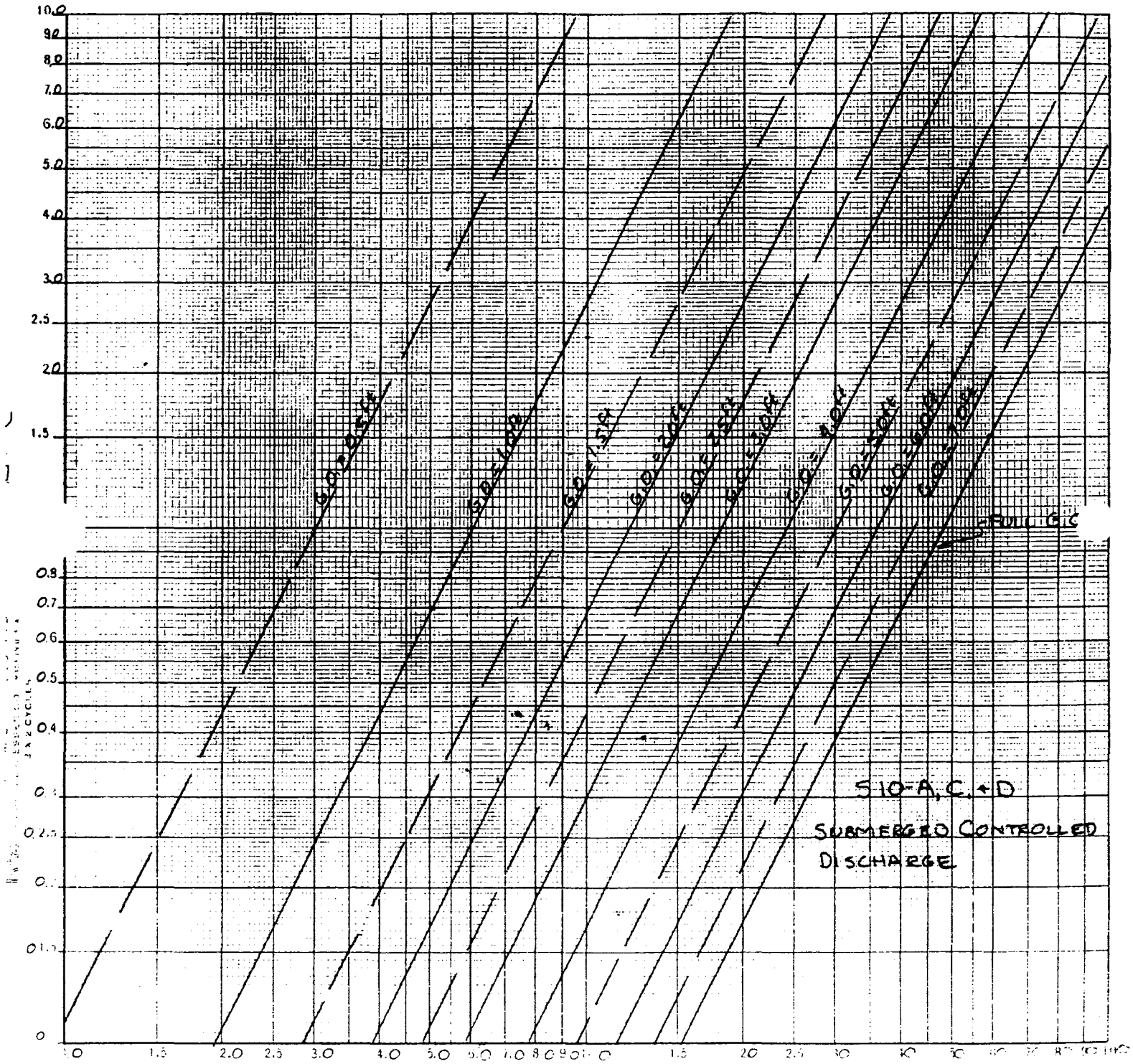
Low Flow Regulation. The S-10's have no minimum low flow discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts the minimum elevation preferred in the borrow canals is 11.0 ft., NGVD. Below this elevation no further releases should be permitted from WCA No. 1 unless a supply of water from another storage area is transferred to WCA No. 1.

Constraints. Water releases from S-10A should not be made when water stage in WCA No. 1 is 11.0 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-10 structures at the same time.

STRUCTURE 10A (S-10A)

Summary of Hydraulic Design

Location	L-39
Drainage Area - total for S-10's (sq. miles)	728
Design Conditions	
Total Discharge for 3 Spillways (cfs)	14,800
Type	Uncontrolled submerged
Headwater Elevation (ft.)	17.3
Tailwater Elevation (ft.)	16.4
SPF Condition	
Discharge (cfs)	4,680
Headwater Elevation (ft.)	24.4
Tailwater Elevation (ft.)	2.4 TO 8.5
Optimum Conditions	
Headwater Elevation (ft.)	17.0
Tailwater Elevation (ft.)	14.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	10.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	10.0
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.7 x 8.0
Top of Gates Elevation (ft.) (fully closed position)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	6.5
Apron Length (ft.)	25.0
End Sill Height (ft.)	1.5
Training Wall Minimum Elevation (ft.)	17.3
Wing Wall Angle to flow (degree)	45



DISCHARGE (100 CFS)

CENTRAL AND SOUTHERN FLORIDA PROJ.
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE 10A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 10C (S-10C)

Location. Structure 10C is located in Levee 39 approximately 3.6 miles northwest of Structure 39. Levee 39 extends along the Hillsboro Canal in South Palm Beach County west of Boca Raton and State Highway No. 9.

Description. S-10C is a reinforced concrete, four-bay, U-shaped spillway with concrete wing walls and training walls. The vertical-lift gates are operated from the service bridge by a vehicular-drive mechanism. Each gate is 25.7 ft. wide by 8 ft. high and is individually operated by a separate hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber needles and structural-steel needle beams are provided for one bay only but will suit all the bays.

Purpose. S-10C (along with S-10A and S-10D) controls water levels in WCA No. 1 and permits releases from WCA No. 1 into WCA No. 2A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 14.0 to 17.0 ft., NGVD on a seasonal basis. The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-10C is generally operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 13.0 ft., NGVD. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

Flood Control. The spillways provide a means of controlling and transporting the flow from WCA No. 1 to WCA No. 2A for all flood discharges up to the Spillway Design Flood (SDF). The S-10's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 14,800 cfs. The peak SPF stage in WCA No. 1 is about 18.3 ft., NGVD with a total storage of about 494,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-10's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-10's have no minimum low flow

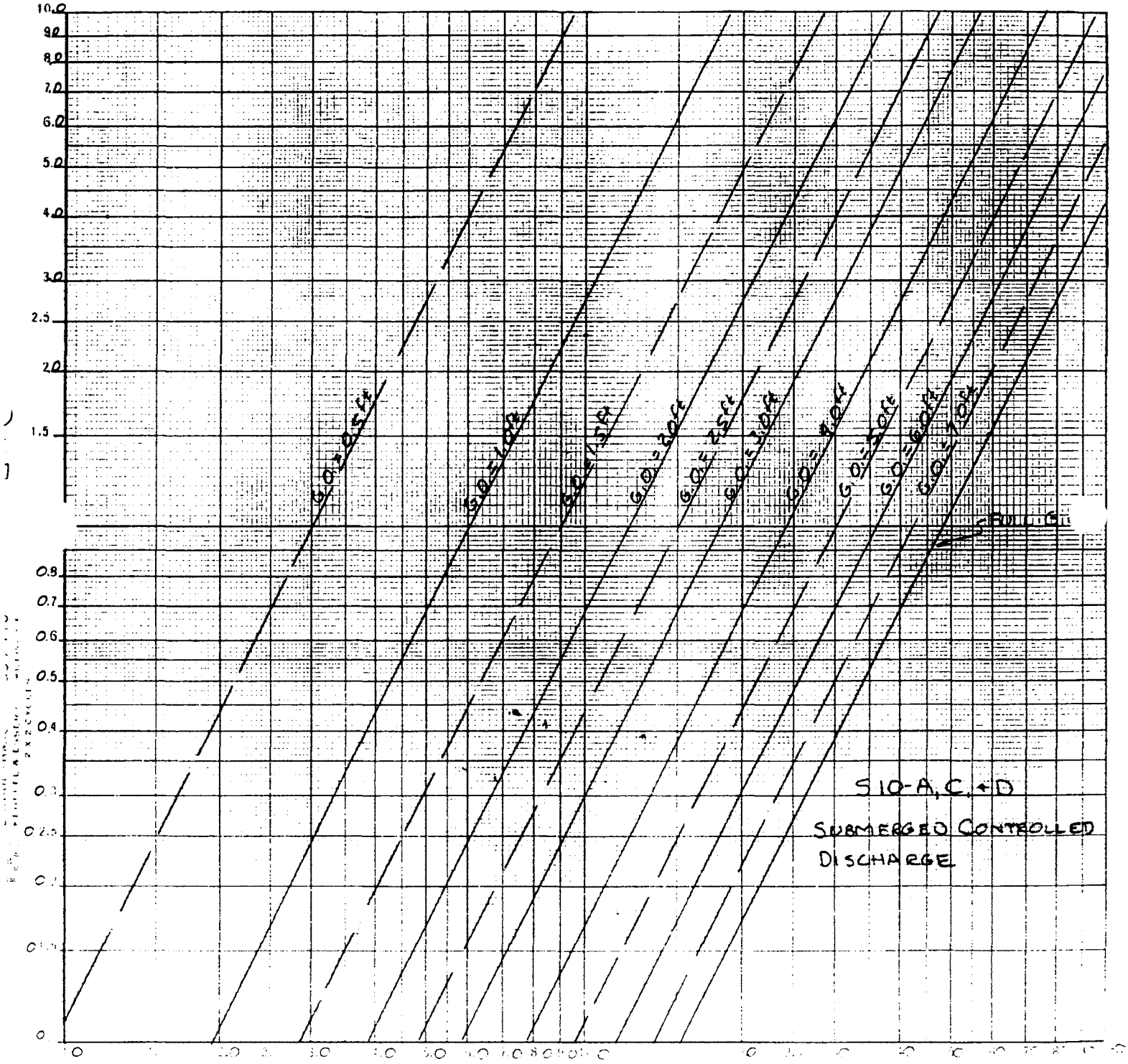
discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts the minimum elevation preferred in the borrow canals is 11.0 ft., NGVD. Below this elevation no further releases should be permitted from WCA No. 1 unless a supply of water from another storage area is transferred to WCA No. 1.

Constraints. Water releases from S-10C should not be made when water stage in WCA No. 1 is 11.0 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-10 structures at the same time.

STRUCTURE 10C (S-10C)

Summary of Hydraulic Design

Location	L-39
Drainage Area - total for S-10's (sq. miles)	728
Design Conditions	
Total Discharge for 3 Spillways (cfs)	14,800
Type	Uncontrolled submerged
Headwater Elevation (ft.)	17.3
Tailwater Elevation (ft.)	16.4
SPF Condition	
Discharge (cfs)	4,680
Headwater Elevation (ft.)	24.4
Tailwater Elevation (ft.)	2.4 to 8.5
Optimum Conditions	
Headwater Elevation (ft.)	17.0
Tailwater Elevation (ft.)	14.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	10.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	10.0
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.7 x 8.0
Top of Gates Elevation (ft.) (fully closed position)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	5.5
Apron Length (ft.)	25.0
End Sill Height (ft.)	1.5
Training Wall Minimum Elevation (ft.)	17.3
Wing Wall Angle to flow (degree)	45



DISCHARGE (100 CFS)

CENTRAL AND SOUTHERN FLORIDA PROJ.
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE 10C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 10D (S-10D)

Location. Structure 10D is located in Levee 39 approximately 5.9 miles northwest of Structure 39 on the southwest perimeter of WCA No. 1. Levee 39 extends along the Hillsboro Canal in South Palm Beach County west of Boca Raton and State Highway No. 9.

Description. S-10D is a reinforced concrete, four-bay, U-shaped spillway with concrete wing walls and training walls. The vertical-lift gates are operated from the service bridge by a vehicular-drive mechanism. Each gate is 25.7 ft. wide by 8 ft. high and is individually operated by a separate hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber needles and structural-steel needle beams are provided for one bay only but will suit all the bays.

Purpose. S-10D (along with S-10A and S-10C) controls water levels in WCA No. 1 and permits releases from WCA No. 1 into WCA No. 2A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 14.0 to 17.0 ft., NGVD on a seasonal basis. The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. S-10D is generally operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 13.0 ft., NGVD. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

Flood Control. The spillways provide a means of controlling and transporting the flow from WCA No. 1 to WCA No. 2A for all flood discharges up to the Spillway Design Flood (SDF). The S-10's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 14,800 cfs. The peak SPF stage in WCA No. 1 is about 18.3 ft., NGVD with a total storage of about 494,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-10's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-10's have no minimum low flow

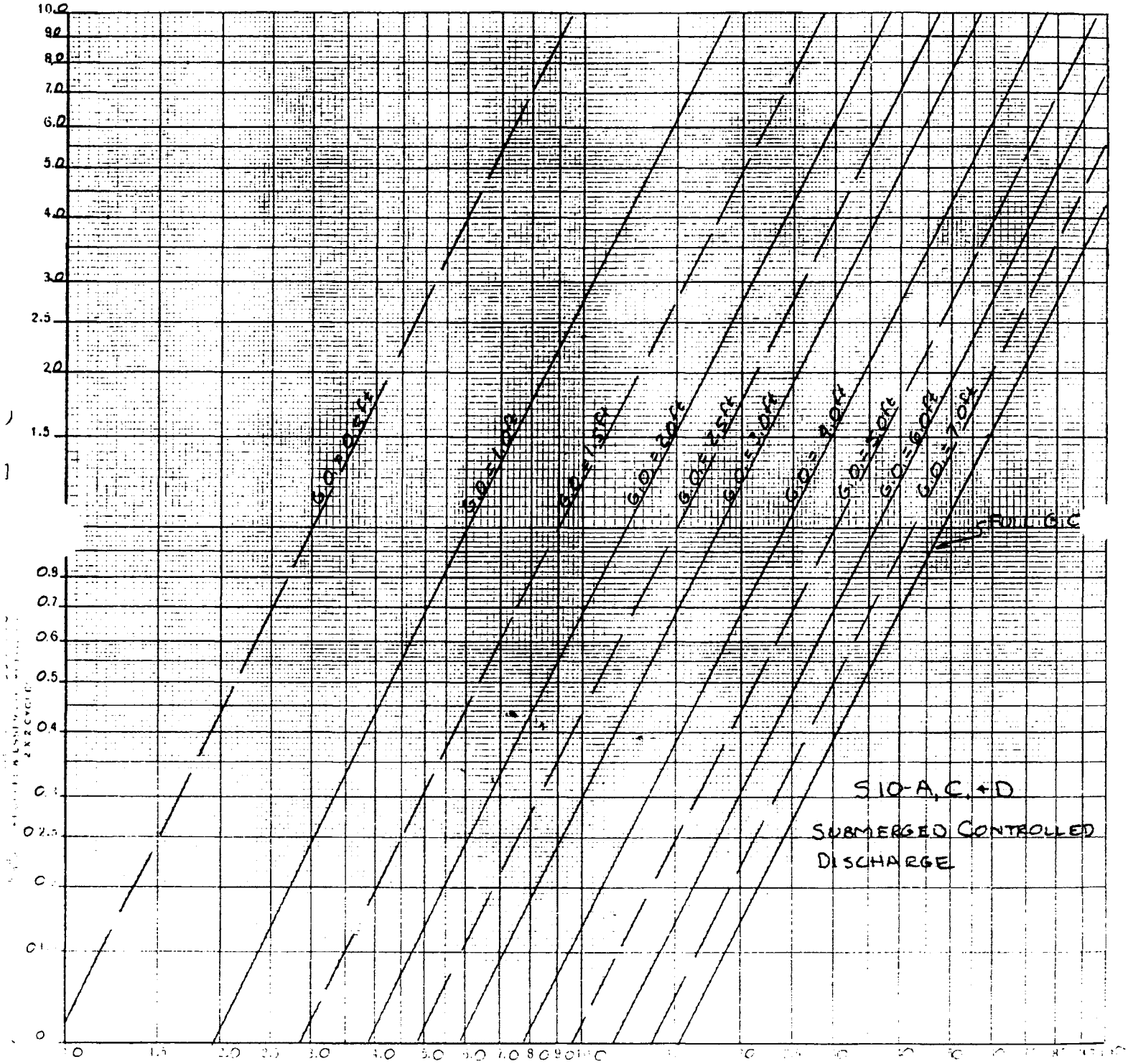
discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts the minimum elevation preferred in the borrow canals is 11.0 ft., NGVD. Below this elevation no further releases should be permitted from WCA No. 1 unless a supply of water from another storage area is transferred to WCA No. 1.

Constraints. Water releases from S-10D should not be made when water stage in WCA No. 1 is 11.0 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-10 structures at the same time.

STRUCTURE 10D (S-10D)

Summary of Hydraulic Design

Location	L-39
Drainage Area - total for S-10's (sq. miles)	728
Design Conditions	
Total Discharge for 3 Spillways (cfs)	14,800
Type	Uncontrolled submerged
Headwater Elevation (ft.)	17.3
Tailwater Elevation (ft.)	16.4
SPF Condition	
Discharge (cfs)	4,680
Headwater Elevation (ft.)	24.4
Tailwater Elevation (ft.)	2.4 to 8.5
Optimum Conditions	
Headwater Elevation (ft.)	17.0
Tailwater Elevation (ft.)	14.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	10.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	10.0
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.7 x 8.0
Top of Gates Elevation (ft.)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	7.5
Apron Length (ft.)	25.0
End Sill Height (ft.)	1.5
Training Wall Minimum Elevation (ft.)	17.3
Wing Wall Angle to flow (degree)	45



DISCHARGE (100 CFS)

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE 10D

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 10E (S-10E)

Location. S-10E is located through Levee 39 about one-half mile southeast of S-6.

Description. S-10E is a three-barreled corrugated metal pipe culvert. Control is effected by three manually operated sluice gates mounted on a steel frame erected on the upstream.

Purpose. This structure permits release of water from WCA No. 1 into the northern portion of WCA No. 2A.

Regulation. This structure is manually operated only under flood conditions as directed by the U.S. Army, Corps of Engineers, in a manner so as to follow the regulation schedule for WCA No. 1. When such regulation discharge is required, this structure will normally be opened before S-10A, C or D are opened.

STRUCTURE 10E

Summary of Hydraulic Design

Location	L-39
Design Conditions	
Discharge (cfs)	438
Type	uncontrolled submerged
Headwater Elevation (ft.)	17.3
Tailwater Elevation (ft.)	16.4
Structure	
Type	CMP
Number of barrels	3
Size diameter (ft.)	6
Length (ft.)	40
Flow line elevation (ft.)	9.0
Gates	
Type	sluice
Number	3
Width x Height (ft.)	6 x 6
Control	manual
Dewatering Capabilities	none

Flow Rate Equation:

$$Q \text{ (cfs)} = 494.78(\Delta H)^{1/2}$$

$$\Delta H \text{ (ft.)} = (Q \div 494.78)^2$$

where, $\Delta H = HW \text{ (ft.)} - TW \text{ (ft.)}$

For $Q = 750$ cfs,

$$\Delta H = (750 \div 494.78)^2$$
$$\approx 2.3 \text{ ft}$$

STRUCTURE 11A (S-11A)

Location. Structure 11A is located in Levee 38 about 1.9 miles north of where U.S. Highway 27 and State Road 84 intersect. This is about 20 miles west of Ft. Lauderdale, Florida.

Description. Structure 11A is one of three spillways which make up Structure 11. S-11A is a reinforced concrete, four-bay, gated spillway with a sloped weir, stilling basin, downstream training walls and flared upstream wing walls to improve entrance conditions. Each gate is 25 ft. wide by 9 ft. high and is individually operated by its own hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber stoplogs and aluminum needle beams are provided and are stored at Clewiston.

Purpose. Structures 11A, B, and C control water levels in WCA No. 2A and permit releases from WCA No. 2A into WCA No. 3A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 11.0 ft. to 13.0 ft., NGVD on a seasonal basis. The regulation schedule is shown in this manual. When the WCA No. 2A stage is in Zone A releases should be made up to maximum capacity. In Zone B only releases for water supply should be made. The S-11B headwater gage is the indicator gage for regulation from 1 February through 30 June. The rest of the year the indicator is the 2-17 gage. From 1 January to 30 January, the S-11B headwater gage will become the indicator only if the 2-17 gage has receded to 11.5 ft.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-11's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 10.0 ft., NGVD. Spillway gate openings should be checked against the Maximum Allowable Gate Opening Curve to insure the gate openings are within the allowable gate opening for non-damaging operations. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

The U.S. Army Corps of Engineers is responsible for the operation and maintenance of this project. The SFWMD, under contract with the Corps, makes gate changes at the spillways under the direction of the Jacksonville District on a cost-reimbursable basis.

Flood Control. The spillways provide a means of controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The S-11's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 17,200 cfs. The peak SPF stage in WCA No. 2 is about 16.6 ft., NGVD with a total storage of about 596,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-11's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

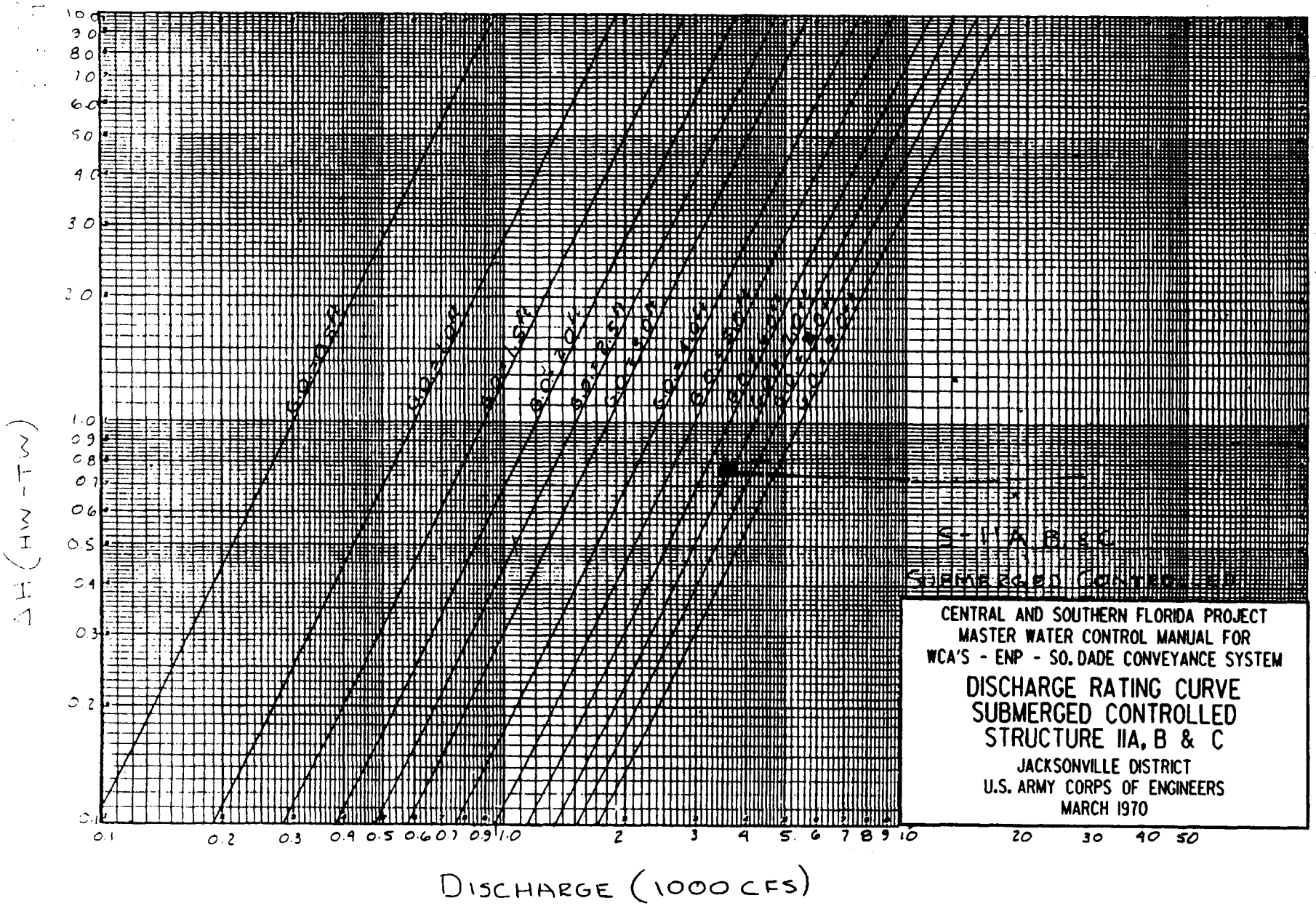
Low Flow Regulation. The S-11's have no minimum low flow required discharge. During droughts the minimum elevation preferred in the borrow canals is 10.5 ft., NGVD. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 2A.

Constraints. Water releases from S-11 should not be made when the water stage in WCA No. 2 is at 10.5 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-11 structures at the same time.

STRUCTURE 11A (S-11A)

Summary of Hydraulic Design

Location	L-38
Design Conditions	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	
Maximum	15.4
Minimum	12.0
Tailwater Elevation (ft.)	
Maximum	13.6
Minimum	8.0
SPF Condition	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	15.4
Tailwater Elevation (ft.)	13.6
Optimum Conditions	
Headwater Elevation (ft.)	12.0 to 14.5
Tailwater Elevation (ft.)	9.5 to 11.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	7.5
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.8 x 9.0
Top of Gates Elev. (full closed)	16.5
Bottom of Gates Elev. (full open)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	6.0
Apron Length, approx. (ft.)	30.0
End Sill	7.5
Training Wall Minimum Elevation (ft.)	13.0



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

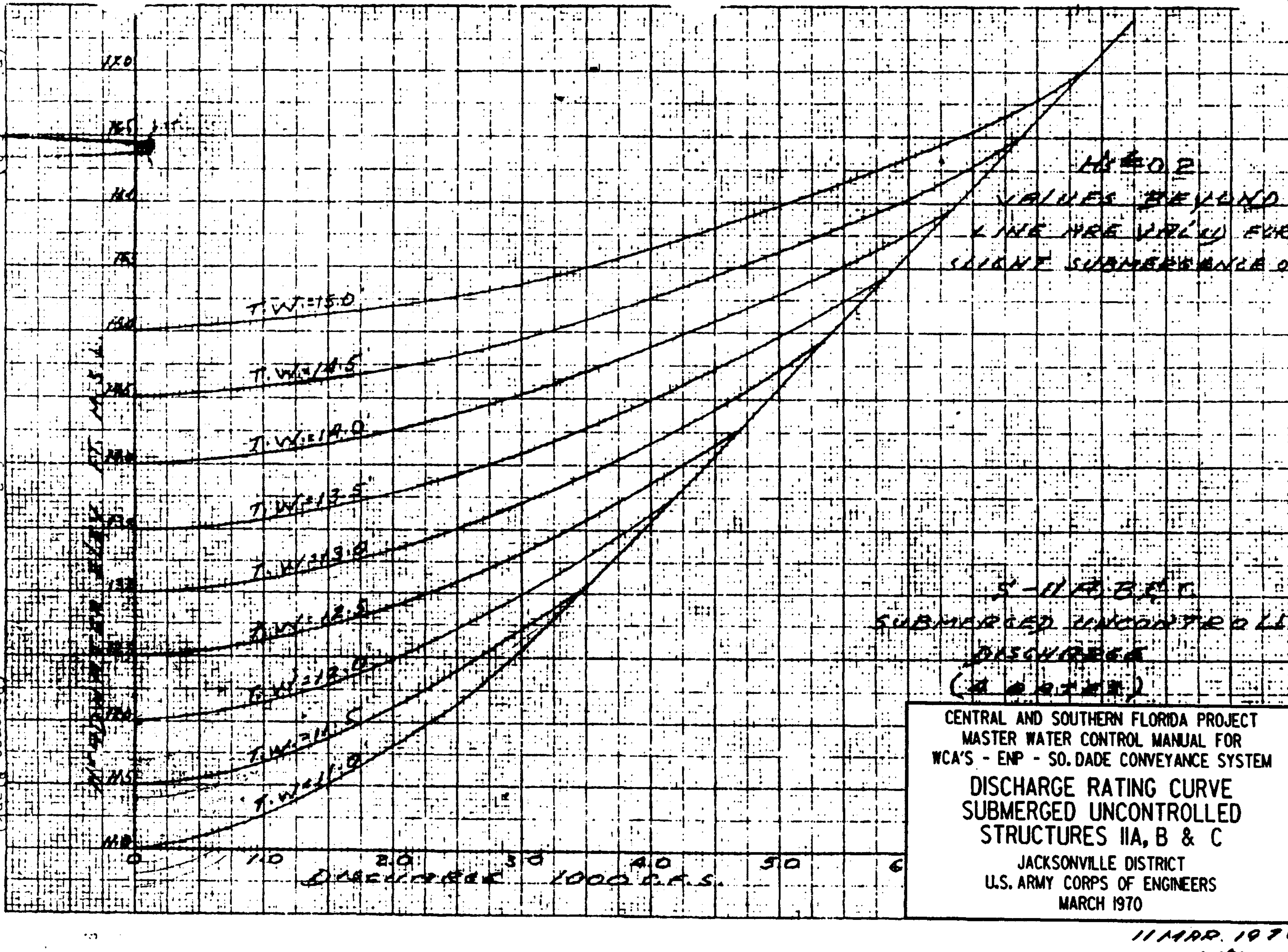
DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE IIA, B & C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MARCH 1970

(Figure 6-2)

6-9

(Reverse Blank)



(Figure 6-1)

6-7

(Reverse Blank)

SAJP 1130-2-10
1 Dec 71

STRUCTURE 11B (S-11B)

Location. Structure 11B is located in Levee 38 about 3.7 miles north of where U.S. Highway 27 and State Road 84 intersect. This is about 20 miles west of Ft. Lauderdale, Florida.

Description. Structure 11B is one of three spillways which make up Structure 11. S-11B is a reinforced concrete, four-bay, gated spillway with a sloped weir, stilling basin, downstream training walls and flared upstream wing walls to improve entrance conditions. Each gate is 25 ft. wide by 9 ft. high and is individually operated by its own hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber stoplogs and aluminum needle beams are provided and are stored at Clewiston.

Purpose. Structures 11A, B, and C control water levels in WCA No. 2A and permit releases from WCA No. 2A into WCA No. 3A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 11.0 ft. to 13.0 ft., NGVD on a seasonal basis. The regulation schedule is shown in this manual. When the WCA No. 2A stage is in Zone A releases should be made up to maximum capacity. In Zone B only releases for water supply should be made. The S-11B headwater gage is the indicator gage for regulation from 1 February through 30 June. The rest of the year the indicator is the 2-17 gage. From 1 January to 30 January, the S-11B headwater gage will become the indicator only if the 2-17 gage has receded to 11.5 ft.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-11's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 10.0 ft., NGVD. Spillway gate openings should be checked against the Maximum Allowable Gate Opening Curve to insure the gate openings are within the allowable gate opening for non-damaging operations. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

The U.S. Army Corps of Engineers is responsible for the operation and maintenance of this project. The SFWMD, under contract with the Corps, makes gate changes at the spillways under the direction of the Jacksonville District on a cost-reimbursable basis.

Flood Control. The spillways provide a means of controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The S-11's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 17,200 cfs. The peak SPF stage in WCA No. 2 is about 16.6 ft., NGVD with a total storage of about 596,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-11's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

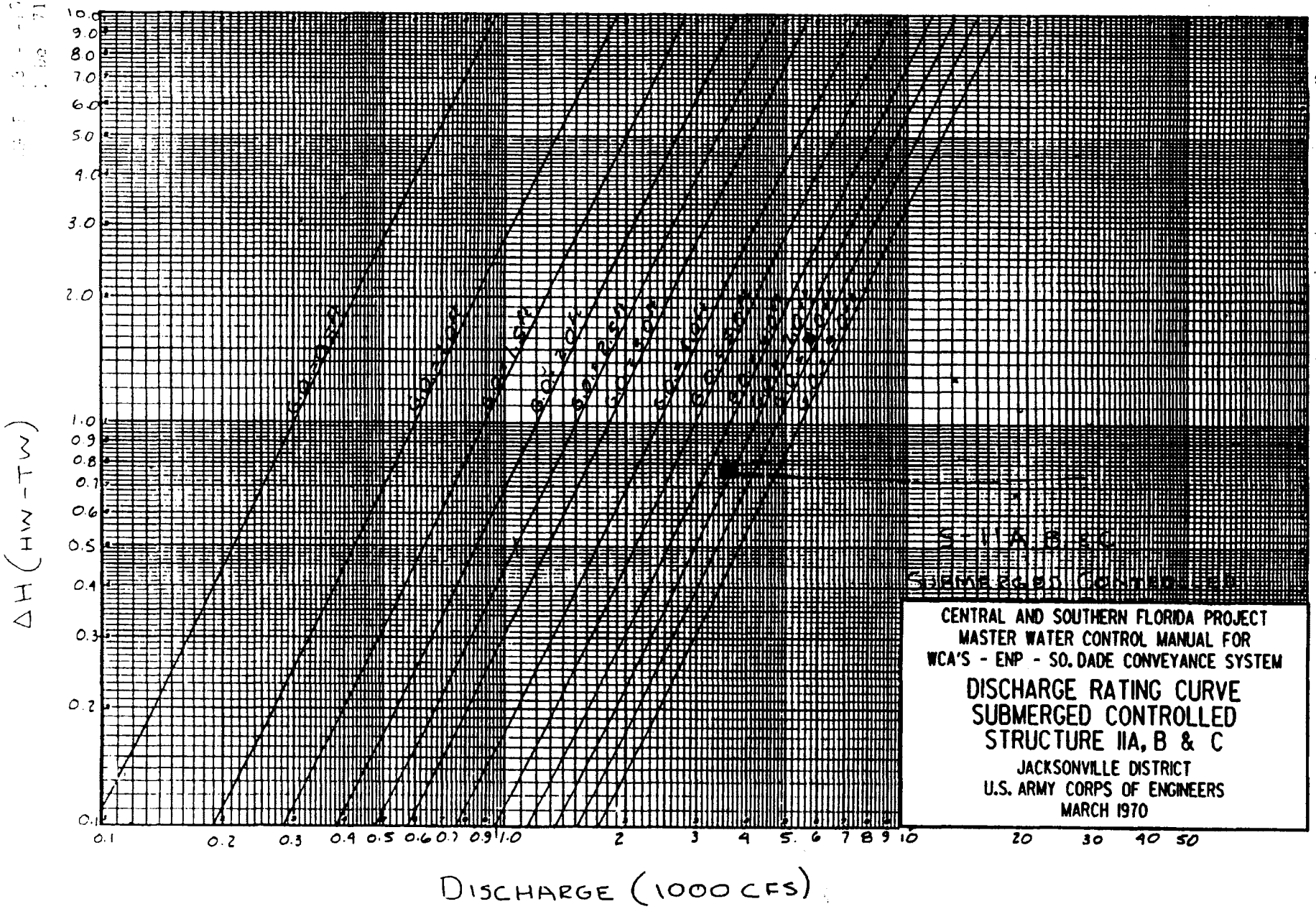
Low Flow Regulation. The S-11's have no minimum low flow required discharge. During droughts the minimum elevation preferred in the borrow canals is 10.5 ft., NGVD. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 2A.

Constraints. Water releases from S-11B should not be made when the water stage in WCA No. 2 is at 10.5 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-11 structures at the same time.

STRUCTURE 11B (S-11B)

Summary of Hydraulic Design

Location	L-38
Design Conditions	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	
Maximum	15.4
Minimum	12.0
Tailwater Elevation (ft.)	
Maximum	13.6
Minimum	8.0
SPF Condition	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	15.4
Tailwater Elevation (ft.)	13.6
Optimum Conditions	
Headwater Elevation (ft.)	12.0 to 14.5
Tailwater Elevation (ft.)	9.5 to 11.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	7.5
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.8 x 9.0
Top of Gates Elev. (full closed)	16.5
Bottom of Gates Elev. (full open)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	6.0
Apron Length, approx. (ft.)	30.0
End Sill Elevation (ft.)	7.5
Training Wall Minimum Elevation (ft.)	13.0



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

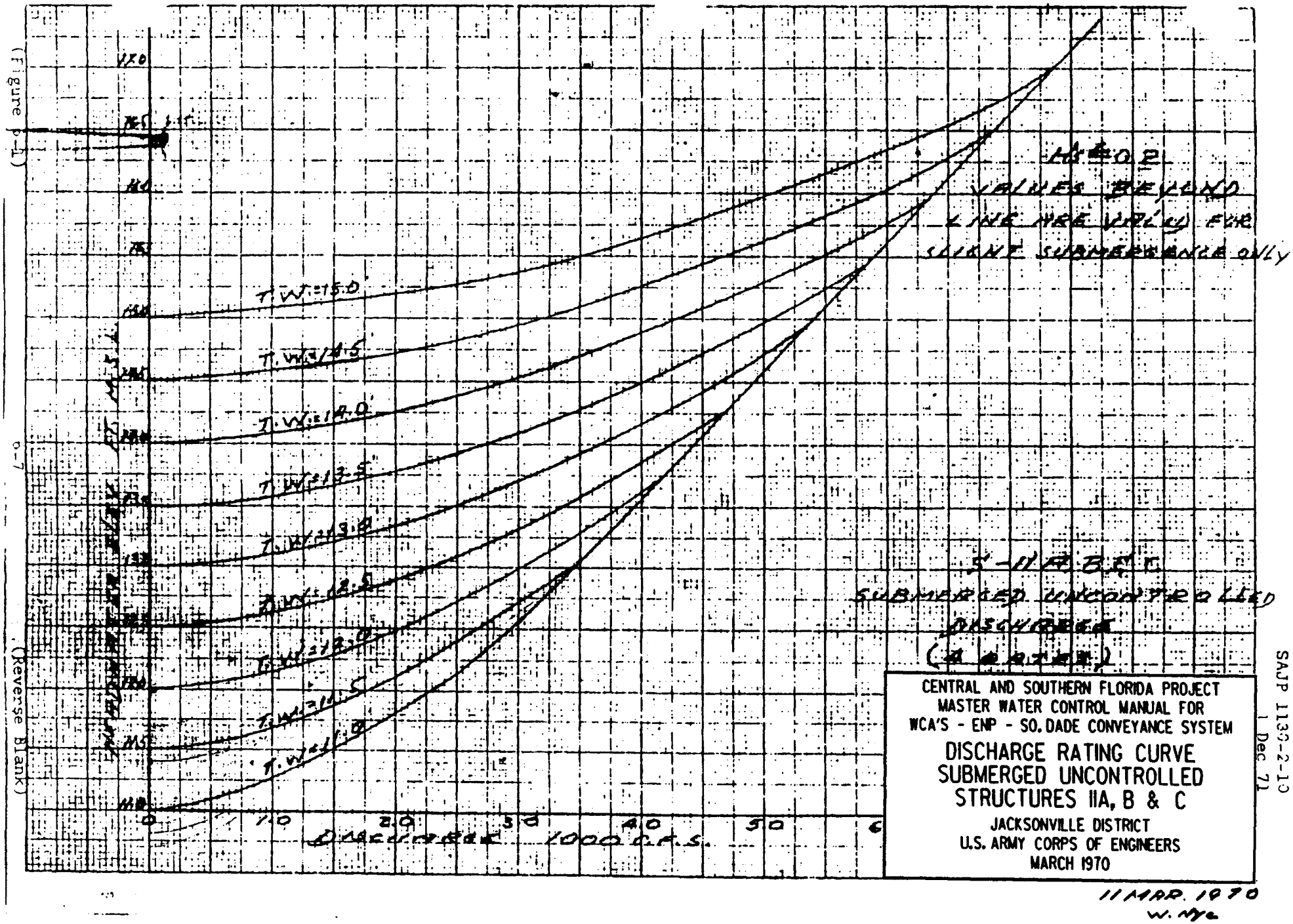
DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE IIA, B & C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MARCH 1970

(Figure 6-2)

6-9

(Reverse Blank)



(Figure 7-7)

(Reverse Blank)

SAJP 1130-2-10
1 Dec 71

STRUCTURE 11C (S-11C)

Location. Structure 11C is located in Levee 38 about 5.8 miles north of where U.S. Highway 27 and State Road 84 intersect. This is about 20 miles west of Ft. Lauderdale, Florida.

Description. Structure 11C is one of three spillways which make up Structure 11. S-11C is a reinforced concrete, four-bay, gated spillway with a sloped weir, stilling basin, downstream training walls and flared upstream wing walls to improve entrance conditions. Each gate is 25 ft. wide by 9 ft. high and is individually operated by its own hoist assembly. A reinforced concrete service bridge supported by the abutments and piers accommodates the vehicular-drive mechanism and provides access over each unit for the levee and structure-maintenance equipment. For dewatering, timber stoplogs and aluminum needle beams are provided and are stored at Clewiston.

Purpose. Structures 11A, B, and C control water levels in WCA No. 2A and permit releases from WCA No. 2A into WCA No. 3A.

Normal Regulation. The spillways are operated to maintain equivalent level pool stages which vary from 11.0 ft. to 13.0 ft., NGVD on a seasonal basis. The regulation schedule is shown in this manual. When the WCA No. 2A stage is in Zone A releases should be made up to maximum capacity. In Zone B only releases for water supply should be made. The S-11B headwater gage is the indicator gage for regulation from 1 February through 30 June. The rest of the year the indicator is the 2-17 gage. From 1 January to 30 January, the S-11B headwater gage will become the indicator only if the 2-17 gage has receded to 11.5 ft.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-11's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 10.0 ft., NGVD. Spillway gate openings should be checked against the Maximum Allowable Gate Opening Curve to insure the gate openings are within the allowable gate opening for non-damaging operations. As a practical consideration, the spillway gate settings should be kept within 1 foot of each other.

The U.S. Army Corps of Engineers is responsible for the operation and maintenance of this project. The SFWMD, under contract with the Corps, makes gate changes at the spillways under the direction of the Jacksonville District on a cost-reimbursable basis.

Flood Control. The spillways provide a means of controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The S-11's were sized to pass the Standard Project Flood (SPF). The discharge from all three spillways under SPF conditions totals 17,200 cfs. The peak SPF stage in WCA No. 2 is about 16.6 ft., NGVD with a total storage of about 596,000 acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-11's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

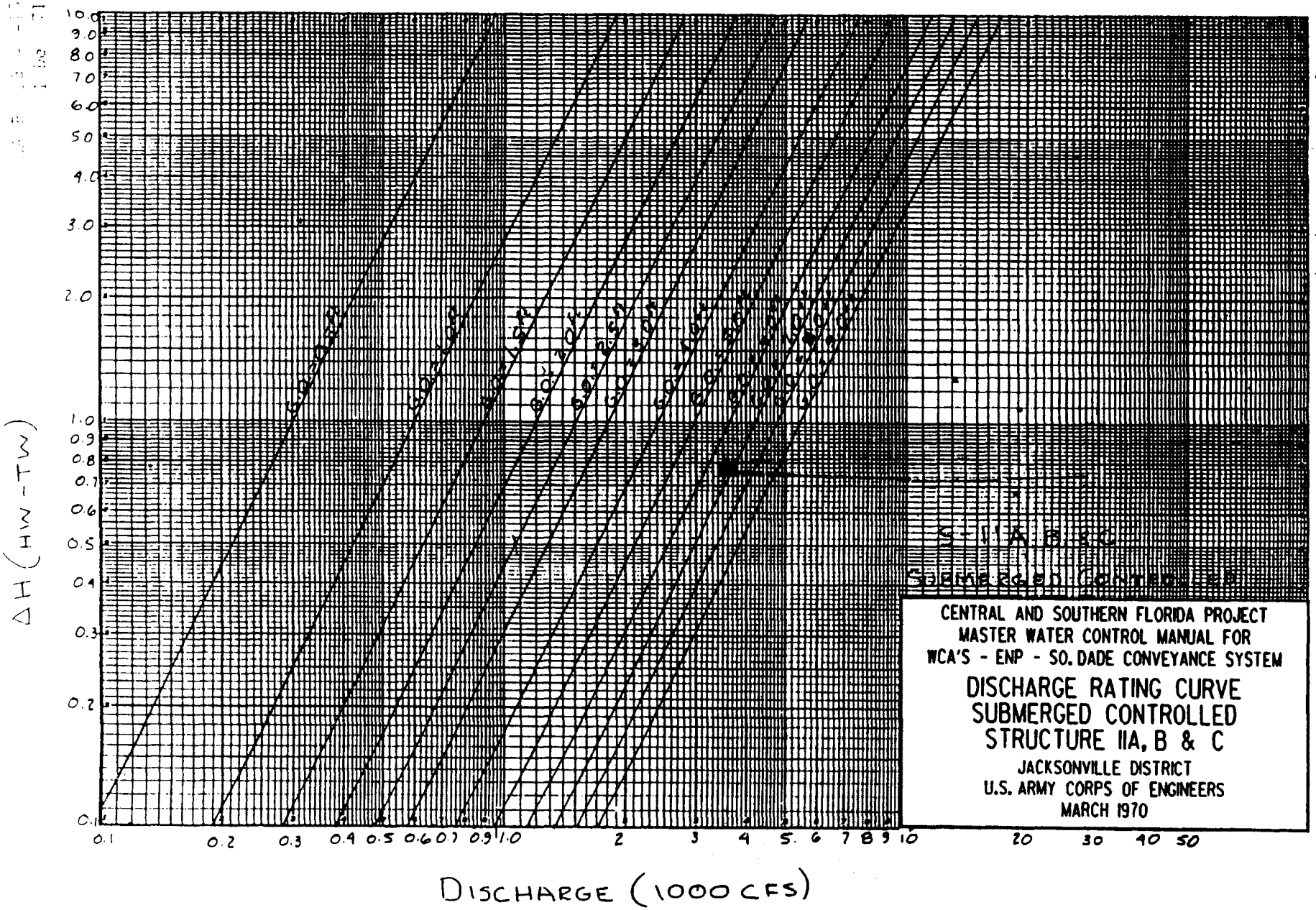
Low Flow Regulation. The S-11's have no minimum low flow required discharge. During droughts the minimum elevation preferred in the borrow canals is 10.5 ft., NGVD. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 2A.

Constraints. Water releases from S-11C should not be made when the water stage in WCA No. 2 is at 10.5 ft., NGVD or below. Because of the likelihood of low tailwater levels, concurrent high headwater levels, and uncontrolled hydraulic jumps, it is recommended that not more than one gate be inoperative in 2 of the 3 S-11 structures at the same time.

STRUCTURE 11C (S-11C)

Summary of Hydraulic Design

Location	L-38
Design Conditions	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	
Maximum	15.4
Minimum	12.0
Tailwater Elevation (ft.)	
Maximum	13.6
Minimum	8.0
SPF Condition	
Total Discharge of 3 S-11 Spillways (cfs)	17,200
Type	Submerged Uncontrolled
Headwater Elevation (ft.)	15.4
Tailwater Elevation (ft.)	13.6
Optimum Conditions	
Headwater Elevation (ft.)	12.0 to 14.5
Tailwater Elevation (ft.)	9.5 to 11.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	7.5
Net Length (ft.)	100.0
Gates	
Type of Gate	Vertical lift
Number	4
Width x Height (ft.)	25.8 x 9.0
Top of Gates Elev. (full closed)	16.5
Bottom of Gates Elev. (full open)	18.0
Control	manual
Stilling Basin	
Apron Elevation (ft.)	6.0
Apron Length, approx. (ft.)	30.0
End Sill Elevation (ft.)	7.5
Training Wall Minimum Elevation (ft.)	13.0



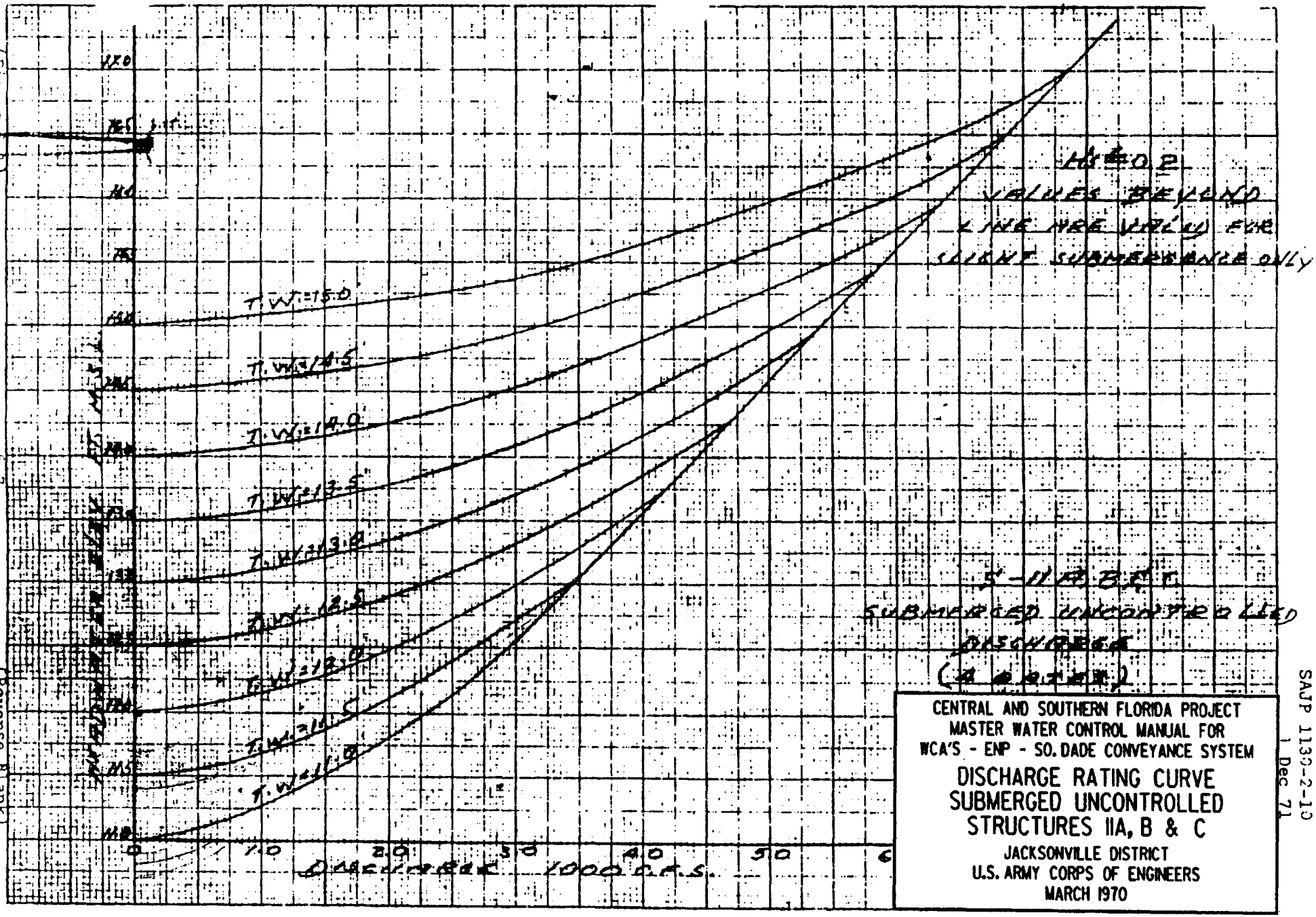
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE IIA, B & C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MARCH 1970

(Figure 6-2)

(Reverse Blank)



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED UNCONTROLLED
STRUCTURES IIA, B & C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MARCH 1970

11 MAR. 1970
W. Nye

(Figure D-1)

(Reverse Blank)

STRUCTURE 12A (S-12A)

Location. S-12A is located in Levee 29 (U.S. Highway 41), Section 2, on the south perimeter of WCA No. 3A, about 42.1 miles west of Miami, Florida.

Description. Structure 12A is one of four spillways which make up Structure 12. S-12A is a reinforced concrete, gated, six-bay spillway, with a trapezoidal weir having a crest elevation of 0.8 feet. The 25 ft. wide x 10.2 ft. high, mechanically operated, vertical-lift gates are installed on the crest of the weir. A steel-sheet-pile cutoff is provided under the downstream edge of the structure and under the downstream training walls. The superstructure consists of a highway bridge, a gate operating platform, and a service walkway, all constructed of reinforced concrete. For dewatering, the aluminum posts and timber stop logs for S-11 and the needle beam and timber needles provided for S-10 may be used.

Purpose. S-12A, B, C, and D provide the principal means of discharge from WCA No. 3A and are also a principal source of gravity flow into Shark River Slough (Everglades National Park). The S-12's serve to maintain an optimum water elevation in Water Conservation Area No. 3A. At this writing, the S-12's and S-333 share (on a percentage basis) the responsibility to deliver water to ENP under the Experimental Program of Water Deliveries to Everglades National Park. The experimental plan is discussed in detail in Chapter VII, paragraph 7-03, of this manual.

Normal Regulation. The water surface elevation of Water Conservation Area No. 3A has been regulated according to a 9.5 - 10.5 ft. regulation schedule, as shown in this manual and as a part of the Experimental Plan of Water Deliveries to ENP. Under the current regulation schedule, the stage peaks at 10.5 to coincide with the end of the normal rainy season (November 1), remains at 10.5 feet through December 30, and then gradually declines to 9.5 feet by June 1 before beginning a gradual return to the peak stage.

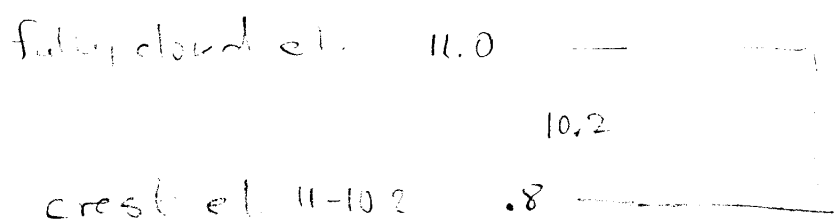
The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-12's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 8.0 ft., NGVD. As a practical consideration, the S-12 spillway gate settings should be kept within 1 foot of each other.

Flood Control. The S-12's were sized to pass the Standard Project Flood (SPF). The spillways provide a means of

controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The peak SPF stage in WCA No. 3A is about 14.4 ft. with a total storage of about 2.7 million acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-12's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-12's have no minimum low flow discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts a minimum elevation in the borrow canals of 7.5 ft., NGVD should be observed. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 3A.

Constraints. Water releases from S-12A should not be made when the water stage in WCA No. 3 is 7.5 ft., NGVD or below.



STRUCTURE 12A (S-12A)

Summary of Hydraulic Design

Location	L-29
Total Drainage Area for S-12's (sq. miles)	3,070
Design Conditions	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
SPF Condition	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
Critical Static Condition (no flow)	
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	9.5 - 10.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	7.5
Crest	
Shape	Trapezoidal
Elevation (ft.)	0.8
Net Length (ft.)	150.0
Gates	
Type of Gate	vertical lift
Number	6
Width x Height (ft.)	25.0 x 10.2
Low Steel Elevation (ft.) (fully open position)	13.4
Top of Gates Elevation (ft.) (fully closed position)	11.0
Top of Gates Elevation (ft.) (fully open position)	23.6
Stilling Basin	
Apron Elevation (ft.)	-0.2
Apron Length (ft.)	20.0
End Sill Elevation (ft.)	0.8
Training Wall Angle to flow (degrees)	45.0
Highway Bridge Low Elevation (ft.)	14.5
Service Walkway Elevation (ft.)	16.0
Operating Platform Elevation (ft.)	29.5
Dewatering Capabilities	Yes

RT 12.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 05-SEP-88 15:10 ECP RATING NO 12.0

25454308049110 1 TAMIAMI CANAL BELOW S-12-A, NR MIAMI, FL TYPE LINEAR

BASED ON ..... DISCHARGE MEASUREMENTS, NOS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

RATING TO BE USED STARTING AT: 03/01/85 (0015) COMP BY ..... DATE .....

REMARKS: TAILWATER RATING - GATES OUT OF THE WATER CKD. BY ..... DATE .....

DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION)

GAGE HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
7.10						.000*	.004	.008	.012	.016	
7.20	.020*	.068	.116	.164	.212	.260	.308	.356	.404	.452	.480
7.30	.500*	1.05	1.60	2.15	2.70	3.25	3.80	4.35	4.90	5.45	5.50
7.40	6.00*	6.70	7.40	8.10	8.30	9.50	10.2	10.9	11.6	12.3	7.0
7.50	13.0*	13.7	14.4	15.1	15.8	16.5	17.2	17.9	18.6	19.3	7.0
7.60	20.0*	20.7	21.8	22.7	23.6	24.5	25.4	26.3	27.2	28.1	9.0
7.70	29.0*	29.9	30.8	31.7	32.6	33.5	34.4	35.3	36.2	37.1	9.0
7.80	38.0*	38.9	39.8	40.7	41.6	42.5	43.4	44.3	45.2	46.1	9.0
7.90	47.0*	48.0	49.0	50.0	51.0	52.0	53.0	54.0	55.0	56.0	10.0
8.00	57.0*	58.1	59.2	60.3	61.4	62.5	63.6	64.7	65.8	66.9	11.0
8.10	68.0*	69.1	70.2	71.3	72.4	73.5	74.6	75.7	76.8	77.9	11.0
8.20	79.0*	80.3	81.6	82.9	84.2	85.5	86.8	88.1	89.4	90.7	13.0
8.30	92.0*	93.3	94.6	95.9	97.2	98.5	99.8	101.1	102.4	103.7	13.0
8.40	105.0*	106.7	108.4	110.1	111.8	113.5	115.2	116.9	118.6	120.3	17.0
8.50	122.0*	123.9	125.8	127.7	129.6	131.5	133.4	135.3	137.2	139.1	19.0
8.60	141.0*	143.6	146.2	148.8	151.4	154.0	156.6	159.2	161.8	164.4	26.0
8.70	167.0*	170.3	173.6	176.9	180.2	183.5	186.8	190.1	193.4	196.7	33.0
8.80	200.0*	203.5	207.0	210.5	214.0	217.5	221.0	224.5	228.0	231.5	35.0
8.90	235.0*	238.6	242.2	245.8	249.4	253.0	256.6	260.2	263.8	267.4	36.0
9.00	271.0*	274.6	278.2	281.8	285.4	289.0	292.6	296.2	299.8	303.4	36.0
9.10	307.0	310.6	314.2	317.8	321.4	325.0	328.6	332.2	335.8	339.4	36.0
9.20	343.0	346.6	350.2	353.8	357.4	361.0	364.6	368.2	371.8	375.4	36.0
9.30	379.0	382.6	386.2	389.8	393.4	397.0	400.6	404.2	407.8	411.4	36.0
9.40	415.0	418.6	422.2	425.8	429.4	433.0	436.6	440.2	443.8	447.4	36.0
9.50	451.0	454.6	458.2	461.8	465.4	469.0	472.6	476.2	479.8	483.4	36.0
9.60	487.0	490.6	494.2	497.8	501.4	505.0	508.6	512.2	515.8	519.4	36.0
9.70	523.0	526.6	530.2	533.8	537.4	541.0	544.6	548.2	551.8	555.4	36.0
9.80	559.0	562.6	566.2	569.8	573.4	577.0	580.6	584.2	587.8	591.4	36.0
9.90	595.0	598.6	602.2	605.8	609.4	613.0	616.6	620.2	623.8	627.4	36.0
10.00	631.0*										

S-12A ~~Rat~~ Tailwater Rating

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
TAILWATER RATING - GATES OUT OF WATER
STRUCTURE 12A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

PT 15.1 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE P DATE: 07-SEP-88 07:46 ECP RATING

0045430204911 00 S-12-A ABOVE TYPE LOG [OFFSET=(0.00, 0.00)]

BASED ON ..... DISCHARGE MEASUREMENTS, NOS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

RATING TO BE USED STARTING AT: 00/01/00 (0015) COMP BY ..... DATE .....

REMARKS: HEAD vs DISCHARGE FOR 1 GATE OPEN 1 FT CKD. BY ..... DATE .....

HEAD ~~(FEET)~~ (FEET)

DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION)

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
0.00			25.4*	32.5	37.6	42.0	45.0*	48.3	50.3	52.2	
0.10	54.0*	56.3	57.5	60.5	62.5	64.4	66.2	68.0	69.7	71.4	19.0
0.20	73.5*	74.5	76.2	77.7	79.3	80.7	82.1	83.5	84.3	86.2	14.5
0.30	87.5*	88.5	89.2	91.0	92.3	93.7	94.9	96.0	97.2	98.3	11.9
0.40	99.4	100.5	101.6	102.7	103.7	104.7	105.3	106.3	107.8	103.8	10.4
0.50	109.8	110.7	111.7	112.5	113.5	114.5	115.4	116.3	117.2	118.1	9.2
0.60	119.0	120.0*	120.7	121.5	122.4	123.3	124.1	124.9	125.7	126.5	8.3
0.70	127.3	128.1	128.7	129.7	130.5	131.2	132.0	132.8	133.5	134.3	7.7
0.80	135.0*	135.7	136.4	137.1	137.7	138.4	139.1	139.7	140.4	141.1	6.7
0.90	141.7	142.4	143.0	143.6	144.5	144.9	145.5	146.2	146.8	147.4	6.3
1.00	148.0*	148.7	149.3	150.0	150.6	151.3	151.9	152.6	153.2	153.8	6.5
1.10	154.5	155.1	155.7	156.3	157.0	157.6	158.2	158.8	159.4	160.0	6.1
1.20	160.6	161.2	161.8	162.4	163.0	163.6	164.2	164.8	165.3	165.9	5.9
1.30	166.5	167.1	167.6	168.2	168.8	169.3	169.9	170.5	171.0	171.6	5.6
1.40	172.1	172.7	173.2	173.8	174.3	174.9	175.4	175.9	176.5	177.0	5.4
1.50	177.5	178.1	178.6	179.1	179.6	180.2	180.7	181.2	181.7	182.2	5.3
1.60	182.8	183.3	183.8	184.3	184.8	185.3	185.8	186.3	186.8	187.3	5.0
1.70	187.8	188.3	188.8	189.3	189.8	190.3	190.7	191.2	191.7	192.2	4.9
1.80	192.7	193.2	193.6	194.1	194.6	195.1	195.5	196.0	196.5	196.9	4.7
1.90	197.4	197.9	198.3	198.8	199.3	199.7	200.2	200.6	201.1	201.5	4.6
2.00	202.0*	202.4	202.9	203.3	203.7	204.1	204.5	205.0	205.4	205.8	4.2
2.10	206.2	206.7	207.1	207.5	207.9	208.3	208.7	209.1	209.5	209.9	4.2
2.20	210.4	210.8	211.2	211.6	212.0	212.4	212.8	213.2	213.6	214.0	4.0
2.30	214.4	214.8	215.2	215.6	215.9	216.3	216.7	217.1	217.5	217.9	3.9
2.40	218.3	218.7	219.1	219.4	219.8	220.2	220.6	221.0	221.3	221.7	3.3
2.50	222.1	222.5	222.9	223.2	223.6	224.0	224.4	224.7	225.1	225.5	3.7
2.60	225.8	226.2	226.6	226.9	227.3	227.7	228.0	228.4	228.8	229.1	3.7
2.70	229.5	229.8	230.2	230.5	230.9	231.3	231.6	232.0	232.4	232.7	3.6
2.80	233.1	233.4	233.8	234.1	234.5	234.8	235.2	235.5	235.9	236.2	3.5
2.90	236.6	236.9	237.3	237.6	237.9	238.3	238.6	239.0	239.3	239.7	3.4
3.00	240.0*	240.3	240.7	241.0	241.4	241.7	242.1	242.4	242.8	243.1	3.5
3.10	243.4	243.8	244.1	244.4	244.8	245.2	245.5	245.9	246.2	246.5	3.4
3.20	246.9	247.2	247.5	247.9	248.2	248.6	248.9	249.2	249.6	249.9	3.3
3.30	250.2	250.6	250.9	251.2	251.5	251.9	252.2	252.5	252.9	253.2	3.3
3.40	253.5	253.8	254.2	254.5	254.8	255.1	255.5	255.8	256.1	256.4	3.2
3.50	256.7	257.1	257.4	257.7	258.0	258.3	258.7	259.0	259.3	259.6	3.2
3.60	259.9	260.2	260.5	260.9	261.2	261.5	261.8	262.1	262.4	262.7	3.2
3.70	263.1	263.4	263.7	264.0	264.3	264.6	264.9	265.2	265.5	265.8	3.0
3.80	266.1	266.4	266.7	267.1	267.4	267.7	268.0	268.3	268.6	268.9	3.1

S-12A Partial Gate Opening

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
PARTIAL GATE OPENING
STRUCTURE 12A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

EXPANDED RATING TABLE PROCESS DATE: 07-SEP-88 07:46 ECP RATING NO 15.0

25434[illegible]04[illegible]110 103 S-12-A ABOVE TYPE LOG [OFFSET=(0.00, 0.00)]

GAGE HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
	DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION)										
3.90	269.2	269.5	269.8	270.1	270.4	270.7	271.0	271.3	271.6	271.9	3.0
4.00	272.2	272.5	272.8	273.1	273.4	273.7	274.0	274.3	274.6	274.8	2.9
4.10	275.1	275.4	275.7	276.0	276.3	276.6	276.8	277.2	277.5	277.3	3.0
4.20	278.1	278.3	278.6	278.9	279.2	279.5	279.8	280.1	280.4	280.6	2.8
4.30	280.9	281.2	281.5	281.8	282.1	282.4	282.6	282.9	283.2	283.5	2.9
4.40	283.8	284.1	284.3	284.6	284.9	285.2	285.5	285.7	286.0	286.3	2.8
4.50	286.6	286.9	287.1	287.4	287.7	288.0	288.2	288.5	288.8	289.1	2.7
4.60	289.3	289.6	289.8	290.1	290.4	290.7	291.0	291.3	291.5	291.8	2.8
4.70	292.1	292.3	292.6	292.9	293.2	293.4	293.7	294.0	294.2	294.5	2.7
4.80	294.8	295.0	295.3	295.5	295.8	296.1	296.4	296.6	296.9	297.2	2.6
4.90	297.4	297.7	297.9	298.2	298.4	298.6	298.9	299.3	299.6	299.8	2.7
5.00	300.1	300.4	300.6	300.9	301.1	301.4	301.7	301.9	302.2	302.4	2.6
5.10	302.7	302.9	303.2	303.4	303.7	304.0	304.3	304.5	304.8	305.0	2.6
5.20	305.3	305.5	305.8	306.0	306.3	306.6	306.8	307.1	307.3	307.6	2.5
5.30	307.8	308.1	308.3	308.6	308.8	309.1	309.4	309.6	309.9	310.1	2.6
5.40	310.4	310.6	310.9	311.1	311.4	311.6	311.9	312.1	312.4	312.6	2.5
5.50	312.9	313.1	313.4	313.6	313.9	314.1	314.4	314.6	314.8	315.1	2.4
5.60	315.3	315.5	315.8	316.1	316.3	316.6	316.8	317.1	317.3	317.5	2.5
5.70	317.8	318.0	318.3	318.5	318.8	319.0	319.2	319.5	319.7	320.0	2.4
5.80	320.2	320.5	320.7	320.9	321.2	321.4	321.7	321.9	322.1	322.4	2.4
5.90	322.6	322.8	323.1	323.3	323.6	323.8	324.1	324.3	324.5	324.8	2.4
6.00	325.0*										

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
(continued)

DISCHARGE RATING TABLE
PARTIAL GATE OPENING
STRUCTURE 12A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

STRUCTURE 12B (S-12B)

Location. S-12B is located in Levee 29 (U.S. Highway 41), Section 2, on the south perimeter of WCA No. 3A, about 38.9 miles west of Miami, Florida.

Description. Structure 12B is one of four spillways which make up Structure 12. S-12B is a reinforced concrete, gated, six-bay spillway, with a trapezoidal weir having a crest elevation of 0.8 feet. The 25 ft. wide x 10.2 ft. high, mechanically operated, vertical-lift gates are installed on the crest of the weir. A steel-sheet-pile cutoff is provided under the downstream edge of the structure and under the downstream training walls. The superstructure consists of a highway bridge, a gate operating platform, and a service walkway, all constructed of reinforced concrete. For dewatering, the aluminum posts and timber stop logs for S-11 and the needle beam and timber needles provided for S-10 may be used.

Purpose. S-12A, B, C, and D provide the principal means of discharge from WCA No. 3A and are also a principal source of gravity flow into Shark River Slough (Everglades National Park). The S-12's serve to maintain an optimum water elevation in Water Conservation Area No. 3A. At this writing, the S-12's and S-333 share (on a percentage basis) the responsibility to deliver water to ENP under the Experimental Program of Water Deliveries to Everglades National Park. The experimental plan is discussed in detail in Chapter VII, paragraph 7-03, of this manual.

Normal Regulation. The water surface elevation of Water Conservation Area No. 3A has been regulated according to a 9.5 - 10.5 ft. regulation schedule, as shown in this manual and as a part of the Experimental Plan of Water Deliveries to ENP. Under the current regulation schedule, the stage peaks at 10.5 to coincide with the end of the normal rainy season (November 1), remains at 10.5 feet through December 30, and then gradually declines to 9.5 feet by June 1 before beginning a gradual return to the peak stage.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-12's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 8.0 ft., NGVD. As a practical consideration, the S-12 spillway gate settings should be kept within 1 foot of each other.

Flood Control. The S-12's were sized to pass the Standard Project Flood (SPF). The spillways provide a means of

controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The peak SPF stage in WCA No. 3A is about 14.4 ft. with a total storage of about 2.7 million acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-12's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-12's have no minimum low flow discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts a minimum elevation in the borrow canals of 7.5 ft., NGVD should be observed. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 3A.

Constraints. Water releases from S-12B should not be made when the water stage in WCA No. 3 is 7.5 ft., NGVD or below.

STRUCTURE 12B (S-12B)

Summary of Hydraulic Design

Location	L-29
Total Drainage Area for S-12's (sq. miles)	3,070
Design Conditions	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
SPF Condition	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
Critical Static Condition (no flow)	
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	9.5 - 10.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	7.5
Crest	
Shape	Trapezoidal
Elevation (ft.)	0.8
Net Length (ft.)	150.0
Gates	
Type of Gate	vertical lift
Number	6
Width x Height (ft.)	25.0 x 10.2
Low Steel Elevation (ft.) (fully open position)	13.4
Top of Gates Elevation (ft.) (fully closed position)	11.0
Top of Gates Elevation (ft.) (fully open position)	23.6
Stilling Basin	
Apron Elevation (ft.)	-0.2
Apron Length (ft.)	20.0
End Sill Elevation (ft.)	0.8
Training Wall Angle to flow (degrees)	45.0
Highway Bridge Low Elevation (ft.)	14.5
Service Walkway Elevation (ft.)	16.0
Operating Platform Elevation (ft.)	29.5
Dewatering Capabilities	Yes

RT 13.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 06-SEP-88 15:08 ECP RATING NO 13.0

02289019 TAMIAMI CANAL BELOW S-12-B, NEAR MIAMI, FLA. TYPE LINEAR

BASED ON ..... DISCHARGE MEASUREMENTS, NOS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

RATING TO BE USED STARTING AT: 03/01/85 (0015) COMP BY ..... DATE .....

REMARKS: TAILWATER RATING - GATES OUT OF THE WATER CKD. BY ..... DATE .....

GAGE HEIGHT (FEET)	DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION) .00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
7.20						.000*	.200	.400	.600	.800	
7.30	1.00*	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80	2.00
7.40	3.00*	3.40	3.80	4.20	4.60	5.00	5.40	5.80	6.20	6.60	4.00
7.50	7.00*	7.40	7.80	8.20	8.60	9.00	9.40	9.80	10.2	10.6	4.0
7.60	11.0*	11.4	11.8	12.2	12.6	13.0	13.4	13.8	14.2	14.6	4.0
7.70	15.0*	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	5.0
7.80	20.0*	20.7	21.4	22.1	22.8	23.5	24.2	24.9	25.6	26.3	7.0
7.90	27.0*	27.7	28.4	29.1	29.8	30.5	31.2	31.9	32.6	33.3	7.0
8.00	34.0*	34.8	35.6	36.7	37.6	38.5	39.4	40.3	41.2	42.1	9.0
8.10	43.0*	44.1	45.2	46.3	47.4	48.5	49.6	50.7	51.8	52.9	11.0
8.20	54.0*	55.3	56.6	57.9	59.2	60.5	61.8	63.1	64.4	65.7	13.0
8.30	67.0*	68.3	69.6	70.9	72.2	73.5	74.8	76.1	77.4	78.7	13.0
8.40	80.0*	81.6	83.2	84.8	86.4	88.0	89.6	91.2	92.8	94.4	16.0
8.50	95.0*	97.7	99.4	101.1	102.8	104.5	106.2	107.9	109.6	111.3	17.0
8.60	113.0*	115.0	117.0	119.0	121.0	123.0	125.0	127.0	129.0	131.0	20.0
8.70	133.0*	135.4	137.8	140.2	142.6	145.0	147.4	149.8	152.2	154.6	24.0
8.80	157.0*	159.6	162.2	164.8	167.4	170.0	172.6	175.2	177.8	180.4	26.0
8.90	183.0*	185.7	188.4	191.1	193.8	196.5	199.2	201.9	204.6	207.3	27.0
9.00	210.0*	213.0	216.0	219.0	222.0	225.0	228.0	231.0	234.0	237.0	30.0
9.10	240.0*	243.0	246.0	249.0	252.0	255.0	258.0	261.0	264.0	267.0	30.0
9.20	270.0*	273.0	276.0	279.0	282.0	285.0	288.0	291.0	294.0	297.0	30.0
9.30	300.0*	303.4	306.8	310.2	313.6	317.0	320.4	323.8	327.2	330.6	34.0
9.40	334.0*	337.4	340.8	344.2	347.6	351.0	354.4	357.8	361.2	364.6	34.0
9.50	368.0*	371.4	374.8	378.2	381.6	385.0	388.4	391.8	395.2	398.6	34.0
9.60	402.0*	405.5	409.0	412.5	416.0	419.5	423.0	426.5	430.0	433.5	35.0
9.70	437.0*	440.7	444.4	448.1	451.8	455.5	459.2	462.9	466.6	470.3	37.0
9.80	474.0*	477.7	481.4	485.1	488.8	492.5	496.2	499.9	503.6	507.3	37.0
9.90	511.0*	514.7	518.4	522.1	525.8	529.5	533.2	536.9	540.6	544.3	37.0
10.00	548.0*	551.7	555.4	559.1	562.8	566.5	570.2	573.9	577.6	581.3	37.0
10.10	585.0*										

S-12B Tailwater Rating

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
TAILWATER RATING - GATES OUT OF WATER
STRUCTURE 12B

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINI
SEPTEMBER 1988

AT 17.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 07-SEP-88 07:47 ECP RATING NO 17.0

02287[illegible] TAMIAMI CANAL ABOVE S-12B, NEAR MIAMI, FLA. TYPE LOG (OFFSET=(0.00, 0.00))

BASED ON ..... DISCHARGE MEASUREMENTS, NGS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

COMP BY ..... DATE .....

CKD. BY ..... DATE .....

RATING TO BE USED STARTING AT: 02/01/[illegible] (2015)

REMARKS: HEAD vs DISCHARGE FOR 1 GATE OPEN 1 FT

HEAD

HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
			DISCHARGE IN CUBIC FEET PER SECOND				(EXPANDED PRECISION)				
0.00			21.7*	26.4*	30.9*	34.2	37.3	40.0*	42.8	45.5*	
0.10	47.0*	49.0	52.0	54.1	56.1	58.1	60.0	61.8	63.6	65.3	19.5
0.20	67.0*	68.8	70.2	71.5	73.3	74.6	76.3	77.7	79.1	80.5	14.9
0.30	81.8*	83.0	84.4	86.3	87.6	88.4	89.7	90.9	92.1	93.3	12.6
0.40	94.5*	95.7	98.4	99.1	99.8	100.4	101.5	102.7	103.8	104.9	11.5
0.50	106.0*	107.0	108.0	108.9	109.9	110.8	111.3	112.7	113.6	114.5	9.4
0.60	115.4	116.3	117.0	118.1	118.9	119.8	120.6	121.5	122.3	123.2	8.6
0.70	124.0	124.9*	125.7	126.5	127.4	128.2	129.0	129.8	130.7	131.5	8.3
0.80	132.3	133.1	133.8	134.6	135.4	136.2	137.0	137.7	138.5	139.2	7.7
0.90	140.0*	140.8	141.6	142.3	143.2	144.0	144.8	145.6	146.4	147.2	8.0
1.00	148.0*	148.7	149.4	150.6	150.9	151.6	152.3	153.0	153.7	154.4	7.1
1.10	155.1	155.8	156.5	157.2	157.9	158.5	159.2	159.9	160.5	161.2	6.8
1.20	161.8	162.5	163.2	163.8	164.5	165.1	165.8	166.4	167.1	167.7	6.4
1.30	168.3	168.9	169.5	170.2	170.8	171.5	172.1	172.7	173.4	174.0	6.3
1.40	174.6	175.2	175.8	176.4	177.0	177.6	178.2	178.8	179.4	180.0	6.0
1.50	180.6	181.2	181.8	182.4	182.9	183.5	184.1	184.7	185.3	185.8	5.8
1.60	186.4	187.0	187.5	188.1	188.7	189.3	189.8	190.4	190.9	191.5	5.6
1.70	192.0	192.6	193.2	193.7	194.3	194.8	195.3	195.9	196.4	197.0	5.5
1.80	197.5	198.1	198.6	199.1	199.7	200.2	200.7	201.2	201.3	202.3	5.3
1.90	202.8	203.4	203.9	204.4	204.9	205.4	205.9	206.5	207.0	207.5	5.2
2.00	208.0*	208.5	209.0	209.5	210.0	210.4	210.9	211.4	211.9	212.4	4.9
2.10	212.9	213.4	213.8	214.3	214.8	215.2	215.7	216.2	216.7	217.1	4.7
2.20	217.6	218.1	218.6	219.0	219.5	219.9	220.4	220.8	221.3	221.8	4.6
2.30	222.2	222.7	223.1	223.6	224.0	224.5	224.9	225.4	225.8	226.3	4.5
2.40	226.7	227.2	227.6	228.1	228.5	229.0	229.4	229.9	230.3	230.7	4.5
2.50	231.2	231.6	232.0	232.5	232.9	233.3	233.8	234.2	234.6	235.1	4.3
2.60	235.5	236.0	236.4	236.8	237.2	237.6	238.1	238.5	238.9	239.3	4.2
2.70	239.7	240.1	240.5	241.0	241.4	241.8	242.2	242.7	243.1	243.5	4.2
2.80	243.9	244.3	244.7	245.1	245.5	246.0	246.4	246.8	247.2	247.6	4.1
2.90	248.0	248.4	248.8	249.2	249.6	250.0	250.4	250.8	251.2	251.6	4.0
3.00	252.0*										

S-12B Partial Gate Opening

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
PARTIAL GATE OPENING
STRUCTURE 12B

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

STRUCTURE 12C (S-12C)

Location. S-12C is located in Levee 29 (U.S. Highway 41), Section 2, on the south perimeter of WCA No. 3A, about 36.3 miles west of Miami, Florida.

Description. Structure 12C is one of four spillways which make up Structure 12. S-12C is a reinforced concrete, gated, six-bay spillway, with a trapezoidal weir having a crest elevation of 0.8 feet. The 25 ft. wide x 10.2 ft. high, mechanically operated, vertical-lift gates are installed on the crest of the weir. A steel-sheet-pile cutoff is provided under the downstream edge of the structure and under the downstream training walls. The superstructure consists of a highway bridge, a gate operating platform, and a service walkway, all constructed of reinforced concrete. For dewatering, the aluminum posts and timber stop logs for S-11 and the needle beam and timber needles provided for S-10 may be used.

Purpose. S-12A, B, C, and D provide the principal means of discharge from WCA No. 3A and are also a principal source of gravity flow into Shark River Slough (Everglades National Park). The S-12's serve to maintain an optimum water elevation in Water Conservation Area No. 3A. At this writing, the S-12's and S-333 share (on a percentage basis) the responsibility to deliver water to ENP under the Experimental Program of Water Deliveries to Everglades National Park. The experimental plan is discussed in detail in Chapter VII, paragraph 7-03, of this manual.

Normal Regulation. The water surface elevation of Water Conservation Area No. 3A has been regulated according to a 9.5 - 10.5 ft. regulation schedule, as shown in this manual and as a part of the Experimental Plan of Water Deliveries to ENP. Under the current regulation schedule, the stage peaks at 10.5 to coincide with the end of the normal rainy season (November 1), remains at 10.5 feet through December 30, and then gradually declines to 9.5 feet by June 1 before beginning a gradual return to the peak stage.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-12's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 8.0 ft., NGVD. As a practical consideration, the S-12 spillway gate settings should be kept within 1 foot of each other.

Flood Control. The S-12's were sized to pass the Standard Project Flood (SPF). The spillways provide a means of

controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The peak SPF stage in WCA No. 3A is about 14.4 ft. with a total storage of about 2.7 million acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-12's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-12's have no minimum low flow discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts a minimum elevation in the borrow canals of 7.5 ft., NGVD should be observed. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 3A.

Constraints. Water releases from S-12C should not be made when the water stage in WCA No. 3 is 7.5 ft., NGVD or below.

STRUCTURE 12C (S-12C)

Summary of Hydraulic Design

Location	L-29
Total Drainage Area for S-12's (sq. miles)	3,070
Design Conditions	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
SPF Condition	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
Critical Static Condition (no flow)	
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	9.5 - 10.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	7.5
Crest	
Shape	Trapezoidal
Elevation (ft.)	0.8
Net Length (ft.)	150.0
Gates	
Type of Gate	vertical lift
Number	6
Width x Height (ft.)	25.0 x 10.2
Low Steel Elevation (ft.) (fully open position)	13.4
Top of Gates Elevation (ft.) (fully closed position)	11.0
Top of Gates Elevation (ft.) (fully open position)	23.6
Stilling Basin	
Apron Elevation (ft.)	-0.2
Apron Length (ft.)	20.0
End Sill Elevation (ft.)	0.8
Training Wall Angle to flow (degrees)	45.0
Highway Bridge Low Elevation (ft.)	14.5
Service Walkway Elevation (ft.)	16.0
Operating Platform Elevation (ft.)	29.5
Dewatering Capabilities	Yes

FT 14.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 06-SEP-86 15:09 ECP RATING NO 14.0

02289041 TAMIAMI CANAL BELOW S-12-C, NEAR MIAMI, FLA TYPE LINEAR

BASED ON ..... DISCHARGE MEASUREMENTS, NOS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

RATING TO BE USED STARTING AT: 03/01/85 (0015) COMP BY ..... DATE .....

REMARKS: TAILWATER RATING - GATES OUT OF WATER CKD. BY ..... DATE .....

GAGE HEIGHT (FEET)	DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION) .00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
7.00	.000*	.100	.200	.300	.400	.500	.600	.700	.800	.900	1.00
7.10	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	1.00
7.20	2.00*	2.20	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	2.00
7.30	4.00*	4.40	4.80	5.20	5.60	6.00	6.40	6.80	7.20	7.60	4.00
7.40	8.00*	8.50	9.00	9.50	10.0	10.5	11.0	11.5	12.0	12.5	5.0
7.50	13.0*	13.3	14.6	15.4	16.2	17.0	17.8	18.6	19.4	20.2	8.0
7.60	21.0*	21.9	22.8	23.7	24.6	25.5	26.4	27.3	28.2	29.1	9.0
7.70	30.0*	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0	10.0
7.80	40.0*	41.2	42.4	43.6	44.8	46.0	47.2	48.4	49.6	50.8	12.0
7.90	52.0*	53.3	54.6	55.9	57.2	58.5	59.8	61.1	62.4	63.7	13.0
8.00	65.0*	66.5	68.0	69.5	71.0	72.5	74.0	75.5	77.0	78.5	15.0
8.10	80.0*	81.7	83.4	85.1	86.8	88.5	90.2	91.9	93.6	95.3	17.0
8.20	97.0*	98.8	100.6	102.4	104.2	106.0	107.8	109.6	111.4	113.2	18.0
8.30	115.0*	117.0	119.0	121.0	123.0	125.0	127.0	129.0	131.0	133.0	20.0
8.40	135.0*	137.3	139.6	141.9	144.2	146.5	148.8	151.1	153.4	155.7	23.0
8.50	158.0*	160.6	163.2	165.8	168.4	171.0	173.6	176.2	178.8	181.4	26.0
8.60	184.0*	186.9	189.8	192.7	195.6	198.5	201.4	204.3	207.2	210.1	29.0
8.70	213.0*	216.2	219.4	222.6	225.8	229.0	232.2	235.4	238.6	241.8	32.0
8.80	245.0*	248.9	252.8	256.7	260.6	264.5	268.4	272.3	276.2	280.1	39.0
8.90	284.0*	288.4	292.8	297.2	301.6	306.0	310.4	314.8	319.2	323.6	44.0
9.00	328.0*	332.7	337.4	342.1	346.8	351.5	356.2	360.9	365.6	370.3	47.0
9.10	375.0*	379.9	384.8	389.7	394.6	399.5	404.4	409.3	414.2	419.1	49.0
9.20	424.0*	429.1	434.2	439.3	444.4	449.5	454.6	459.7	464.8	469.9	51.0
9.30	475.0*	480.5	486.0	491.5	497.0	502.5	508.0	513.5	519.0	524.5	55.0
9.40	530.0*	535.7	541.4	547.1	552.8	558.5	564.2	569.9	575.6	581.3	57.0
9.50	587.0*	592.8	598.6	604.4	610.2	616.0	621.8	627.6	633.4	639.2	58.0
9.60	645.0*	651.0	657.0	663.0	669.0	675.0	681.0	687.0	693.0	699.0	60.0
9.70	705.0*	711.0	717.0	723.0	729.0	735.0	741.0	747.0	753.0	759.0	60.0
9.80	765.0*	771.0	777.0	783.0	789.0	795.0	801.0	807.0	813.0	819.0	60.0
9.90	825.0*	831.0	837.0	843.0	849.0	855.0	861.0	867.0	873.0	879.0	60.0
10.00	885.0*										

S-12C Tailwater Rating

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
TAILWATER RATING - GATES OUT OF WATER
STRUCTURE 12C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 07-SEP-86 07:47 ECP RATING NO 13.0

02285040 TAMIAMI C OUTLETS L67A TO 40 MI BND NR MIAMI, FL TYPE LOG [OFFSET=(0.00, 0.00)]

BASED ON ..... DISCHARGE MEASUREMENTS, NO ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

COMP BY ..... DATE .....
CKD. BY ..... DATE .....

HEAD

RATING TO BE USED STARTING AT: 04/01/86 (0015)
REMARKS: HEAD vs DISCHARGE FOR 4 GATE OPEN 1 FT

GAGE HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
			DISCHARGE IN CUBIC FEET PER SECOND				(EXPANDED PRECISION)				
0.00			19.0*	26.0*	28.0	30.8*	34.4	37.3*	40.1	42.3	
0.10	44.4*	46.7	49.9	51.0	53.0	55.0	56.9	58.7	60.5	62.3	19.6
0.20	64.0*	65.7	67.3	68.9	70.5	72.1	73.6	75.1	76.5	78.0	15.4
0.30	79.4	80.	82.2	83.5	84.3	86.2	87.5	88.7	90.0	91.3	13.1
0.40	92.5*	93.7	94.8	96.0	97.2	98.3	99.4	100.5	101.6	102.7	11.3
0.50	103.8	104.9	105.9	106.9	108.0	109.0	110.0	111.0	112.0	113.0	10.2
0.60	114.0	115.0*	116.0	117.0	118.0	119.0	120.0	120.9	121.9	122.9	9.8
0.70	123.8	124.7	125.7	126.6	127.6	128.5	129.4	130.3	131.2	132.1	9.2
0.80	133.0*	133.9	134.8	135.7	136.5	137.4	138.3	139.2	140.0	140.9	8.7
0.90	141.7	142.5	143.4	144.2	145.1	145.9	146.7	147.6	148.4	149.2	8.3
1.00	150.0*	150.8	151.6	152.4	153.2	153.9	154.7	155.5	156.3	157.0	7.8
1.10	157.8	158.5	159.3	160.1	160.8	161.6	162.3	163.1	163.8	164.6	7.5
1.20	165.3	166.0	166.8	167.5	168.2	168.9	169.7	170.4	171.1	171.8	7.2
1.30	172.5	173.2	173.9	174.6	175.3	176.0	176.7	177.4	178.1	178.8	6.9
1.40	179.4	180.1	180.7	181.5	182.2	182.8	183.5	184.2	184.8	185.5	6.8
1.50	186.2	186.8	187.5	188.1	188.8	189.4	190.1	190.7	191.4	192.0	6.5
1.60	192.7	193.3	194.0	194.6	195.2	195.9	196.5	197.1	197.8	198.4	6.3
1.70	199.0	199.6	200.2	200.9	201.5	202.1	202.7	203.3	203.9	204.5	6.2
1.80	205.2	205.8	206.4	207.0	207.6	208.2	208.8	209.4	210.0	210.6	6.0
1.90	211.2	211.7	212.3	212.9	213.5	214.1	214.7	215.3	215.8	216.4	5.8
2.00	217.0*										

S-12C Partial Gate Opening

A-S12C-5

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
PARTIAL GATE OPENING
STRUCTURE 12C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

STRUCTURE 12D (S-12D)

Location. S-12D is located in Levee 29 (U.S. Highway 41), Section 2, on the south perimeter of WCA No. 3A, about 33.5 miles west of Miami, Florida.

Description. Structure 12D is one of four spillways which make up Structure 12. S-12D is a reinforced concrete, gated, six-bay spillway, with a trapezoidal weir having a crest elevation of 0.8 feet. The 25 ft. wide x 10.2 ft. high, mechanically operated, vertical-lift gates are installed on the crest of the weir. A steel-sheet-pile cutoff is provided under the downstream edge of the structure and under the downstream training walls. The superstructure consists of a highway bridge, a gate operating platform, and a service walkway, all constructed of reinforced concrete. For dewatering, the aluminum posts and timber stop logs for S-11 and the needle beam and timber needles provided for S-10 may be used.

Purpose. S-12A, B, C, and D provide the principal means of discharge from WCA No. 3A and are also a principal source of gravity flow into Shark River Slough (Everglades National Park). The S-12's serve to maintain an optimum water elevation in Water Conservation Area No. 3A. At this writing, the S-12's and S-333 share (on a percentage basis) the responsibility to deliver water to ENP under the Experimental Program of Water Deliveries to Everglades National Park. The experimental plan is discussed in detail in Chapter VII, paragraph 7-03, of this manual.

Normal Regulation. The water surface elevation of Water Conservation Area No. 3A has been regulated according to a 9.5 - 10.5 ft. regulation schedule, as shown in this manual and as a part of the Experimental Plan of Water Deliveries to ENP. Under the current regulation schedule, the stage peaks at 10.5 to coincide with the end of the normal rainy season (November 1), remains at 10.5 feet through December 30, and then gradually declines to 9.5 feet by June 1 before beginning a gradual return to the peak stage.

The spillway gates should be opened and closed gradually to provide an even transition to the new flow regime and to minimize hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. The S-12's generally are operated under highly submerged flow conditions. Before large releases are made, the spillway gates should be opened gradually to allow the tailwater stages to rise above 8.0 ft., NGVD. As a practical consideration, the S-12 spillway gate settings should be kept within 1 foot of each other.

Flood Control. The S-12's were sized to pass the Standard Project Flood (SPF). The spillways provide a means of

controlling and transporting the flow from the WCA to the tailwater for all flood discharges up to the Spillway Design Flood (SDF). The peak SPF stage in WCA No. 3A is about 14.4 ft. with a total storage of about 2.7 million acre-feet. When a hurricane or tropical storm alert is initiated, Corps of Engineers personnel from the South Florida Operations Office will inspect the S-12's to make sure they are operating properly. The Water Management and Meteorology Section in the Jacksonville District Office will provide the desired gate settings to the South Florida Operations Office personnel to be used during the alert period.

Low Flow Regulation. The S-12's have no minimum low flow discharge other than that covered under the ENP Interim Water Delivery Schedule. During droughts a minimum elevation in the borrow canals of 7.5 ft., NGVD should be observed. Below this elevation no further releases should be permitted from the area unless a supply of water from another storage area is transferred to WCA No. 3A.

Constraints. Water releases from S-12D should not be made when the water stage in WCA No. 3 is 7.5 ft., NGVD or below.

STRUCTURE 12D (S-12D)

Summary of Hydraulic Design

Location	L-29
Total Drainage Area for S-12's (sq. miles)	3,070
Design Conditions	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
SPF Condition	
Total Discharge for 4 spillways (cfs)	32,000
Type	uncontrolled submerged
Headwater Elevation (ft.)	12.4
Tailwater Elevation (ft.)	11.9
Critical Static Condition (no flow)	
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	9.5 - 10.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	7.5
Crest	
Shape	Trapezoidal
Elevation (ft.)	0.8
Net Length (ft.)	150.0
Gates	
Type of Gate	vertical lift
Number	6
Width x Height (ft.)	25.0 x 10.2
Low Steel Elevation (ft.) (fully open position)	13.4
Top of Gates Elevation (ft.) (fully closed position)	11.0
Top of Gates Elevation (ft.) (fully open position)	23.6
Stilling Basin	
Apron Elevation (ft.)	-0.2
Apron Length (ft.)	20.0
End Sill Elevation (ft.)	0.8
Training Wall Angle to flow (degrees)	45.0
Highway Bridge Low Elevation (ft.)	14.5
Service Walkway Elevation (ft.)	16.0
Operating Platform Elevation (ft.)	29.5
Dewatering Capabilities	Yes

PT 15.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 06-SEP-88 15:11 ECP RATING NO 15.0

2546430804054 01 TAMIAMI CANAL BELOW S-12-D, NR MIAMI, FL TYPE LINEAR

BASED ON ..... DISCHARGE MEASUREMENTS, NOS ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

RATING TO BE USED STARTING AT: 03/01/85 (0015) COMP BY ..... DATE .....

REMARKS: TAILWATER RATING - GATES OUT OF WATER CKD. BY ..... DATE .....

GAGE HEIGHT (FEET)	DISCHARGE IN CUBIC FEET PER SECOND (EXPANDED PRECISION) .00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
7.00	.000*	.700	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00
7.10	7.00*	7.70	8.40	9.10	9.80	10.5	11.2	11.9	12.6	13.3	7.0
7.20	14.0*	14.7	15.4	16.4	17.2	18.0	18.8	19.6	20.4	21.2	8.0
7.30	22.0*	22.8	23.6	24.4	25.2	26.0	26.8	27.6	28.4	29.2	8.0
7.40	30.0*	30.9	31.8	32.7	33.6	34.5	35.4	36.3	37.2	38.1	9.0
7.50	39.0*	40.1	41.2	42.3	43.4	44.5	45.6	46.7	47.8	48.9	11.0
7.60	50.0*	51.1	52.2	53.3	54.4	55.5	56.6	57.7	58.8	59.9	11.0
7.70	61.0*	62.2	63.4	64.6	65.8	67.0	68.2	69.4	70.6	71.8	12.0
7.80	73.0*	74.3	75.6	76.9	78.2	79.5	80.8	82.1	83.4	84.7	13.0
7.90	86.0*	87.4	88.8	90.2	91.6	93.0	94.4	95.8	97.2	98.6	14.0
8.00	100.0*	101.6	103.2	104.8	106.4	108.0	109.6	111.2	112.8	114.4	16.0
8.10	116.0*	117.8	119.6	121.4	123.2	125.0	126.8	128.6	130.4	132.2	18.0
8.20	134.0*	136.0	138.0	140.0	142.0	144.0	146.0	148.0	150.0	152.0	20.0
8.30	154.0*	156.1	158.2	160.3	162.4	164.5	166.6	168.7	170.8	172.9	21.0
8.40	175.0*	177.7	180.4	183.1	185.8	188.5	191.2	193.9	196.6	199.3	27.0
8.50	202.0*	205.0	208.0	211.0	214.0	217.0	220.0	223.0	226.0	229.0	30.0
8.60	232.0*	235.3	238.6	241.9	245.2	248.5	251.8	255.1	258.4	261.7	33.0
8.70	265.0*	268.5	272.0	275.5	279.0	282.5	286.0	289.5	293.0	296.5	35.0
8.80	300.0*	303.7	307.4	311.1	314.8	318.5	322.2	325.9	329.6	333.3	37.0
8.90	337.0*	340.8	344.6	348.4	352.2	356.0	359.8	363.6	367.4	371.2	38.2
9.00	372.0*	375.1	378.3	381.5	384.7	387.9	391.1	394.3	397.5	400.7	32.2
9.10	403.9	406.9	409.9	412.9	415.9	418.9	421.9	424.9	427.9	430.9	30.0
9.20	433.9	436.9	439.9	442.9	445.9	448.9	451.9	454.9	457.9	460.9	30.0
9.30	463.9	466.9	469.9	472.9	475.9	478.9	481.9	484.9	487.9	490.9	30.0
9.40	493.9	496.9	499.9	502.9	505.9	508.9	511.9	514.9	517.9	520.9	30.0
9.50	523.9	526.9	529.9	532.9	535.9	538.9	541.9	544.9	547.9	550.9	30.0
9.60	553.9	556.9	559.9	562.9	565.9	568.9	571.9	574.9	577.9	580.9	30.0
9.70	583.9	586.9	589.9	592.9	595.9	598.9	601.9	604.9	607.9	610.9	30.0
9.80	613.9	616.9	619.9	622.9	625.9	628.9	631.9	634.9	637.9	640.9	30.0
9.90	643.9	646.9	649.9	652.9	655.9	658.9	661.9	664.9	667.9	670.9	30.0
10.00	673.9	676.9	679.9	682.9	685.9	688.9	691.9	694.9	697.9	700.9	30.0
10.10	703.9	706.9	709.9	712.9	715.9	718.9	721.9	724.9	727.9	730.9	30.0
10.20	733.9	736.9	739.9	742.9	745.9	748.9	751.9	754.9	757.9	760.9	30.0
10.30	763.9	766.9	769.9	772.9	775.9	778.9	781.9	784.9	787.9	790.9	30.0
10.40	793.9	796.9	799.9	802.9	805.9	808.9	811.9	814.9	817.9	820.9	30.0
10.50	823.9	826.9	829.9	832.9	835.9	838.9	841.9	844.9	847.9	850.9	30.0
10.60	853.9	856.9	859.9	862.9	865.9	868.9	871.9	874.9	877.9	880.9	30.0
10.70	883.9	886.9	889.9	892.9	895.9	898.9	901.9	904.9	907.9	910.9	30.0
10.80	913.9	916.9	919.9	922.9	925.9	928.9	931.9	934.9	937.9	940.9	30.0
10.90	943.9	946.9	949.9	952.9	955.9	958.9	961.9	964.9	967.9	970.9	30.0
11.00	973.9	976.9	979.9	982.9	985.9	988.9	991.9	994.9	997.9	1000.9	30.0

S-12D Tailwater Rating

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
TAILWATER RATING - GATES OUT OF WATER
STRUCTURE 12D

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

RT 15. UNITED STATES DEPARTMENT OF INTERIOR - GEOL SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE P. 35 DATE: 06-SEP-88 15:11 ECP RATING ..0

254543080405401 TAMIAMI CANAL BELOW S-12-D, NR MIAMI, FL TYPE LINEAR

GAGE HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
	DISCHARGE IN CUBIC FEET PER SECOND						(EXPANDED PRECISION)				
10.90	2869	2882	2895	2908	2921	2934	2947	2961	2974	2987	131
11.00	3000*										

Jim
looks like
S12A 500
S12B 500
S12C 800
S12D 1000
Gate open Pal.

Let's
discuss.
Susan &
Tracy

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
(Continued)

DISCHARGE RATING TABLE
TAILWATER RATING - GATES OUT OF WATER
STRUCTURE 12D

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

-T 19.0 UNITED STATES DEPARTMENT OF INTERIOR - GEOL. SURVEY - WATER RESOURCES DIVISION

EXPANDED RATING TABLE PROCESS DATE: 07-SEP-88 07:48 ECP RATING NO 19.0

0645430080400 10a S-12-D ABOVE TYPE LOG [OFFSET=(0.00, 0.00)]

BASED ON ..... DISCHARGE MEASUREMENTS, NO ....., AND ....., AND IS ..... WELL DEFINED BETWEEN ..... AND ..... CFS

COMP BY ..... DATE .....

CKD. BY ..... DATE .....

Hz HD

RATING TO BE USED STARTING AT: 08/01/88 (0015)

REMARKS: HEAD vs DISCHARGE FOR 1 GATE OPEN 1 FT

GAGE HEIGHT (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER TENTH GH
			DISCHARGE IN CUBIC FEET PER SECOND				(EXPANDED PRECISION)				
0.00				24.0*	22.5*	35.1	35.4*	38.4	41.2*	43.4	
0.10	49.3*	47.7	51.0	53.3	55.4	57.5	59.5	61.4	63.3	65.2	20.7
0.20	67.0*	68.9	70.5	72.3	73.9	75.5	77.1	78.6	80.2	81.7	16.2
0.30	83.2	84.7	86.1	87.5	88.9	90.3	91.7	93.0	94.4	95.7	13.8
0.40	97.0*	98.3	99.5	100.8	102.0	103.2	104.4	105.6	106.7	107.9	12.1
0.50	109.1	110.2	111.3	112.4	113.5	114.6	115.7	116.8	117.9	118.9	10.9
0.60	120.0*	121.1	122.1	123.2	124.2	125.3	126.3	127.3	128.3	129.3	10.3
0.70	130.3	131.3	132.3	133.3	134.3	135.3	136.2	137.2	138.1	139.1	9.7
0.80	140.0*	140.9	141.9	142.8	143.7	144.7	145.6	146.5	147.4	148.3	9.2
0.90	149.2	150.1	151.0	151.9	152.8	153.7	154.5	155.4	156.3	157.1	8.8
1.00	158.0*	158.8	159.6	160.5	161.3	162.1	162.9	163.7	164.5	165.3	8.1
1.10	166.1	166.9	167.6	168.4	169.2	170.0	170.7	171.5	172.3	173.0	7.7
1.20	173.8	174.5	175.3	176.1	176.8	177.5	178.3	179.0	179.8	180.5	7.4
1.30	181.2	182.0	182.7	183.4	184.1	184.8	185.6	186.3	187.0	187.7	7.2
1.40	188.4	189.1	189.8	190.5	191.2	191.9	192.6	193.3	193.9	194.6	6.9
1.50	195.3	196.0	196.7	197.3	198.0	198.7	199.3	200.0	200.7	201.3	6.7
1.60	202.0	202.7	203.3	204.0	204.6	205.3	205.9	206.5	207.2	207.9	6.5
1.70	208.5	209.2	209.8	210.4	211.1	211.7	212.3	213.0	213.6	214.2	6.3
1.80	214.8	215.5	216.1	216.7	217.3	217.9	218.5	219.2	219.8	220.4	6.2
1.90	221.0	221.6	222.2	222.8	223.4	224.0	224.6	225.2	225.8	226.4	6.0
2.00	227.0*										

S-12D Partial Gate Opening

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING TABLE
PARTIAL GATE OPENING
STRUCTURE 12D

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1988

STRUCTURE 12E (S-12E)

Location. Control Structure 12E is located in Section 2 of Levee 29 where L-67A intersects L-29. The structure is in Dade County about 33 miles west of Miami, Florida.

Description. S-12E, as built, was a reinforced concrete, gated, four barrel box culvert. The structure had manually controlled vertical-lift gates which could be operated from an operating platform. However, the structure is no longer in service.

Purpose. The culvert was originally built to be the regulatory outlet for WCA No. 3B but is no longer in service. S-12E would have discharged from the L-29 borrow canal (through the Tamiami Canal) to the Everglades National Park via the L-67 Extension borrow canal.

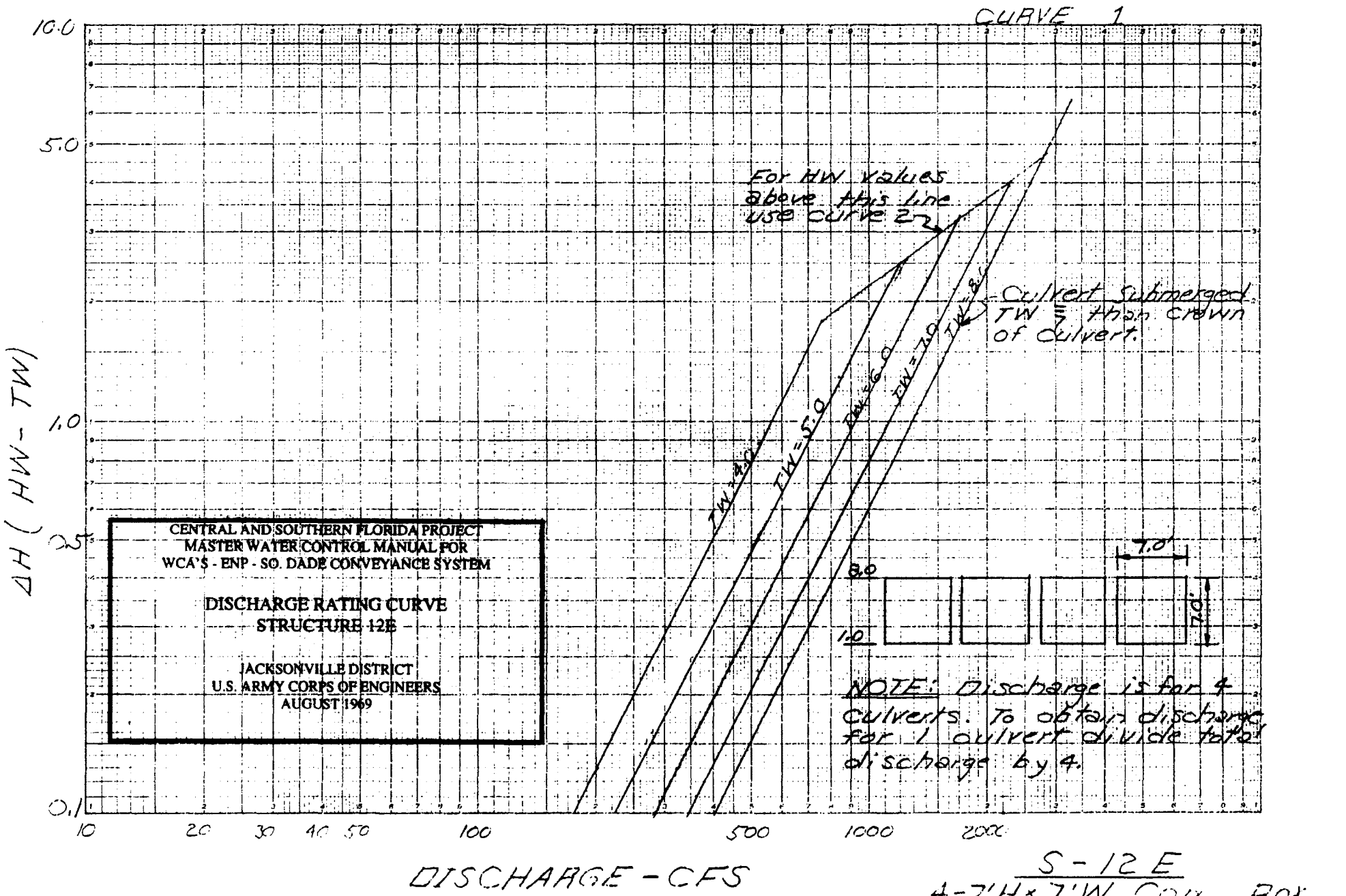
Normal Regulation. S-12E never functioned as intended due to tailwater conditions which were higher than designed. The construction of the ENP-South Dade Conveyance System has made S-12E a non-functional structure. However, under normal regulation the gates would have remained closed until water levels in WCA No. 3B were above a desirable elevation. Under design conditions, the four-barrel box culvert would have discharged 700 cfs into the Everglades National Park.

Note: S-12E never functioned as intended due to tailwater conditions which were higher than designed. The construction of the ENP-South Dade Conveyance System has made S-12E a non-functional structure. The gates have been removed and the structure has been abandoned.

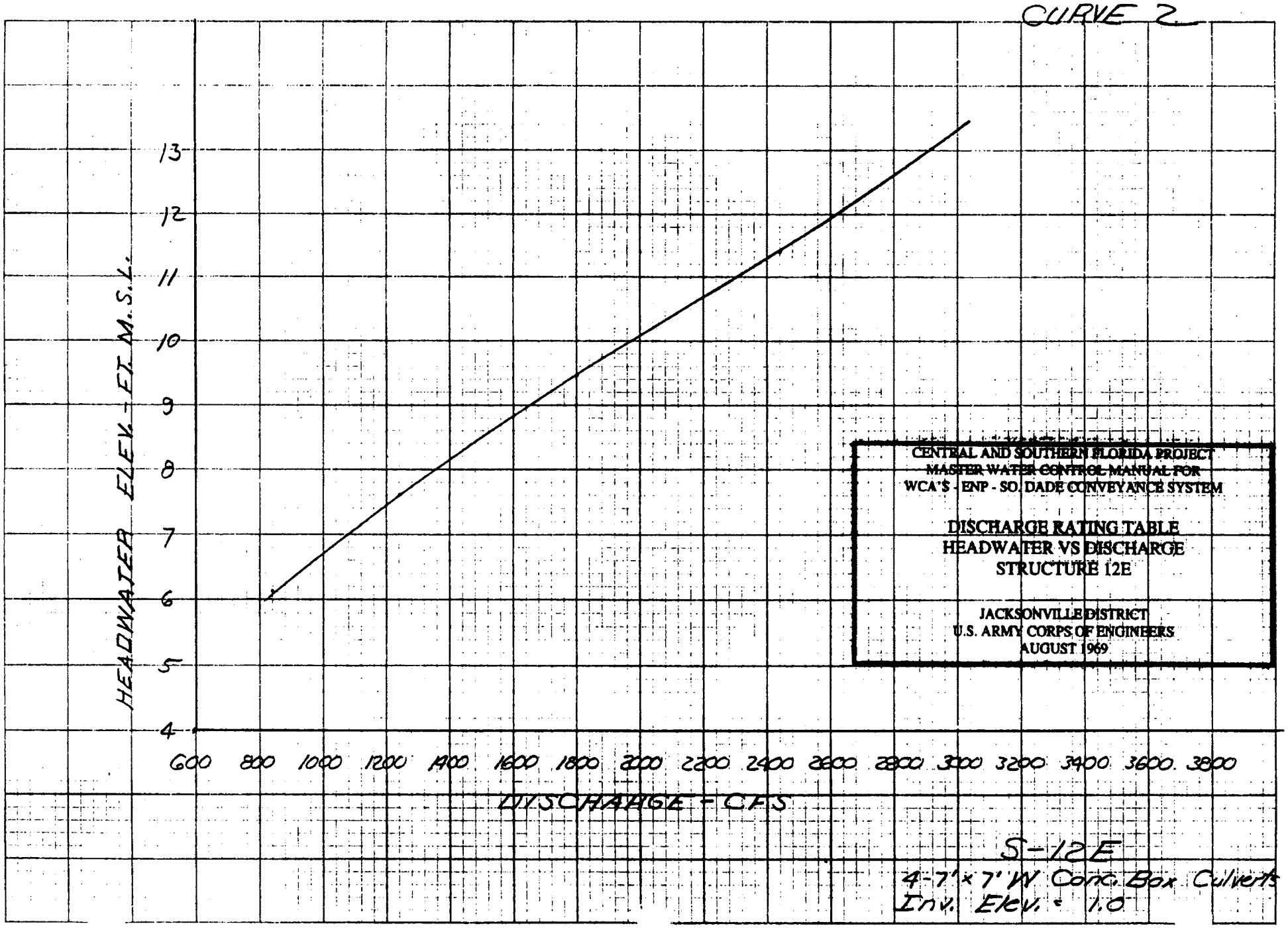
STRUCTURE S-12E

Summary of Hydraulic Design Data
(Culvert)

Location	L-29
Station	577+29
Design Conditions	
Discharge (cfs)	700
Type	controlled submerged
Headwater Elevation (ft.)	8.5
Tailwater Elevation (ft.)	8.0
Maximum Water Elevation (ft.)	
Headwater Elevation	10.0
Tailwater Elevation	12.0
Minimum Elevation (ft.)	
Headwater Elevation	7.0
Tailwater Elevation	5.0
Culvert	
Type	concrete box
Number of Barrels	4
Invert Elevation ~~(ft.)~~	1.0
Gates	
Number	4
Type of Control	manual slide gates
Size (ft.)	7.0 x 7.0
Wingwalls	
Type	T-type
Operating Platform Elevation (ft.)	18.0
Dewatering Capabilities	None



S - 12 E
4-7'H × 7'W Conc. Box Culverts - Inv. Elev. = 1.0


CURVE 2
HEADWATER ELEV. - FT. M.S.L.
13
12
11
10
9
8
7
6
5
4
600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800
DISCHARGE - CFS
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING TABLE
HEADWATER VS DISCHARGE
STRUCTURE 12E
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1969
S-12E
4-7' x 7' W Conc. Box Culverts
Inv. Elev. = 1.0

8-14-69

SAJWH

STRUCTURE 12F (S-12F)

Note: This structure is inoperative and has not been operated since 1960's. COE Jacksonville District has received approval to remove the structure and to place backfill to maintain the function of the access road. Data is included for informational purposes only.

Location. Structure 12F is located in the Tamiami Canal approximately midway between S-12C and S-12D. The culverts pass under Access Road No. 1, which goes between the old Tamiami Trail on the south and the new U.S. Highway 41 on the north.

Description. S-12F consists of three 72-inch diameter corrugated metal pipe culverts each 81 feet long, and one 48-inch diameter corrugated metal pipe 78 feet long. The culverts are equipped with stoplog risers.

Purpose. S-12F maintains desirable water levels in the old Tamiami Canal west of S-12F, preventing overdrainage of this stretch of the canal during low-flow periods.

Normal Operation. None. S-12F in not operational.

STRUCTURE S-12F

Summary of Hydraulic Design Data

Location	Old Tamiami Canal
Design Conditions	
Discharge (cfs)	700
Type	controlled submerged
Headwater Elevation (ft.)	8.5
Tailwater Elevation (ft.)	8.0
Culvert	
Type	CMP
Number of Barrels	3 72-inch, 1 48-inch
Invert Elevation (ft.)	2.0
Gates	
Number	4
Type	stoplog risers
Size (ft.)	7.0 X 7.0

Note: Structure 12F is not operational.

STRUCTURE 14 (S-14)

Location. Structure 14 is located in Section 2 of Levee 29 west of the S-12's. This structure is parallel to and north of Tamiami Canal, in Dade County, Florida.

Description. S-14 is a reinforced concrete, gated, two-barrel box culvert. The structure has manually controlled vertical-lift gates which can be operated from an operating platform.

Purpose. The culvert provides gravity drainage from the lower reaches of Levee 28 borrow pit, via the Levee 29, Section 2, borrow pit, through the Tamiami Trail into the Everglades National Park.

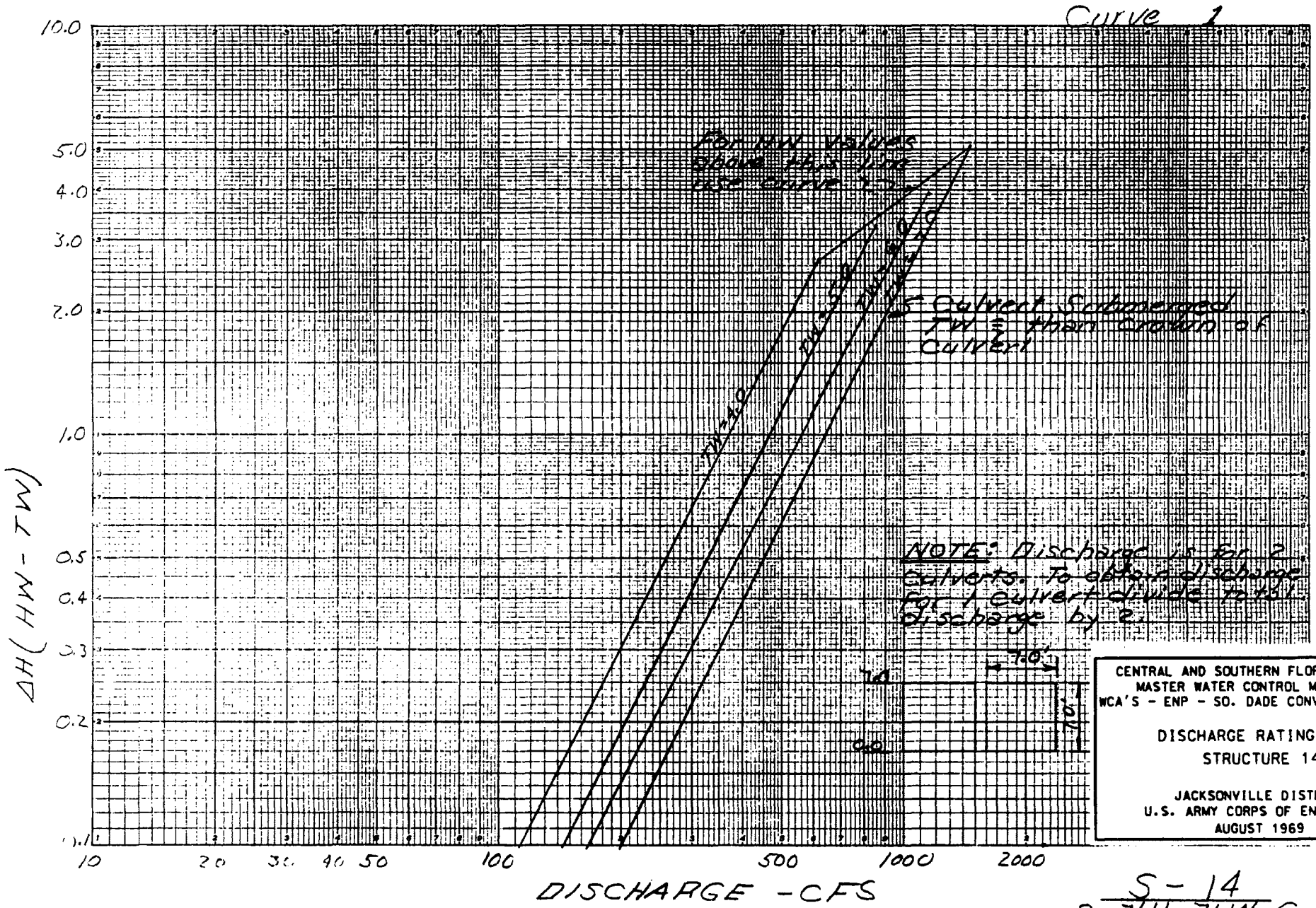
Regulation. S-14's gates are normally closed. This structure acts as a plug for water into S-12. The structure is manually operated only under flood conditions. The gates of the structure are opened whenever the headwater elevation reaches 7.0 ft., NGVD. Under design conditions, the two-barrel box culvert will discharge 500 cfs into the Everglades National Park.

Note: S-14 is not operational. S-14 never functioned as intended due to tailwater conditions which were higher than designed.

STRUCTURE S-14

Summary of Hydraulic Design Data

Location	L-29
Design Conditions	
Discharge	500
Type	controlled submerged
Headwater Elevation (ft.)	7.0
Tailwater Elevation (ft.)	6.0
Maximum Water Elevation (ft.)	
Headwater Elevation	10.0
Tailwater Elevation	12.0
Minimum Elevation (ft.)	
Headwater Elevation	7.0
Tailwater Elevation	5.0
Culvert	
Type	concrete box
Number of Barrels	2
Invert Elevation (ft.)	0.0
Gates	
Number	2
Type	manual slide gates
Size (ft.)	7.0 x 7.0
Wingwalls	
Type	T-type
Operating Platform Elevation (ft.)	17.0
Dewatering Capabilities	None



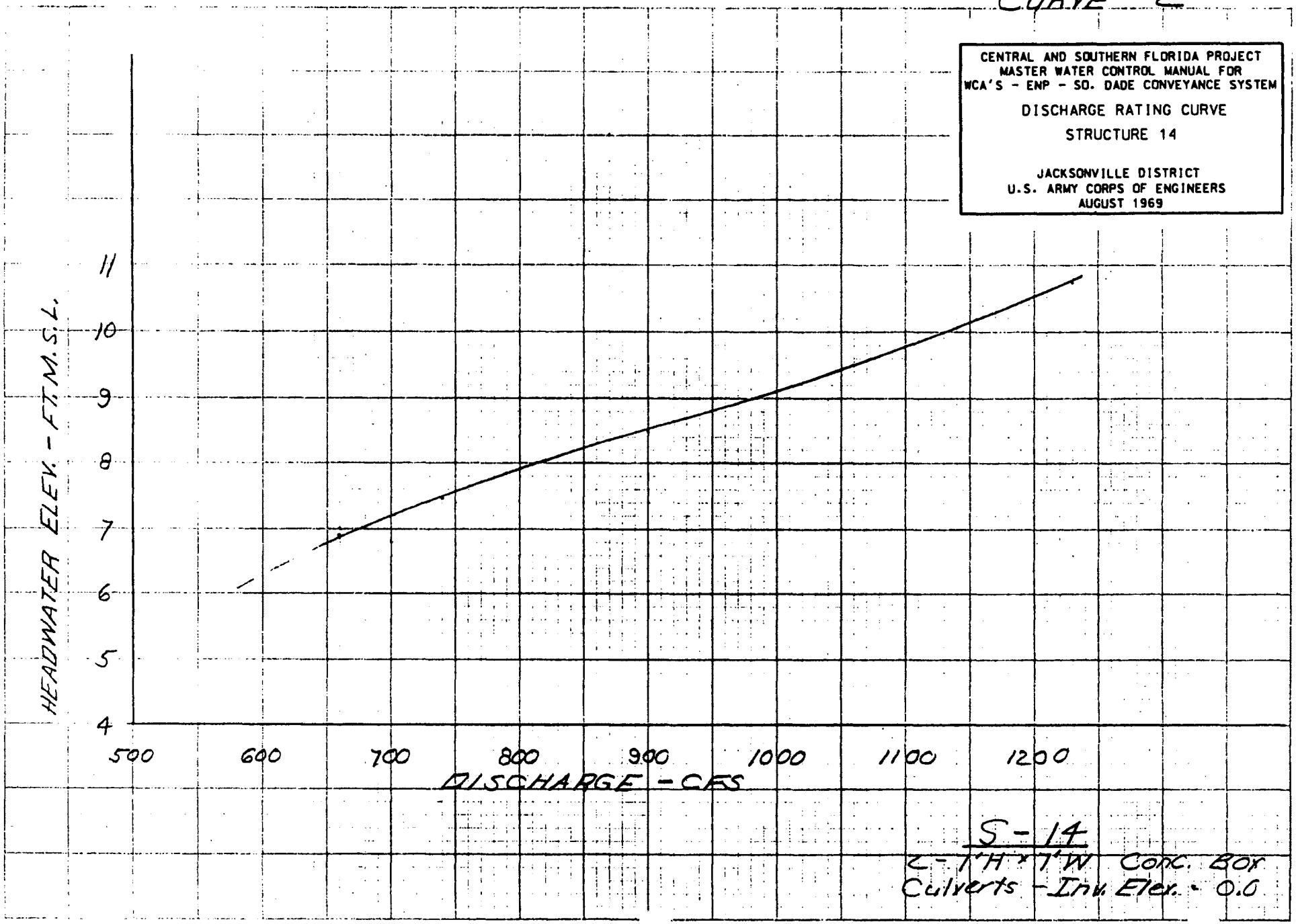
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 14

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1969

S - 14
2 - 7'H × 7'W Conc. Box
Culverts - Inv. El. = 0.0

CURVE 2


CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
STRUCTURE 14
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1969
HEADWATER ELEV. - FT. M.S.L.
11
10
9
8
7
6
5
4
500
600
700
800
900
1000
1100
1200
DISCHARGE - CFS
S-14
2-1'H x 1'W Conc. Box
Culverts - Inv. Elev. - 0.0

8/69

STRUCTURE 18 (S-18)

Note: This is an inoperative spillway. Data is included for informational purposes only. A description is also included in Volume 5, East Coast Canals Water Control Manual.

Location. S-18 is located about 9 miles south of Homestead, Florida approximately 2500 feet west of Highway 1. It was constructed as an outlet for Canal 109. However, except for partial clearing, drilling and blasting, C-109 was not constructed, at the request of the State of Florida.

Description. Control structure S-18 is a one bay, U-shaped gated spillway. It has a trapezoidal weir and an automatically controlled vertical-lift gate. The structure has an operating platform at elevation 26.0 ft. and a 20 ft. wide service bridge at elevation 8.0 on the downstream side of the gate. Riprap is provided upstream and downstream to protect against erosion.

Purpose. S-18 would have provided water control and salinity control to prevent salt water intrusion along Canal 109. It would have been able to discharge up to 750 cfs under standard project flood conditions.

Normal Operation. None. S-18 is not operational.

STRUCTURE 18 (S-18)

Summary of Hydraulic Design

Location	C-109
Drainage Area (sq. miles)	7.3
Design Conditions	
Discharge (cfs)	440
Headwater Elevation (ft.)	2.3
Tailwater Elevation (ft.)	2.1
SPF Condition	
Discharge (cfs)	750
Headwater Elevation (ft.)	3.9
Tailwater Elevation (ft.)	3.5
Crest	
Shape	Trapezoidal
Elevation (ft.)	-5.9
Net Length (ft.)	20.0
Gates	
Type of Gate	vertical lift
Number	1
Width x Height (ft.)	20.0 x 9.9
Clearance Elevation (ft.)	3.4
Overflow Slot Elevation (ft.)	1.0 - 2.5
Apron	
Elevation (ft.)	-7.9
Length (ft.)	20.0
End sill elevation (ft.)	-6.9

Note: Structure 18 is not operational.

STRUCTURE 18C (S-18C)

Location. Structure 18C is located in Section 1 of Canal 111.

Description. S-18C is a two bay, U-shaped, gated spillway with a trapezoidal weir and vertical-lift gates. The gate hydraulic operating system operates both gates simultaneously according to headwater level criteria.

Purpose. The structure maintains optimum water control stages upstream in Canal 111. It passes the design flood (40 percent of the SPF) without exceeding upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels. S-18C assists in preventing saline intrusion into C-111. It also makes discharges to the eastern panhandle of the Everglades National Park.

Normal Regulation. The automatic controls operate both gates simultaneously to maintain an optimum headwater elevation between 2.0 ft. and 2.6 ft., NGVD. The automatic controls function as follows: When the headwater rises to 2.6 ft., the gates will open at six inches per minute. When the headwater drops to 2.3 ft., the gates remain stationary until the headwater again reaches 2.6 ft. or drops to 2.0 ft. at which time the gates will begin to close at the rate of six inches per minute. The gates continue to close until they are fully closed or until the headwater again reaches 2.0 when they once more remain stationary until reactivated by the rising or falling headwater.

Flood Control Regulation. When the headwater reaches 2.6 ft., NGVD, the gates will open to continuously pass the design discharge of 2,100 cfs or up to the amount as will reach the structure.

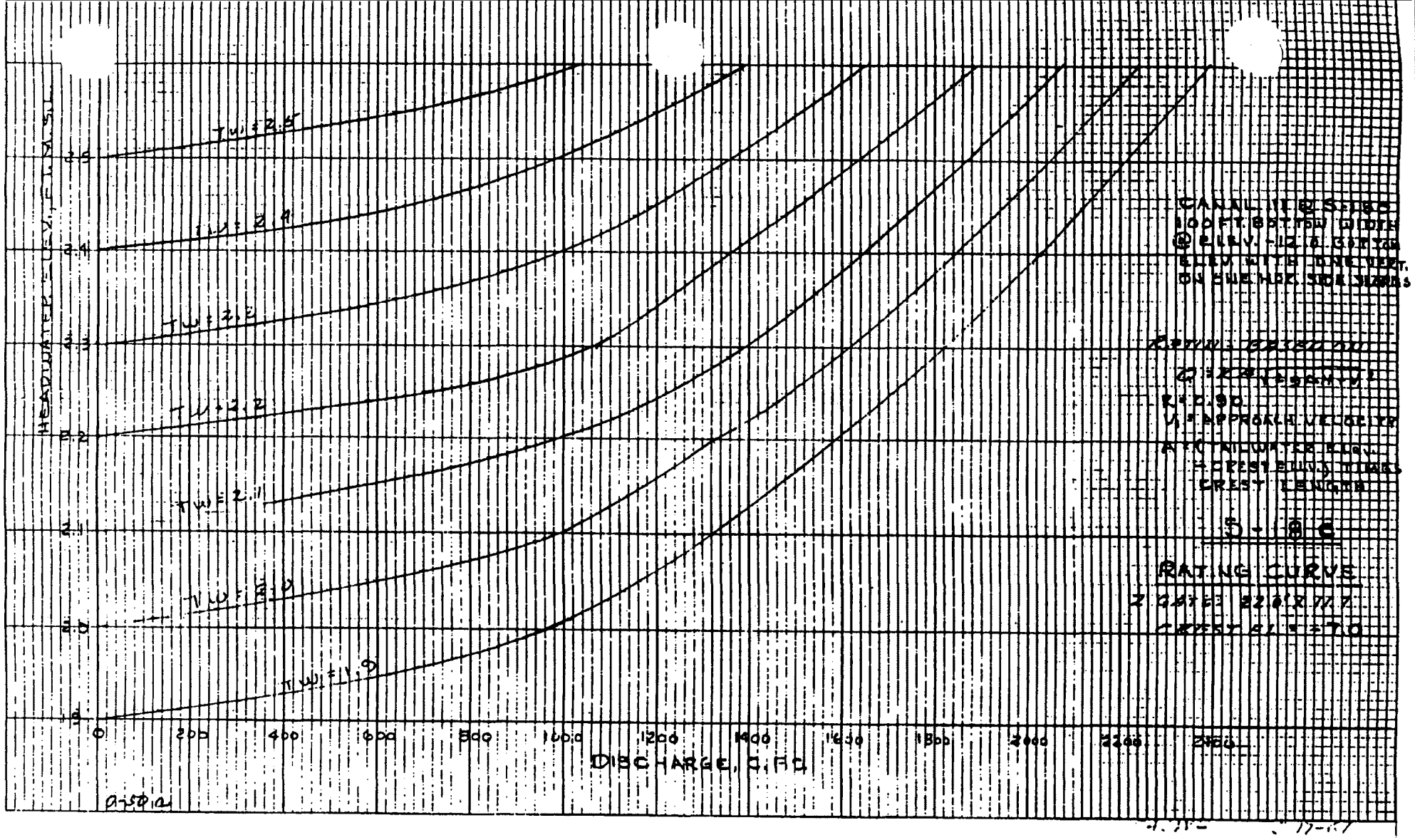
Park Releases. The gates at S-18C will be remotely controlled to maintain the structure's optimum headwater elevation while making monthly water releases to the Everglades National Park as follows:

January	1,540 AF	July	510 AF
February	630 AF	August	860 AF
March	290 AF	September	2,690 AF
April	110 AF	October	4,630 AF
May	110 AF	November	4,060 AF
June	340 AF	December	2,230 AF

STRUCTURE 18C (S-18C)

Summary of Hydraulic Design

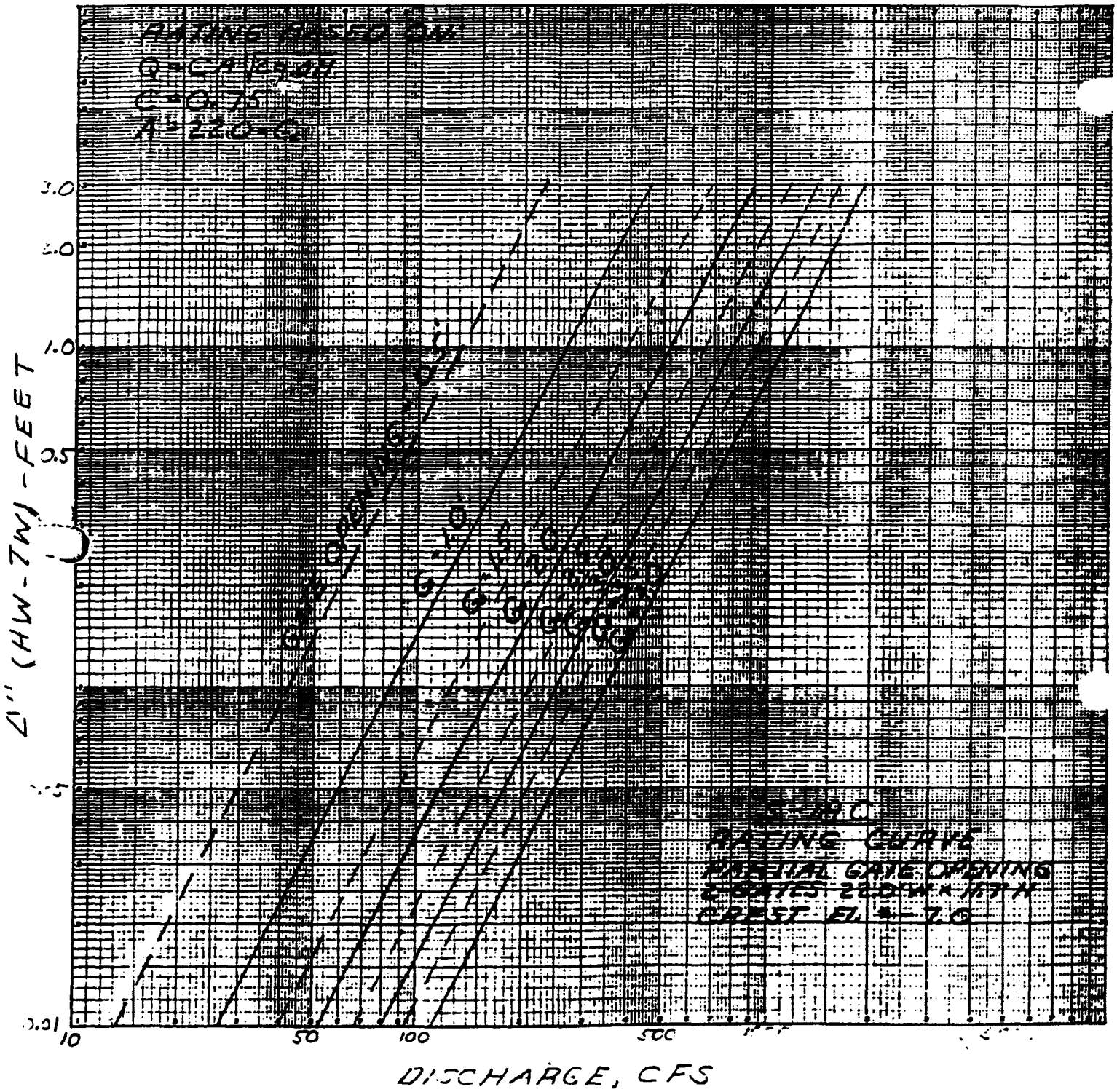
Location	C-111
Drainage Area (sq. miles)	34.1
Design Conditions	
Discharge (cfs)	2,100
Type	uncontrolled submerged
Headwater Elevation (ft.)	2.6
Tailwater Elevation (ft.)	2.1
SPF Condition	
Discharge (cfs)	3,200
Type	uncontrolled submerged
Headwater Elevation (ft.)	3.8
Tailwater Elevation (ft.)	2.8
Optimum Conditions (ft.)	
Headwater Elevation	2.0
Tailwater Elevation	1.4
Minimum Estimated Headwater Elevation (ft.)	1.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-7.0
Net Length (ft.)	44.0
Gates	
Type of Gate	vertical lift gates
Number	2
Width x Height (ft.)	22.0 x 11.0
Clearance Elevation (ft.)	4.8
Overflow Slots Elevation (ft.)	1.0 to 2.5
Apron	
Elevation (ft.)	-8.0
Length (ft.)	20.0
End sill elevation (ft.)	-7.0
Operating Platform Elevation (ft.)	27.0
Service Bridge Elevation (ft.)	8.0
Dewatering Capabilities	Yes



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 18C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1967



0-50b

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 18C

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1967

STRUCTURE 24 (S-24)

Location. S-24 is located 635 ft. east of L-31N and under U.S. Highway 41 at the northern end of the L-31N borrow canal. It is at the junction of Tamiami Canal and Levee 30.

Description. S-24 is a single barrel, 54-inch corrugated metal culvert with slide gate control in the north or upstream end. The structure's concrete headwalls provide erosion control and the culvert's crown elevation of 4.5 ft. insures maximum efficiency.

Purpose. Structure 24 drains water from the area between the Dade-Broward levee and Levee 30 into the L-31N borrow canal.

Normal Regulation. The structure is operated to make flood releases when downstream conditions will not be aggravated, generally when the stage at the junction of C-4 and C-2 is less than 4.0 ft., NGVD.

STRUCTURE 24 (S-24)

Summary of Hydraulic Design

Location	L-30
Design Conditions	
Discharge (cfs)	unknown
Headwater Elevation (ft.)	unknown
Tailwater Elevation (ft.)	unknown
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	54
Net Length (ft.)	81
Invert Elevation (ft.)	-0.4
Gate	
Type of Control	Slide
Number	1
Size (dia., inches)	54

STRUCTURE 24A (S-24A)

Location. S-24A is in Levee 31N about 3 1/2 miles south of S-24.

Description. S-24A is a gated, two barrel, 54-inch, corrugated metal pipe culvert with manually operated slide gates mounted on the upstream end of the culvert. The crown of the culvert is at elevation 5.5 ft, for maximum efficiency.

Purpose. The structure permits drainage of the area between L-31 and Krome Avenue.

Normal Regulation. This structure operates solely for flood control.

Flood Control Regulation. The gates remain closed when the tailwater elevation, on the west side of the structure, exceeds the headwater elevation, on the east side of the structure. The gates are opened when the headwater elevation exceeds the tailwater elevation.

STRUCTURE 24A (S-24A)

Summary of Hydraulic Design

Location	L-31N
Design Conditions	
Discharge (cfs)	unknown
Headwater Elevation (ft.)	unknown
Tailwater Elevation (ft.)	unknown
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	54
Net Length (ft.)	86
Invert Elevation (ft.)	1.0
Gates	
Type of Control	manual slide gate
Number	2

STRUCTURE 31 (S-31)

Location. Structure 31 is located where Levee 30 crosses the Miami Canal, about 15 miles west of Miami.

Description. S-31 is a three barrel, 84-inch corrugated metal pipe culvert with slide gates. The structure also has a timber operating platform.

Purpose. This structure controls water levels in WCA No. 3B. However, this structure along with S-151 can also permit water releases from WCA No. 3A to the East Coast during dry periods or when seepage is inadequate. Also in combination with S-151, it can discharge excess water from WCA No. 3A when channel capacity is available in the Miami Canal.

Normal Regulation. Releases may be made, as necessary, to supply downstream water requirements to maintain an optimum stage of 2.5 feet at S-26 in C-6 and 1.85 feet at S-27 in C-7. Under design conditions, the culvert will discharge a total of 700 cfs. The structure can make low water releases to maintain minimum desirable stages in the developed area east of L-30.

Flood Control Regulation. The gates of S-31 may be opened prior to hurricane season, when the stage in WCA No. 3A (measured as the average of gages 63, 64, and 65) is in Zone A of the regulation schedule. The gates may also need to be operated so the tailwater remains below 4.0 feet.

Constraints. To preclude fish kills in C-304, the combined discharge of S-337 and S-31 shall be equal to or less than the discharge of S-151. In addition, S-151 shall be opened the day before S-337 and/or S-31 are opened, and S-151 shall remain open until the day after S-337 and/or S-31 are closed.

Currently, regulatory releases from WCA No. 3B can only be made on a secondary basis through S-31 to the East Coast.

Design criteria for structure stability make it imperative that the head not exceed 10.0 feet.

STRUCTURE 31 (S-31)

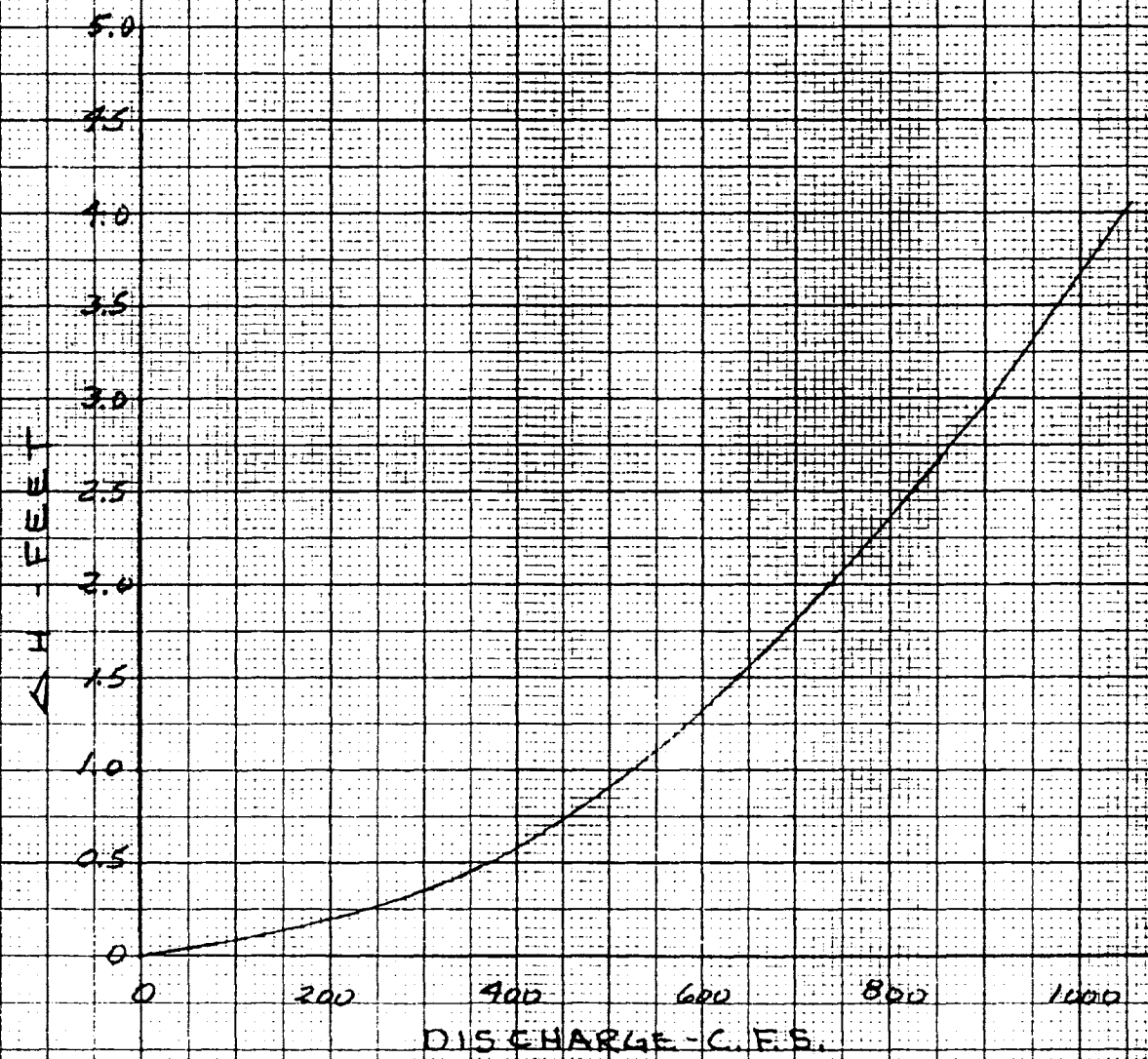
Summary of Hydraulic Design Data (Culvert)

Location	L-30
Design Conditions	
Discharge (cfs)	700
Type	controlled submerged
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	4.0
Maximum Head (ft.)	10.00
Culvert	
Type	CMP
Number of Barrels	3
Size (inches)	84
Invert Elevation (ft.)	-3.0
Length (ft.)	172
Gates	
Number	3
Type of Control	manual slide gate

S-31

RATINGS BASED ON:

1. THREE 84" C.M.P.'s, 172' LONG WITH INVERTS AT ELEV. +3.0± FT. M.S.L.
2. ALL GATES OPEN, PIPES FLOWING FULL
3. n = 0.024 AND ENTRANCE PLUS EXIT LOSS = 1.78 $\frac{V^2}{2g}$



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 31

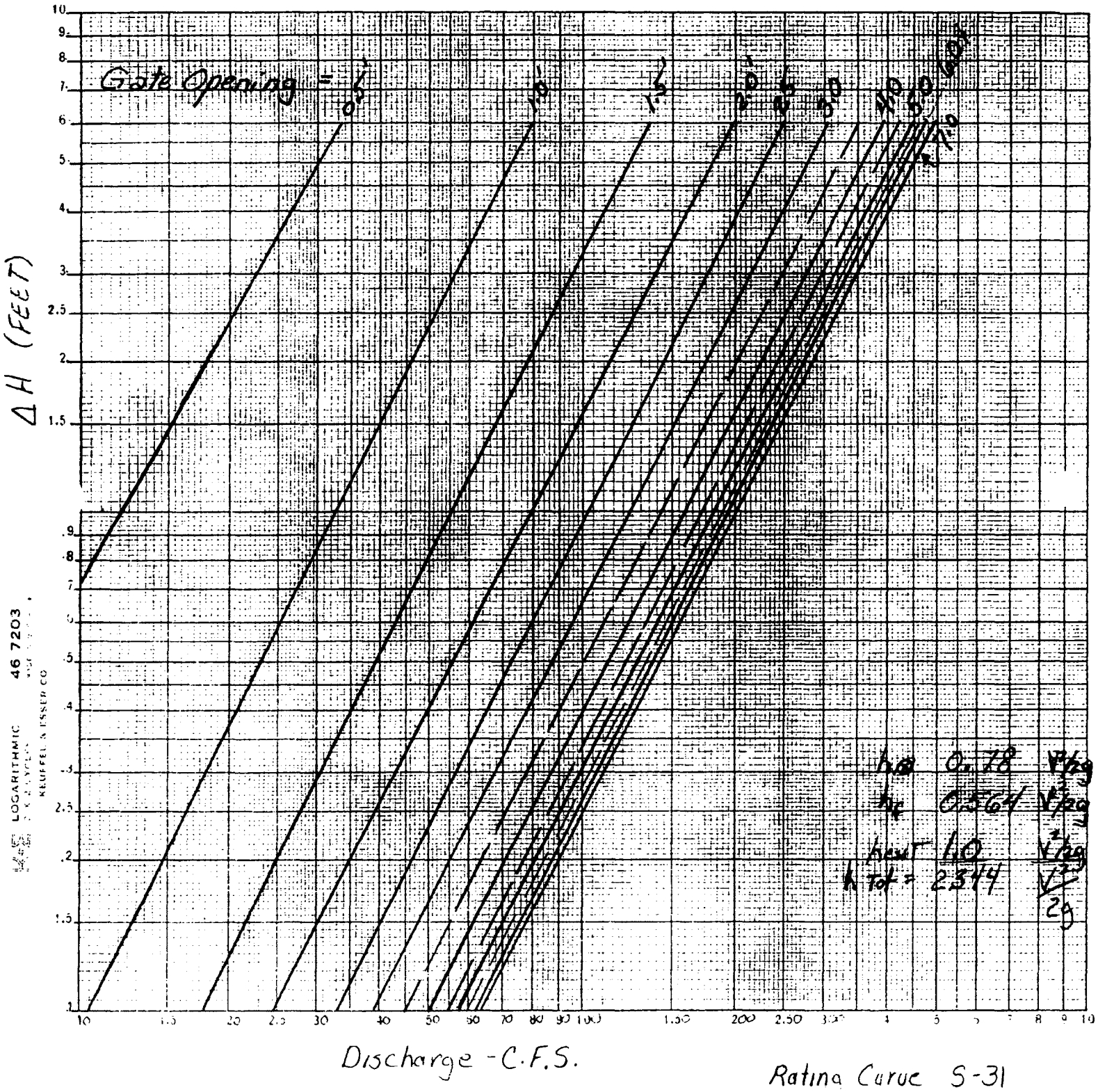
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1966

K&E 10 X 10 TO ½ INCH 46 1323
KEUFFEL & ESSER CO.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 31

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994



Rating Curve S-31
Curves are for 1-84" pipe discharge
71'-0" Long
Total C.F.S. = Discharge x 3.0

STRUCTURE 32 (S-32)

Location. This structure connects the Miami Canal and the borrow pit of Levee 33. S-32 is located in a county road adjacent to the Miami Canal.

Description. S-32 is a gated, two barrel, 72-inch, corrugated metal pipe culvert with manually operated slide gates on the upstream end of the culvert. The reinforced concrete headwall supports the control gates.

Purpose. S-32, together with S-30 and S-9XS, controls drainage of the area between Levees 33 and 37, and U.S. Highway 27. The structure allows water to be stored in the area and released during periods of flow deficiency. This storage reduces the seepage under Levees 33 and 37 from WCA No. 3B.

Flood Control Regulation. Gates should be closed when S-32 releases might aggravate downstream flood conditions. When the headwater stage at S-32 exceeds 6.0 feet, and releases will not aggravate downstream conditions, the gates should be opened. The water level which will bypass the structure is 11.5 ft.

Low Flow Regulation. Releases should be made, as necessary, subject to water availability, to meet downstream water needs. Releases should be made based on the stage requirements at S-29.

STRUCTURE 32 (S-32)

Summary of Hydraulic Design

Location	L-33
Design Conditions	
Discharge (cfs)	unknown
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	unknown
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Invert Elevation (ft.)	-2.0
Net Length (ft.)	40
Gates	
Type of Control	Manual slide gate
Number	2
Size (dia., inches)	72

STRUCTURE 32A (S-32A)

Location. S-32A is located at the north end of Levee 30 in the Dade-Broward Dike about 19 miles northwest of Miami, Florida.

Description. S-32A is a gated, single barrel, 54-inch diameter, corrugated metal pipe culvert. The manually operated, 54-inch square, slide gate is on the upstream side (south end) of the culvert.

Purpose. This structure, along with S-335, controls water stored in the Levee 30 borrow canal to prevent seepage under Levee 30 from WCA No. 3B, and maintains head for the southward discharge of water at S-335.

Regulation. The gates should be open when the headwater stage at S-32A or S-335 exceeds 6.0 feet, and the releases will not aggravate downstream conditions. The tailwater will fluctuate depending on conditions in the Miami Canal, east of S-31. Under low water conditions, S-32A should remain closed to maintain adequate stages in the L-30 borrow canal to help the southward delivery of water.

Constraints. Water will bypass the structure at elevation 11.5 ft.

STRUCTURE 32A (S-32A)

Summary of Hydraulic Design

Location	L-30
Design Conditions	
Discharge (cfs)	80
Headwater Elevation (ft.)	5.2
Tailwater Elevation (ft.)	4.0
Optimum Conditions	
Headwater Elevation (ft)	6.0
Tailwater Elevation (ft.)	2.5
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	54
Net Length (ft.)	102
Invert Elevation (ft.)	-2.0
Gates	
Type of Control	manual slide gate
Number	1
Size (width x height, inches)	54 x 54

STRUCTURE 34 (S-34)

Location. S-34 is located in North New River Canal under Levee L-37, about 20 miles west of Ft. Lauderdale, Florida at Andytown.

Description. S-34 is a double barrel, 72-inch corrugated metal pipe culvert with manual slide gates.

Purpose. Structure 34 permits water releases from WCA No. 2 to meet water supply needs along the North New River Canal during dry periods. It may also discharge excess water from WCA No. 2A and/or 2B when capacity is available in the North New River Canal and when the water is not needed in WCA No. 3.

Normal Regulation. When operations are not required by flood conditions, S-34 may release water to supply downstream water requirements and to maintain an optimum stage at Sewell's Lock, between elevation 3.5 ft. and 4.5 ft.

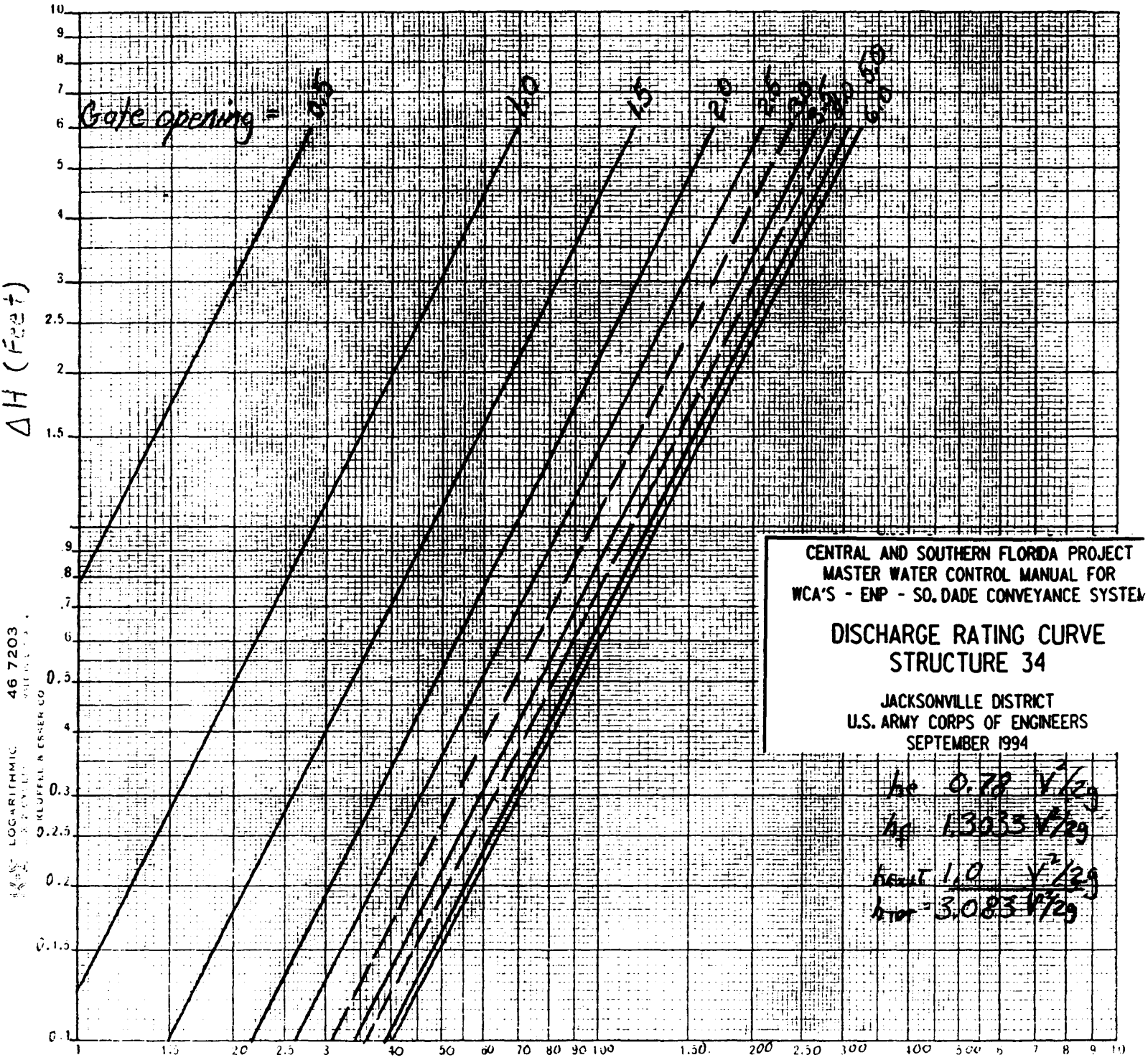
Flood Control Regulation. The gates should be open whenever damage stages would not be exceeded below the structure and excess water in North New River Canal and WCA No. 2 is increasing the flood potential in the agricultural area south of Lake Okeechobee. Excess water should be released from WCA No. 2 prior to the hurricane season.

The gates of S-34 should be open whenever excess storage is present in WCA No. 2A and/or WCA No. 2B before hurricane season, which is when the stage in WCA No. 2A is in Zone A of the regulation schedule, as measured at gage 112. The gates may be opened if the excess water in WCA No. 2A is not needed in WCA No. 3 and/or the tailwater elevation will not exceed 6.0 ft.

STRUCTURE 34 (S-34)

Summary of Hydraulic Design Data (Culvert)

Location	L-37/L-33
Design Conditions	
Discharge (cfs)	350
Headwater	7.7
Tailwater Elevation (ft.)	6.0
Culvert	
Type	CMP
Number of Barrels	2
Size (Inches & Type)	72
Net Length (ft.)	133.5
Invert Elevation (ft.)	-3.0 to -4.0
Gates	
Number	2
Type of Control	Manual slide gates
Size (dia. inches)	72



Rating Curve
S-34

Curves are for 1-pipe discharge
1-72" C.M.P. - 133.5' Long
Total C.F.S = Discharge x 2.0

STRUCTURE 38 (S-38)

Location. Structure 38 is located in the southeast corner of WCA No. 2A in L-36, where L-36, Canal 14, and the L-35B borrow canal intersect. The structure is about 15 miles northwest of Ft. Lauderdale, Florida.

Description. S-38 is a gated, two barrel, 72-inch diameter, corrugated metal pipe culvert with concrete headwalls, wingwalls, and aprons. It has manually operated slide gates, a timber walkway, and concrete operating platform.

Purpose. S-38 permits water releases from WCA No. 2A to meet water supply needs in the area served by Canals 13 and 14 during the dry season. It may also discharge excess water from WCA No. 2A when capacity is available in Canals 13 and 14 and when the water is not needed in WCA No. 3.

Normal Regulation. When not operating under flood conditions, S-38 may operate to support optimum water control conditions downstream by providing a stage of 6.8 ft. at S-37 and 5.0 ft at S-36.

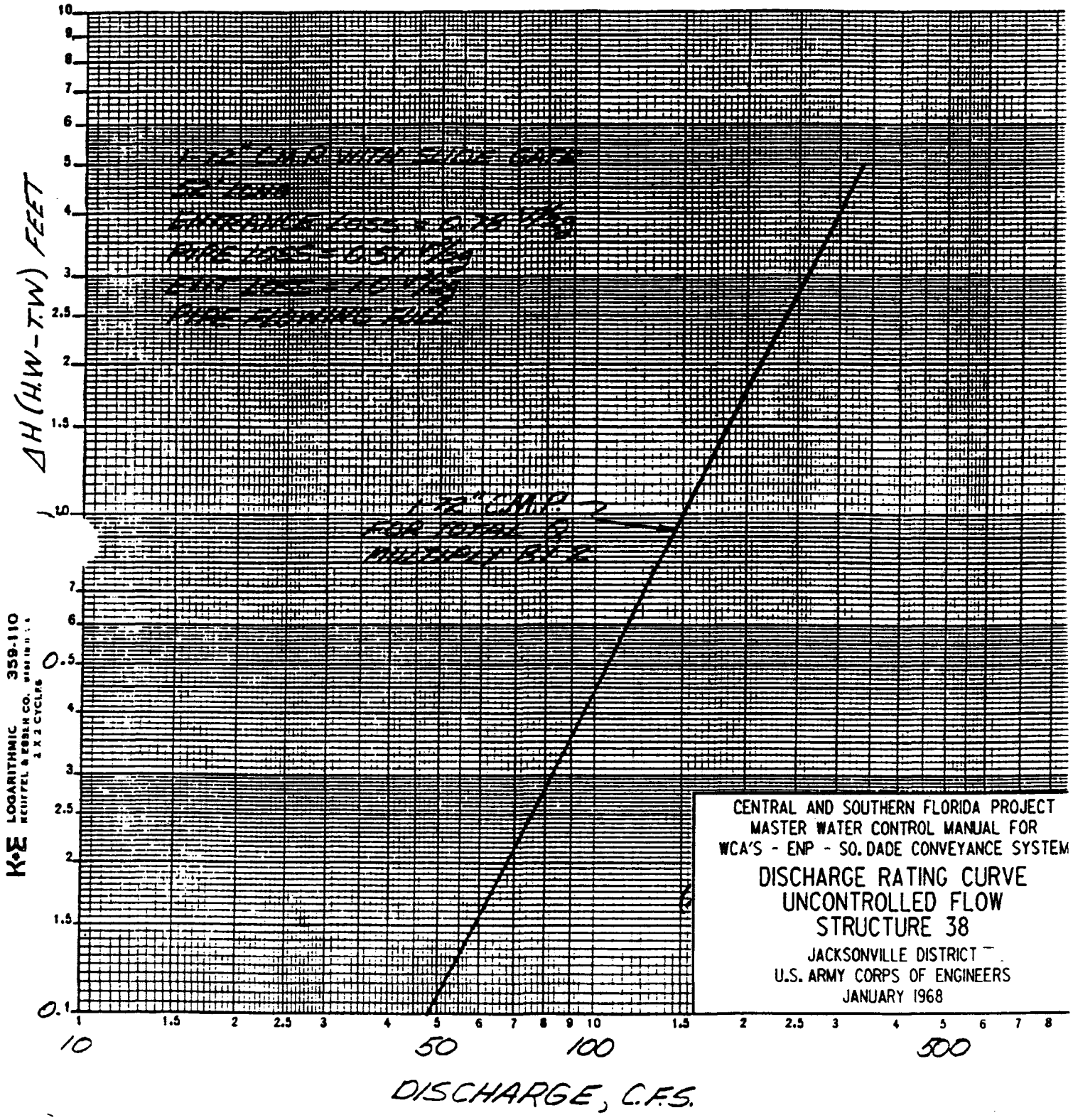
Flood Control Regulation. Discharges may be made from S-38 if the water is not needed in WCA No. 3 and WCA No. 2A has excess water. When the WCA No. 2A stage is in Zone A and Structure 11 is at maximum capacity, the U.S. Army Corps of Engineers may request maximum practicable releases from S-38.

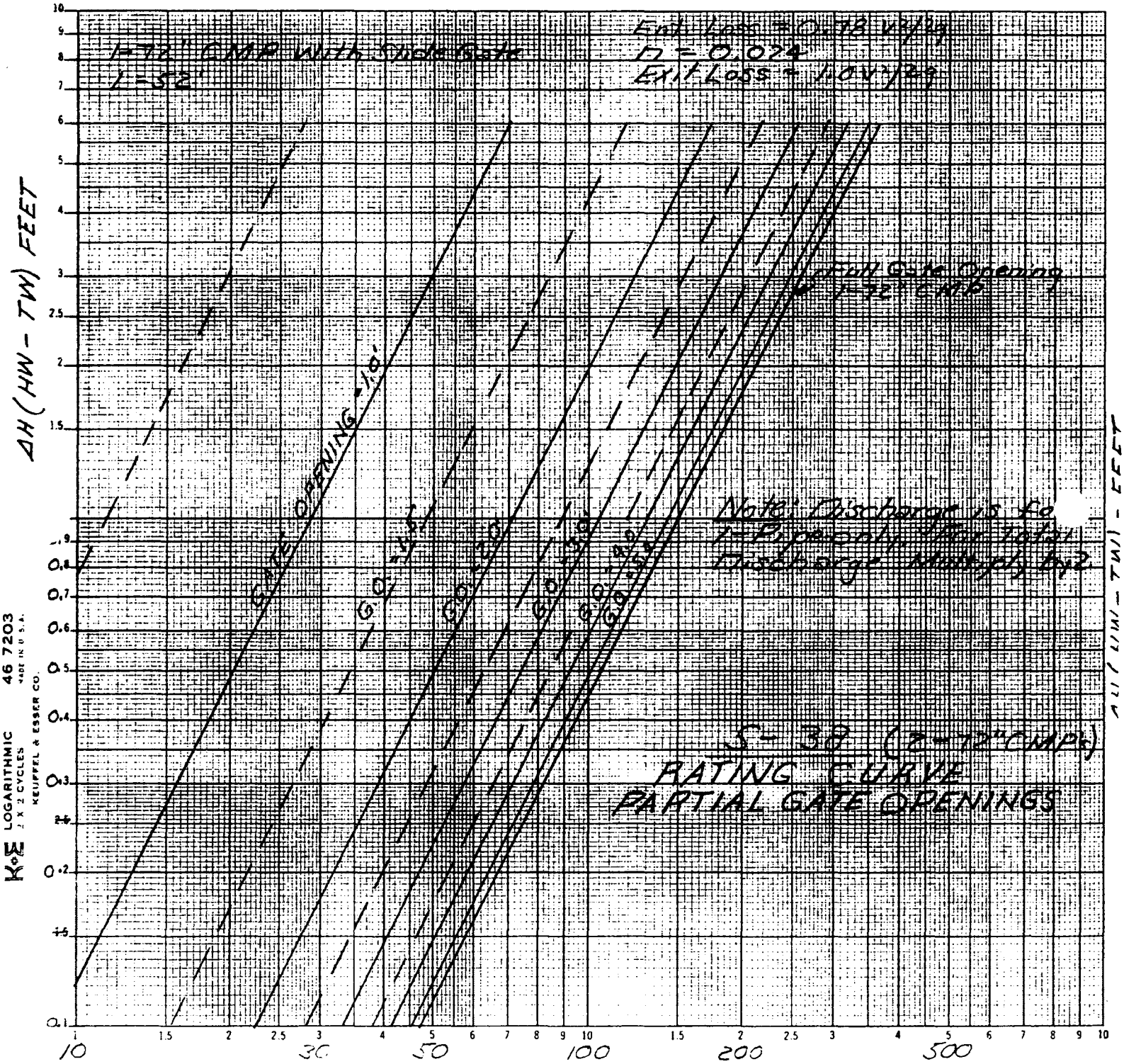
Constraints. Discharge from S-38 should not cause the tailwater to exceed 8.2 ft.

STRUCTURE 38 (S-38)

Summary of Hydraulic Design

Location	L-36
Design Conditions	
Discharge (cfs)	500
Headwater Elevation (ft.)	13.0
Tailwater Elevation (ft.)	10.0
SPF Condition	
Discharge (cfs)	600
Headwater Elevation (ft.)	14.5
Optimum Conditions	
Headwater Elevation (ft.)	11.0-11.5
Tailwater Elevation (ft.)	6.5
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	52
Invert Elevation (ft.)	
Headwater	3.0
Tailwater	2.0
Gates	
Type of Control	manual slide gate
Number	2
Size (dia., inches)	72


ΔH (HW-TW) FEET
DISCHARGE, C.F.S.
K+E LOGARITHMIC 359-110
KEUFFEL & ESSER CO.
2 X 2 CYCLES
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
UNCONTROLLED FLOW
STRUCTURE 38
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 1968



CENTRAL AND SOUTHERN FLORIDA PROJEC
MASTER WATER CONTROL MANUAL FOR
WCA'S - E[illegible] - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 38

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NOVEMBER 1969

STRUCTURE 38A (S-38A)

Location. Structure 38A is located in the L-36 borrow canal on the east perimeter on WCA No. 2, just north of C-14 and about 13 miles west of Pompano Beach, Florida.

Description. S-38A is a double-barreled, 60-inch diameter, corrugated metal pipe culvert. Control is effected by flashboards in a CMP riser pipe on the upstream or north end of the structure.

Purpose. This structure along with S-38B controls the seepage rate from WCA No. 2A and discharge from the North Springs Improvement District Pump Station at S-38B by regulating the water level in the south half of the L-36 borrow canal.

Regulation. This structure is manually operated to maintain the optimum upstream water level of 7.65 feet, NGVD, insofar as possible. When the North Springs Improvement District discharges, sufficient boards are removed to hold a maximum headwater stage at 9.0 feet, NGVD.

Constraints. Water elevation of 14.37 feet, NGVD, will bypass structure.

STRUCTURE 38A (S-38A)

Summary of Hydraulic Design

Location	
L-36	
Design Conditions	
Discharge (cfs)	190
Headwater Elevation (ft.)	9.0
Tailwater Elevation (ft.)	8.0
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	60
Length (ft.), each	70
Invert Elevation (ft.)	2.0
Service Bridge Elevation (ft.)	12.77
Riser Pipe Top Elevation (ft.)	12.37
Size (dia., inches)	84
Stop Logs	
Number per barrel	8
Size	2" x 10" x 6'10"
Top of Board Elevation (ft.)	12.77
Elevation of Control Weir (ft.)	
All boards removed	2.0
All boards in place	8.5

STRUCTURE 38B (S-38B)

Location. S-38B is located in the L-36 borrow canal about midway between S-38 and S-39 and about 13 1/2 miles southwest of Boca Raton, Florida.

Description. S-38B is a gated, single barrel, 66-inch, corrugated metal pipe culvert. The manually operated, 72-inch square, slide gate is on the upstream side, north end of the culvert.

Purpose. S-38B, with S-38A, controls the seepage rate from WCA No. 2A by regulating the water level in the south half of the Levee 36 borrow canal.

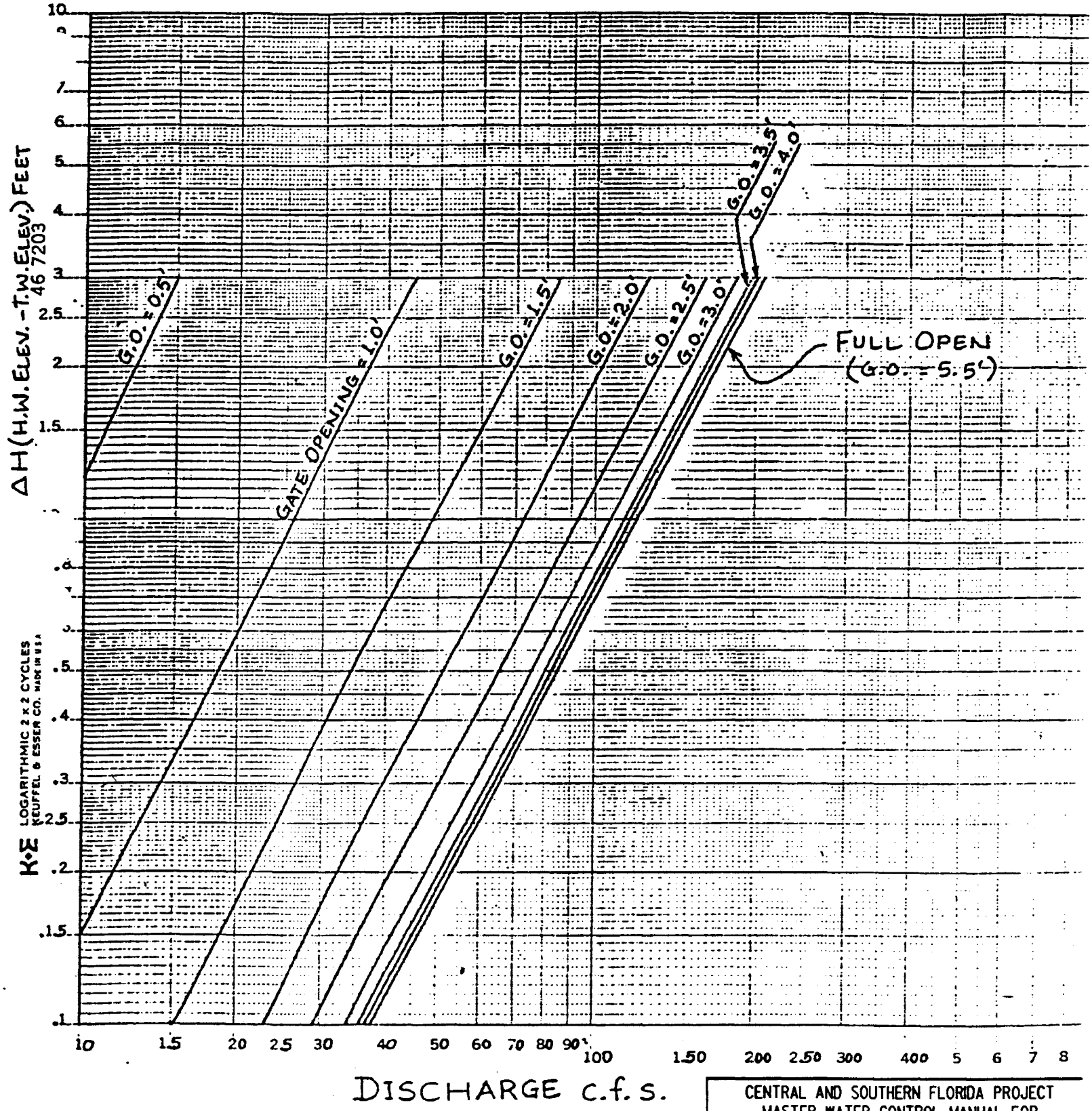
Normal Regulation. S-38B is manually operated to maintain an optimum water surface of 7.65 ft. in the southern portion of the L-36 borrow canal in so far as possible.

Constraints. Water will bypass the structure at a stage of 15.0 ft.

STRUCTURE 38B (S-38B)

Summary of Hydraulic Design

Location	L-36
Design Conditions	
Discharge (cfs)	unknown
Headwater Elevation (ft.)	9.0
Tailwater Elevation (ft.)	7.65
Optimum Conditions	
Headwater Elevation (ft.)	9.0
Tailwater Elevation (ft.)	7.65
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	66
Net Length (ft.)	72
Invert Elevation (ft.)	0.0
Gates	
Type of Control	manual slide gate
Number	1
Size (width x height, inches)	72



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 38B

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1981

A-S38B-3

STRUCTURE 39 (S-39)

Location. S-39 is located in WCA No. 1, where L-40 crosses the Hillsboro Canal, about 13 miles west of Boca Raton, Florida.

Description. Structure S-39 is a single-bay reinforced concrete spillway. The flow is controlled by a top sealing tainter gate, which can be operated remotely by computer or manually on site.

Purpose. The primary purpose of S-39 is to release water from WCA No. 1 to supply water needs along the Hillsboro Canal during dry periods. It may also discharge excess water from WCA No. 1 when there is available capacity in the Hillsboro Canal and when the water is not needed in WCA No. 2 or WCA No.3.

Normal Regulation. Releases are made, as necessary, to supply downstream water requirements, so as to maintain an optimum stage of 7.7 ft. at Deerfield Lock. Water releases should not be made from S-39 if the elevation of gage 1-8C is 11.0 ft. or lower.

Flood Control Regulation. The gate of this structure is usually closed. However, it may be opened whenever WCA No. 1 is above the regulation schedule and the excess water is not needed in WCA No. 2 or WCA No. 3.

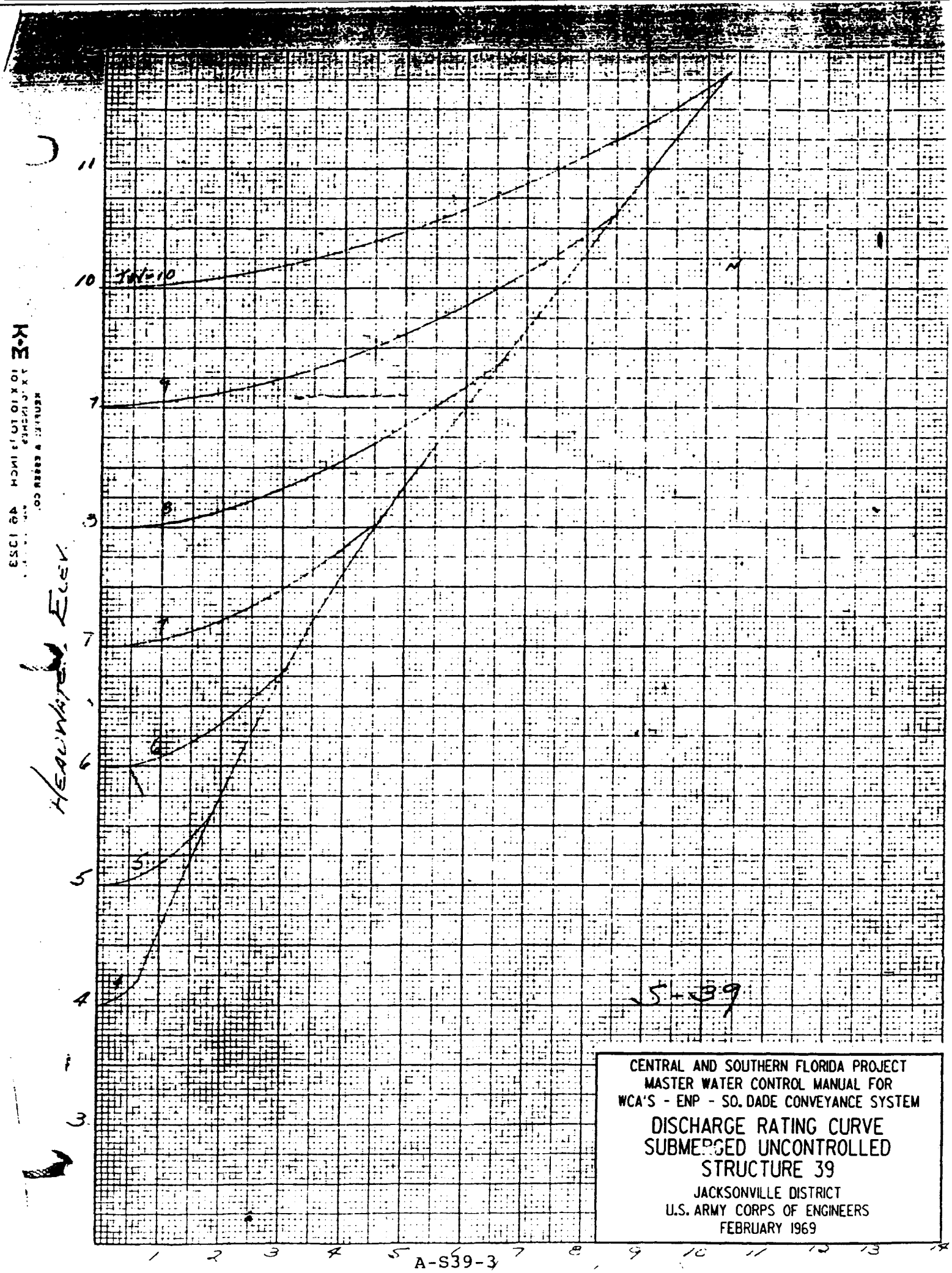
The structure's gate shall be closed whenever releases would aggravate flood conditions downstream. The gate shall be opened whenever damage stages will not be exceeded below the structure and excess water in the WCA No. 1 is increasing the flood potential in the agricultural area south of Lake Okeechobee.

Constraints. Water releases should not be made from S-39 if the elevation of gage 1-8C is 11.0 ft. or lower. Releases should not cause the tailwater to rise above 9.0 ft.

STRUCTURE 39 (S-39)

Summary of Hydraulic Design

Location	L-40
Design Conditions	
Discharge (cfs)	800
Type	uncontrolled submerged
Headwater Elevation (ft.)	11.0
Tailwater Elevation (ft.)	9.0
SPF Condition	
Discharge (cfs)	800
Type	controlled submerged
Headwater Elevation (ft.)	18.4
Tailwater Elevation (ft.)	10.6
Optimum Conditions	
Headwater Elevation (ft.)	14.0-17.0
Tailwater Elevation (ft.)	7.7
Crest	
Shape	rounded
Elevation (ft.)	2.5
Net Length (ft.)	15.0
Gates	
Type of Gate	Tainter
Number	1
Width x Height (ft.)	16.0 x 9.2
Clearance Elevation (ft.)	10.5
Apron	
Elevation (ft.)	-3.5
Length (ft.)	30.0
Service Bridge Elevation (ft.)	24.0



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED UNCONTROLLED
STRUCTURE 39

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1969

STRUCTURE 39A (S-39A)

Location. S-39A is located in the L-36 borrow canal at its junction with the Hillsboro Canal, and about 13 miles west of Boca Raton, Florida.

Description. S-39A is a triple-barrel, 72-inch, corrugated metal pipe culvert. Control is effected by flashboards mounted on a steel frame erected on the upstream or south end of the structure.

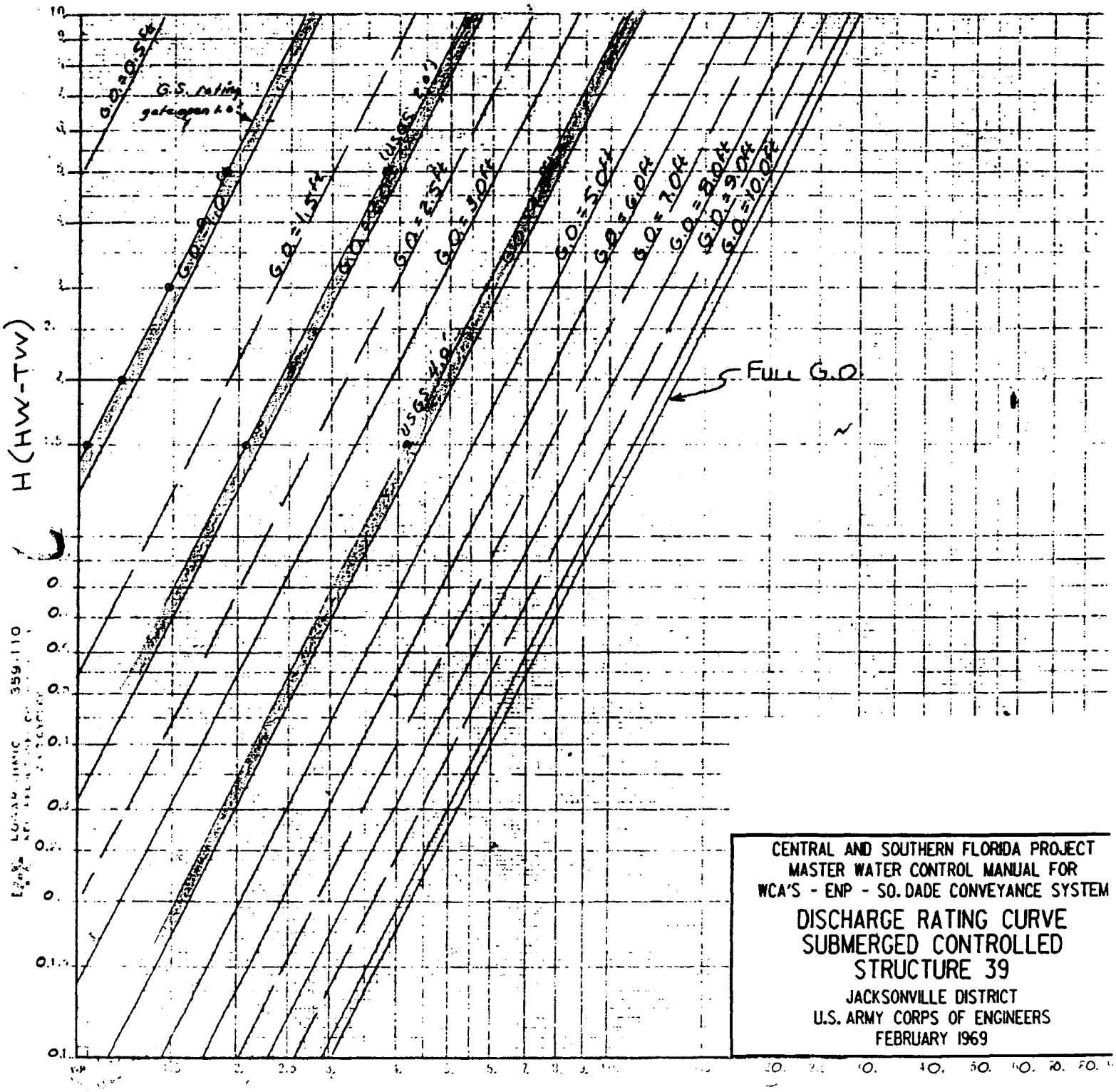
Purpose. S-39A, with S-38B, controls the seepage rate from WCA No. 2A by regulating the water level in the north half of the L-36 borrow canal.

Regulation. S-39A is manually operated to maintain an optimum water surface elevation of 7.0 to 7.5 ft., NGVD, in the northern portion of the L-36 borrow canal. Normally, this structure is opened.

STRUCTURE 39A (S-39A)

Summary of Hydraulic Design

Location	L-36
Design Conditions	
Discharge (cfs)	unknown
Optimum Conditions	
Headwater Elevation (ft.)	7.0 - 7.5
Culvert	
Type	CMP
Number of Barrels	3
Size (dia., inches)	72
Length, each, (ft.)	54
Flow line Elevation (ft.)	3.2
Gates	
Type of Control	manual - flashboards
Number	3
Size (width x height, inches)	72



DISCHARGE (100 CFS)

STRUCTURE 124 (S-124)

Location. S-124 is located in the L-35A borrow canal immediately north of North New River Canal. It is a divide structure between the C-13 and North New River Basins.

Description. S-124 is a gated, five barrel, 72-inch corrugated metal pipe culvert with manual slide gates attached to the pipes.

Purpose. This structure works together with S-125, S-38C and S-36 to maintain an optimum water elevation in the C-13 Basin east of WCA No. 2 and to maintain a sufficient stage in the L-35A borrow canal to limit seepage from WCA No. 2B. S-124 releases excess water from the C-13 Basin so the water may be pumped into WCA No. 3, or discharged to tidewater when capacity is available in North New River Canal.

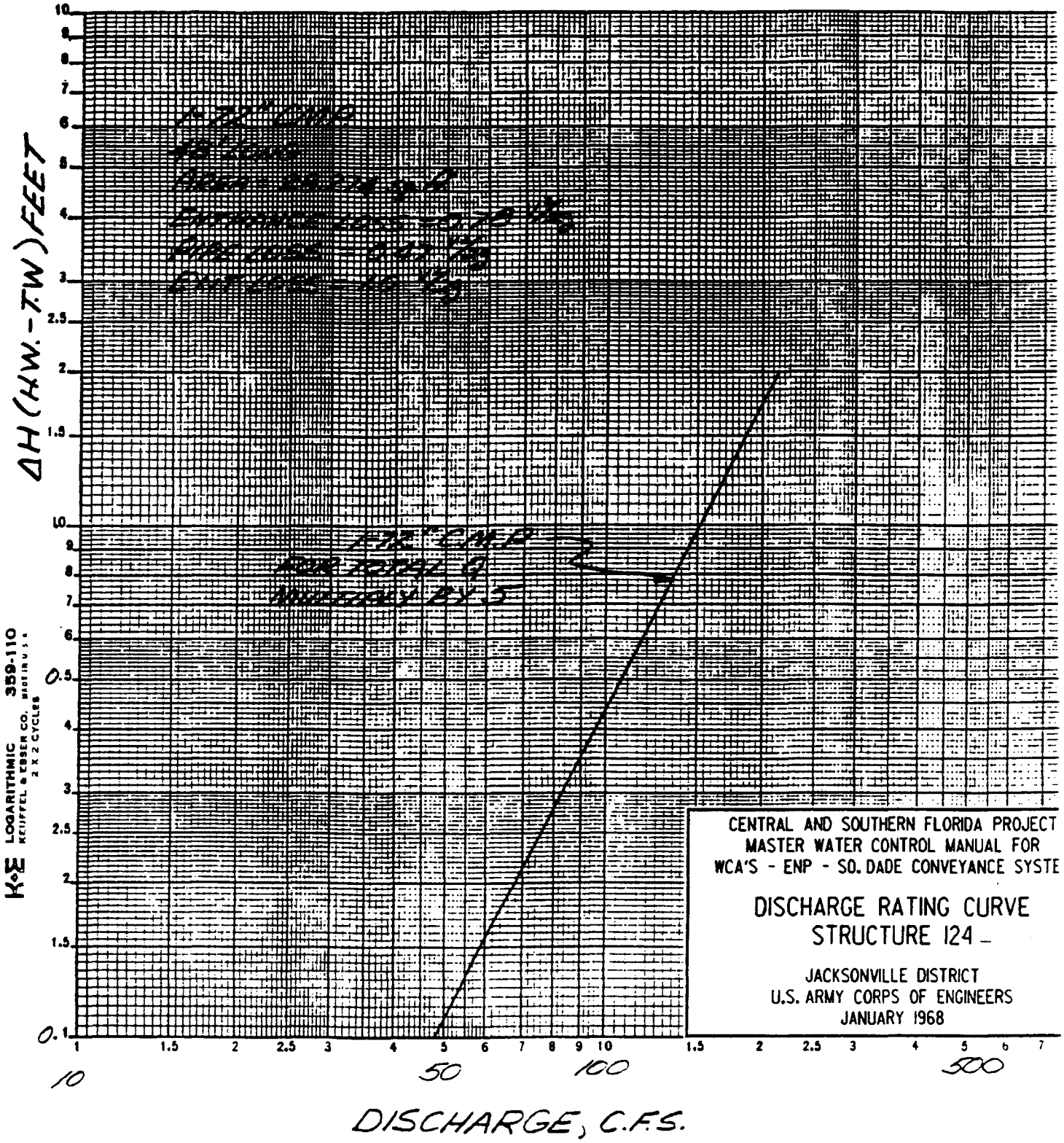
Normal Regulation. S-124 is operated manually according to water levels in the C-13 Basin, and pumping operations in the North New River Canal.

Low Flow Regulation. The gates on the five 72-inch barrels should be operated to support an optimum headwater elevation of 6.0 ft. and to continuously pass the design discharge, 550 cfs, or up to the amount that can reach the structure.

STRUCTURE 124 (S-124)

Summary of Hydraulic Design

Location	L-35A
Design Conditions	
Discharge (cfs)	550
Type	uncontrolled submerged
Headwater Elevation (ft.)	6.5
Tailwater Elevation (ft.)	6.0
Optimum Conditions	
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	5.5
Culvert	
Type	CMP
Number of Barrels	5
Size (diam., inches)	72
Net Length (ft.)	48.0
Invert Elevation (ft.)	-1.0
Gates	
Type of Control	manual slide gate
Number	5
Size (width x height, inches)	72


ΔH (H.W. - T.W.) FEET
DISCHARGE, C.F.S.
10
50
100
500
K+E LOGARITHMIC 359-110
KEUFFEL & ESSER CO. MADE IN U.S.A.
2 X 2 CYCLES
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTE
DISCHARGE RATING CURVE
STRUCTURE 124
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 1968

A-S124-3

STRUCTURE 140 (S-140)

Location. Structure 140 is in L-28 approximately 42 miles south of Clewiston on the east edge of the Seminole Indian Reservation.

Description. S-140 is a pumping station with a gated, gravity spillway. The spillway section is a 16 ft. wide trapezoidal-type spillway with a wheeled vertical lift gate. The spillway was sized to pass 300 cfs at a headwater elevation of 10.5 feet and a head loss of 0.2 feet. S-140 has three axial-flow type vertical-shaft pumps each having a nominal rating of 435 cfs at a 4.1 foot static head.

Purpose. S-140 is used to maintain the L-28 borrow canal level below 10.5 ft. unless gravity flow into WCA No. 3A is possible at an adequate rate. This structure can remove excess drainage water from the drainage area into WCA No. 3, at a rate of 7/16 inch per day. The station serves a 110 square mile drainage area north and east of the interceptor canal and west of L-28.

Regulation. The pumping station should maintain an optimum water control elevation of 10.5 ft in the Levee 28 borrow canal. The pumps should be started and stopped slowly, one pump at a time, to avoid high velocities and surges in the approach canal. The water surface should not be drawn down below elevation 7.5 ft. at the pump intake. If during pumping, the water surface on the intake bay falls below elevation 7.5 ft. all pumps operating should be reduced to not less than the minimum speed as shown on the Operation Chart. If necessary, shut down one or more units until intake pool is re-established above 7.5 ft. No operation should be attempted at heads in excess of 5.2 feet nor should engine speeds be increased above 1200 rpm. During extended periods of operation, pump speed may be decreased in order to improve operating efficiency and fuel economy, although such operation will simultaneously result in a decrease in capacity. The Operation Chart defines the entire recommended range over which pumping can be accomplished. During certain periods, stages in the conservation area will be low enough to permit sufficient gravity discharge through the spillway.

Constraints. The main pumping units at Station 140 are free from severe or harmful criticals through the speed range zero to 1200 rpm. However, there are minor criticals at 646 rpm and 841 rpm and these speeds should be avoided in the starting up and slowing down phases.

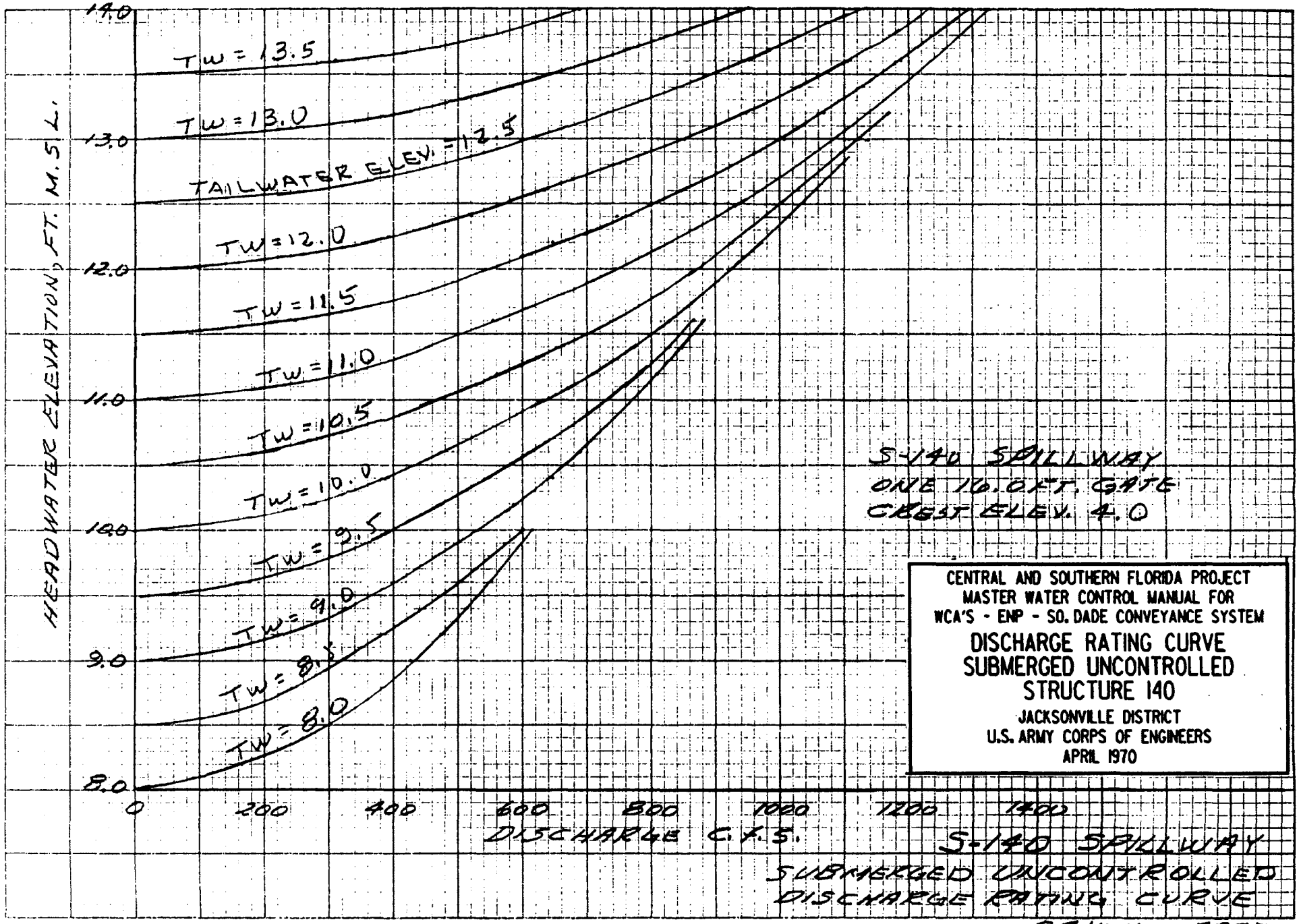
The water level which will bypass the structure is 19.0 ft.

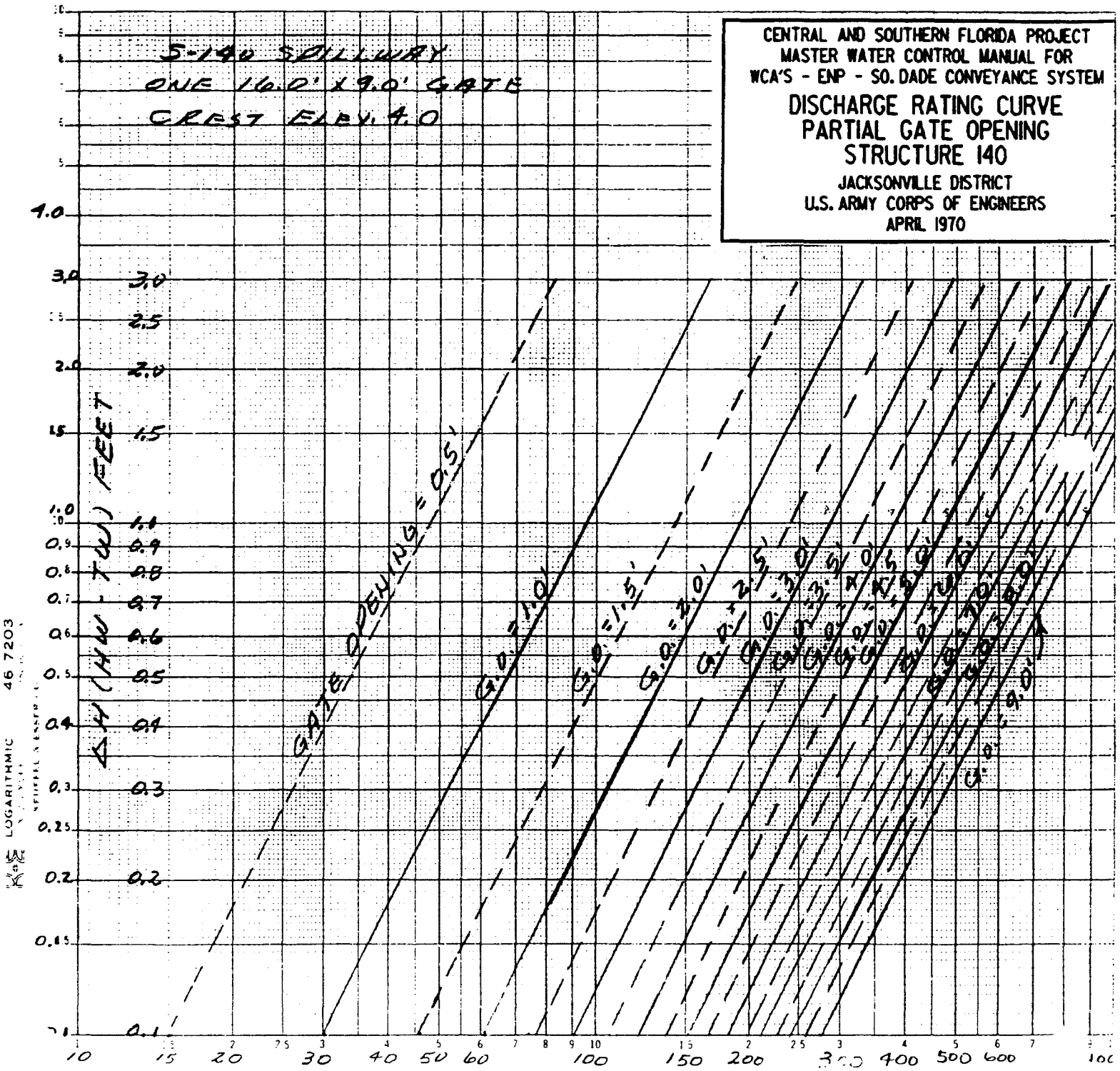
STRUCTURE 140 (S-140)

Summary of Hydraulic Design

Location	L-28
Drainage Area (sq. miles)	110
Pumping Station	
Design Conditions	
Discharge (cfs)	1,300
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	14.6
Intake Water Surface Elevation (ft.)	
Start Pumps	10.5
Normal Drawdown	9.5
Minimum	7.5
Pumps	
Type	vertical propeller
Number & Size (inches)	3 @ 110
Design Rating (cfs)	435
Impeller Speed (rpm)	81.6
Engine Horsepower (ea)	320
Engine Speed (rpm)	1,200
Gates (per bay)	
Number	1
Location	downstream end
Type	vert. lift flapgates
Size (width x height, ft.)	23.25 x 7.9
Gravity Spillway	
Design Conditions	
Discharge (cfs)	300
Headwater Elevation (ft.)	10.5
Tailwater Elevation (ft.)	10.3
Crest	
Type	Trapezoidal
Elevation (ft.)	4.0
Length (ft.)	16.0
Invert Elevation (ft.)	3.0
Gate Sill Elevation (ft.)	4.0
Gates	
Type of Control	Vertical lift
Number	1
Size (width x height, ft.)	16.0 x 9.0

K+E 5 x 5 TO ½ INCH 46 0863
KEUFFEL & ESSER CO.

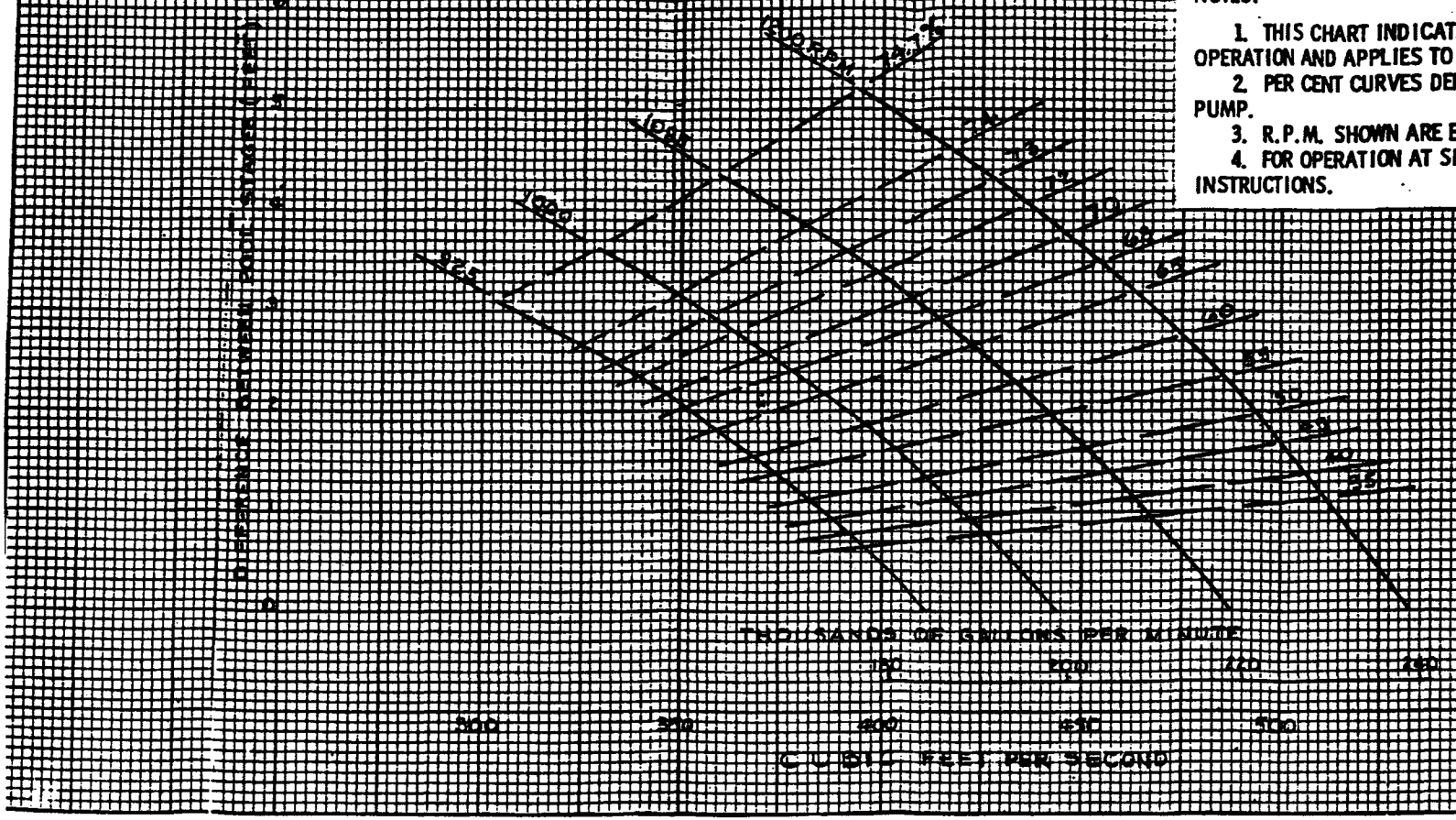




S-140 SPILLWAY

RATING CURVE FOR
PARTIAL GATE OPENING
SAJWH APR. 70

OPERATION CHART FOR PUMPIN' TATION 140



NOTES:

1. THIS CHART INDICATES RECOMMENDED LIMITS FOR CONTINUC OPERATION AND APPLIES TO EACH OF THREE (3) MAIN PUMPS.
2. PER CENT CURVES DENOTE POOL-TO-POOL EFFICIENCY OF THE PUMP.
3. R.P.M. SHOWN ARE ENGINE SPEEDS.
4. FOR OPERATION AT SPEEDS OTHER THAN SHOWN, SEE OPERATI INSTRUCTIONS.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYST

OPERATION CHART
PUMP STATION 140

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994

STRUCTURE 141 (S-141)

Location. S-141 is in Levee 38E at the southwest corner of Water Conservation Area No. 2B, about 20 miles west of Ft. Lauderdale, Florida.

Description. S-141 is a six-bay steel sheet pile spillway with a weir crest length of 30 feet. The structure has timber flashboards and a timber operating platform. The flashboards sit on a concrete sill which also serves as a cap for the sheet pile weir.

Purpose. Regulatory discharges from WCA No. 2B are made via S-141. This spillway structure controls the water level in WCA No. 2B, and permits releases from the area to the North New River Canal when capacity is available.

Normal Regulation. When S-141 is not operating under flood conditions and when water is available with releases from S-142 and S-143, then S-141 may be manually operated to support an optimum elevation range of 3.5 to 4.5 at Sewell's Lock.

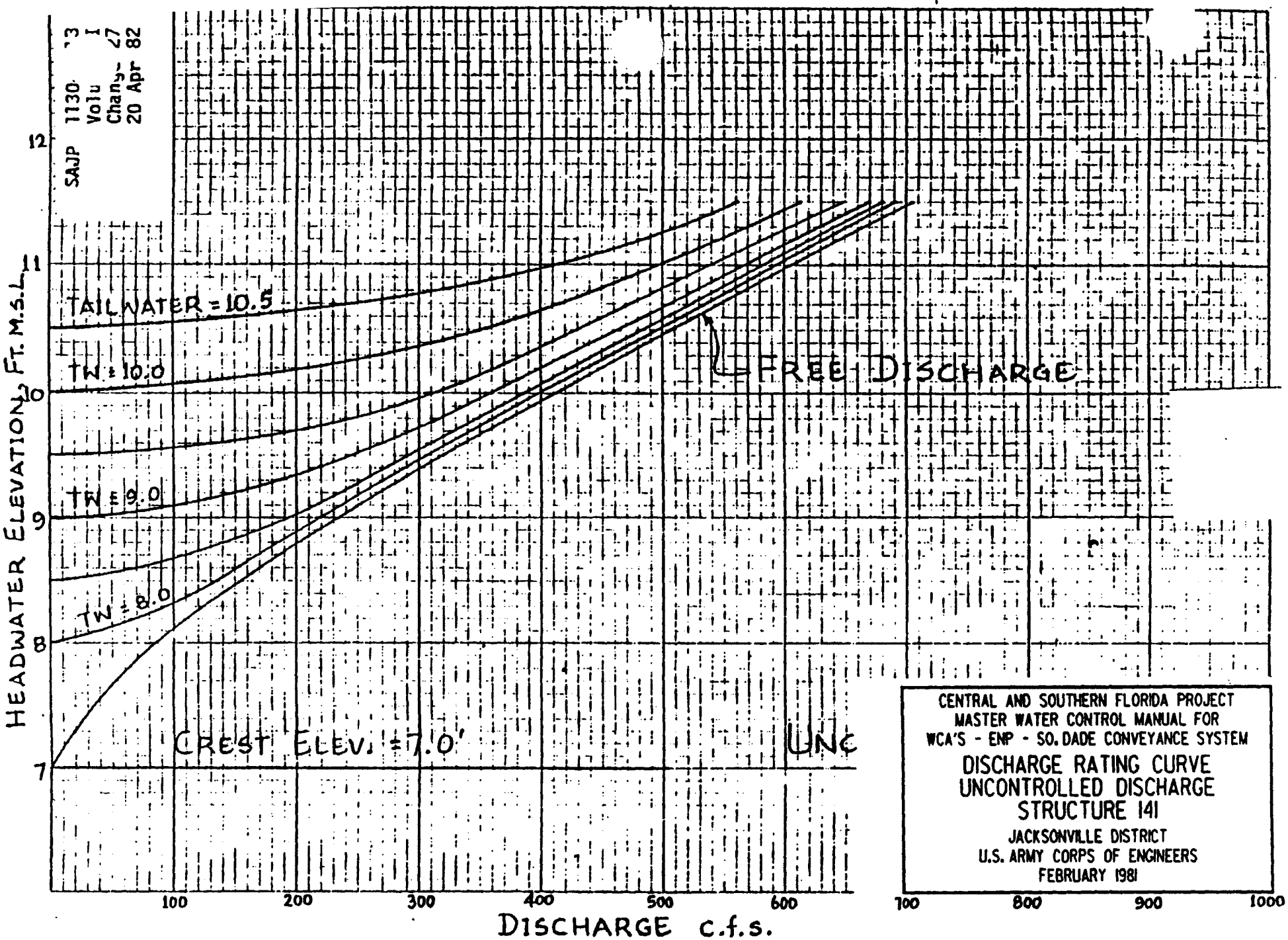
Flood Control Regulation. Whenever WCA No. 2B exceeds 11.0 ft., S-141 will be operated for flood releases through S-34 if canal capacity is available. A regulation schedule is not used for WCA No. 2B due to high rates of seepage from the area.

Constraints. Discharges should not cause S-34's tailwater to exceed 6.0 ft.

STRUCTURE 141 (S-141)

Summary of Hydraulic Design

Location	L-38E
Design Conditions	
Discharge (cfs)	435
Type	controlled submerged
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	8.0
Optimum Conditions	
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	8.0
Crest	
Shape	weir
Elevation (ft.)	7.0
Length	30.0
Gates	
Type	Timber flashboards
Number of Bays	6
Concrete Cap Elevation (ft.)	7.0



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
UNCONTROLLED DISCHARGE
STRUCTURE 141

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1981

STRUCTURE 142 (S-142)

Location. S-142 is in WCA No. 3A, between the North New River Canal and WCA No. 3A., about 350 feet west of U.S. Highway 27. It is about 20 miles west of Ft. Lauderdale, Florida.

Description. S-142 is a gated, two barrel, 72-inch, corrugated metal pipe culvert with concrete headwalls. It has standard manual slide gates, a timber walkway, and a concrete operating platform.

Purpose. S-142 releases water from WCA No. 3A for water supply and other water needs along the North New River Canal through control structure S-34. It can also make regulatory releases from WCA No. 3A.

Normal Regulation. When S-142 is not operating under flood conditions and when water is available, releases are made in conjunction with S-141 and S-143, and S-142 may be manually operated to support an optimum elevation range of 3.5 ft. to 4.5 ft. at Sewell's Lock.

Flood Control Regulation. S-142 may be operated to make regulatory releases from WCA No. 3A.

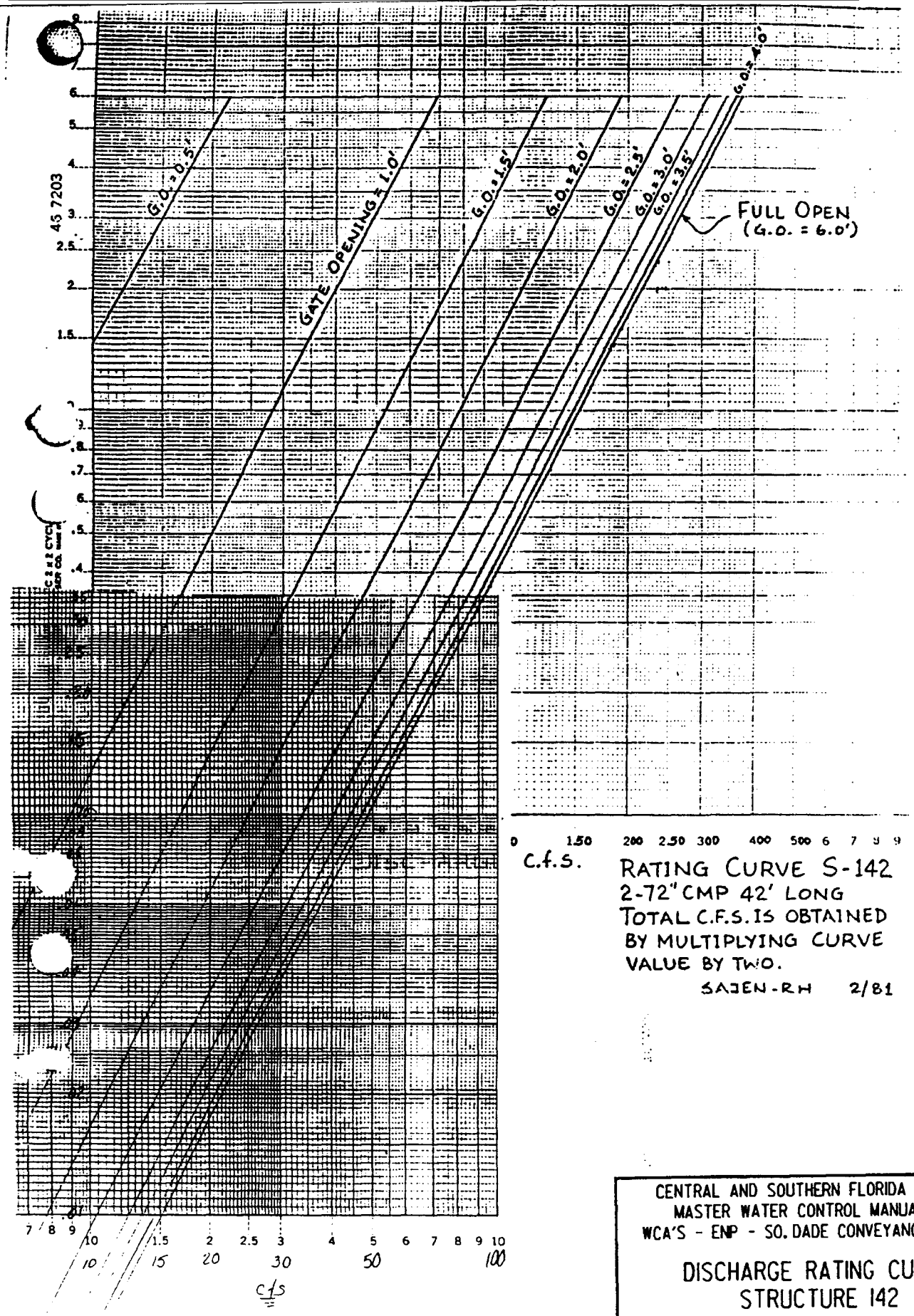
Low Flow Regulation. When there is insufficient water available in the WCA's, water is transferred from Lake Okeechobee through the WCA's to meet the needs of the East Coast and ENP. SFWMD can make water supply releases to the East Coast from the WCA's through S-142 and other structures.

Constraints. Discharges should not cause S-34's tailwater to exceed 6.0 ft.

STRUCTURE 142 (S-142)

Summary of Hydraulic Design

Location	L-38W
Design Conditions	
Discharge (cfs)	430
Type	controlled submerged
Headwater Elevation (ft.)	11.0
Tailwater Elevation (ft.)	9.0
Optimum Conditions	
Headwater Elevation (ft.)	11.0
Tailwater Elevation (ft.)	9.0
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	42
Invert Elevation (ft.)	2.0
Gates	
Type of Control	manual slide gate
Number	2
Size (width x height, inches)	72x72



RATING CURVE S-142
2-72" CMP 42' LONG
TOTAL C.F.S. IS OBTAINED
BY MULTIPLYING CURVE
VALUE BY TWO.

SAJEN-RH 2/81

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 142

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBRUARY 1981

A-S142-3

STRUCTURE 143 (S-143)

Location. S-143 is located in Water Conservation Area No. 2A at the juncture of Levee 35B and the North New River Canal, about 215 feet south of Control Structure 11A.

Description. S-143 is a gated, two barrel, 72-inch, corrugated metal pipe culvert with concrete headwalls, wingwalls, and aprons. It has standard manually operated slide gates, a timber walkway, and a concrete operating platform. Timber flashboards are used to facilitate the dewatering of the gate side of the structure if needed.

Purpose. S-143 releases water from WCA No. 2A to maintain desirable water levels, and to supply irrigation and other water needs along the North New River Canal through control structure S-34. The structure will also permit small flood releases when the capacity of North New River Canal is not required to remove local runoff.

Normal Regulation. When S-143 is not operating under flood conditions and when water is available with releases from S-141 and S-142, then S-143 may be manually operated to support an optimum elevation range of 3.5 to 4.5 feet at Sewell's Lock.

Flood Control Regulation. Prior to the hurricane season, discharges may be made from S-143 whenever WCA No. 2A has excess water. This is when the stage in WCA No. 2A is in "Area A" of the regulation schedule (measured at gage 112). Discharges can be made through S-143 if doing so doesn't cause the tailwater elevation to exceed 10.0 ft.

When the WCA No. 2A stage is in Zone A and Structure 11 is at maximum capacity, the U. S. Army Corps of Engineers may request maximum practicable releases from S-143 as long as doing so will not cause damages downstream.

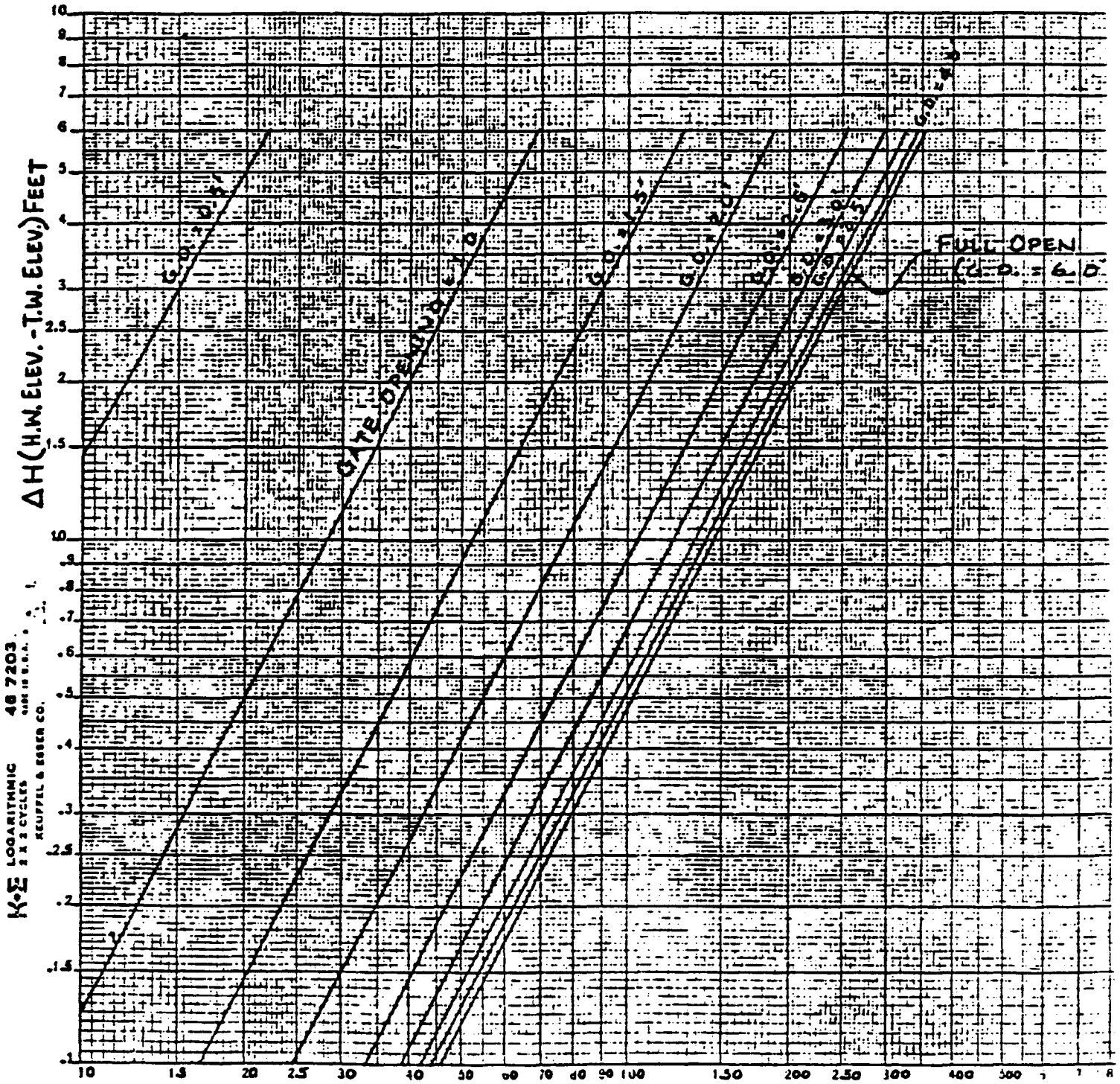
Low Flow Regulation. When there is insufficient water available in the WCA's, water is transferred from Lake Okeechobee through the WCA's to meet the needs of the East Coast and ENP. SFWMD can make water supply releases to the East Coast from the WCA's through S-143 and other structures.

Constraints. Discharges from S-143 shouldn't cause the tailwater to exceed 10.0 ft. during flood conditions or when water is not needed in WCA No. 3.

STRUCTURE 143 (S-143)

Summary of Hydraulic Design

Location	L-35B
Design Conditions	
Discharge (cfs)	500
Type	controlled submerged
Headwater Elevation (ft.)	13.0
Tailwater Elevation (ft.)	10.0
Critical Design Conditions	
Headwater Elevation (ft.)	14.5
Tailwater Elevation (ft.), approx.	8.0
Minimum Tailwater, no flow @S-34	6.0
Culvert	
Number	1
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	70
Invert Elevation (ft.)	2.0
Gates	
Type of Control	manual slide gate
Number	2
Size (dia., inches)	72



DISCHARGE c.f.s.

A-S143-3

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 143

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
FEBURARY 1981

STRUCTURE 144 (S-144)

Location. S-144 is located in Levee 35B, an interior levee of WCA No. 2 which separates WCA No. 2A from WCA No. 2B.

Description. S-144 is a one barrel, 72-inch, corrugated metal pipe culvert with a standard manual slide gate. The structure has a timber operating platform. S-144 was replaced with a new structure in 1991.

Purpose. S-144 together with S-145 and S-146, releases water from WCA No. 2A into WCA No. 2B to regulate water levels in WCA No. 2A. South Florida Water Management District operates S-144 with prior concurrence of the U.S. Army Corps of Engineers, Jacksonville District.

Normal Regulation. The gate at S-144 is usually closed. The structure is used with S-145 and S-146 to provide water to WCA No. 2B. S-144 also serves to remove excess water from WCA No. 2A.

Flood Control Regulation. This structure can be operated to maintain stages in WCA No. 2A according to the regulation schedule. When the WCA No. 2A stage is in Zone A, S-144 may release up to the maximum discharge of 210 cfs. Releases to WCA No. 2B from S-144 should stop if WCA No. 2B stage (measured at gage 99) exceeds 11.0 ft.

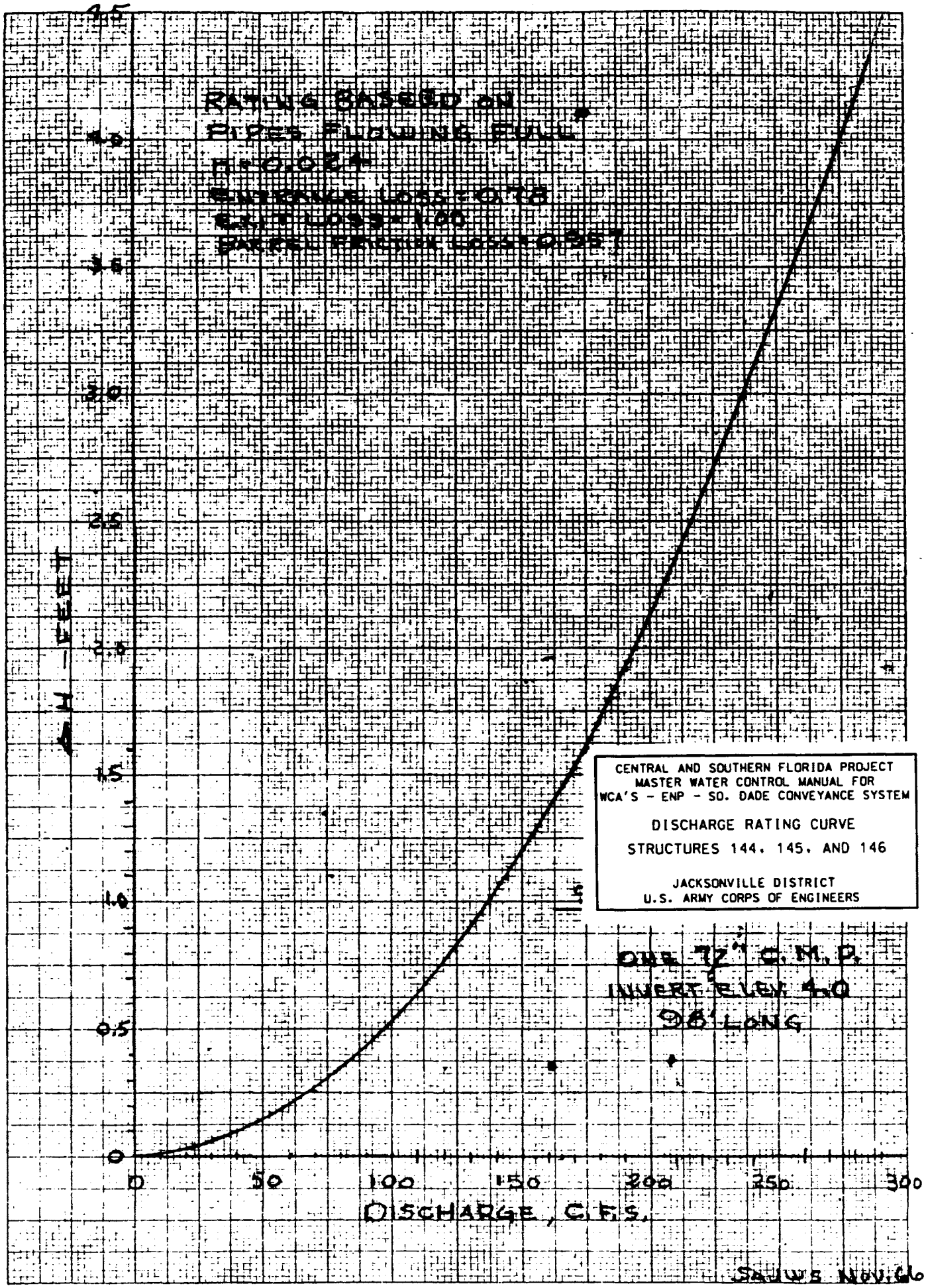
Low Flow Regulation. When WCA No. 2A is below the regulation schedule, releases may be made from S-144 when benefits from releases are greater than benefits from the storage in and the demands on WCA No. 2A. In Zone B only releases for water supply are made.

Constraints. Discharges from S-144 should be discontinued if the stage in WCA No. 2B stage (as measured at gage 99) exceeds 11.0 ft.

STRUCTURE 144 (S-144)

Summary of Hydraulic Design

Location	L-35B
Design Conditions	
Discharge (cfs)	210
Type	controlled submerged
Headwater Elevation (ft.)	12.0
Tailwater Elevation (ft.)	10.0
Critical Design Conditions	
Headwater Elevation (ft.)	14.5
Tailwater Elevation (ft.), approx.	10.5
Minimum Tailwater, no flow	8.5
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	72
Net Length (ft.)	98
Invert Elevation (ft.)	4.0
Gates	
Type of Control	Manual slide gate
Number	1
Size (dia. inches)	72

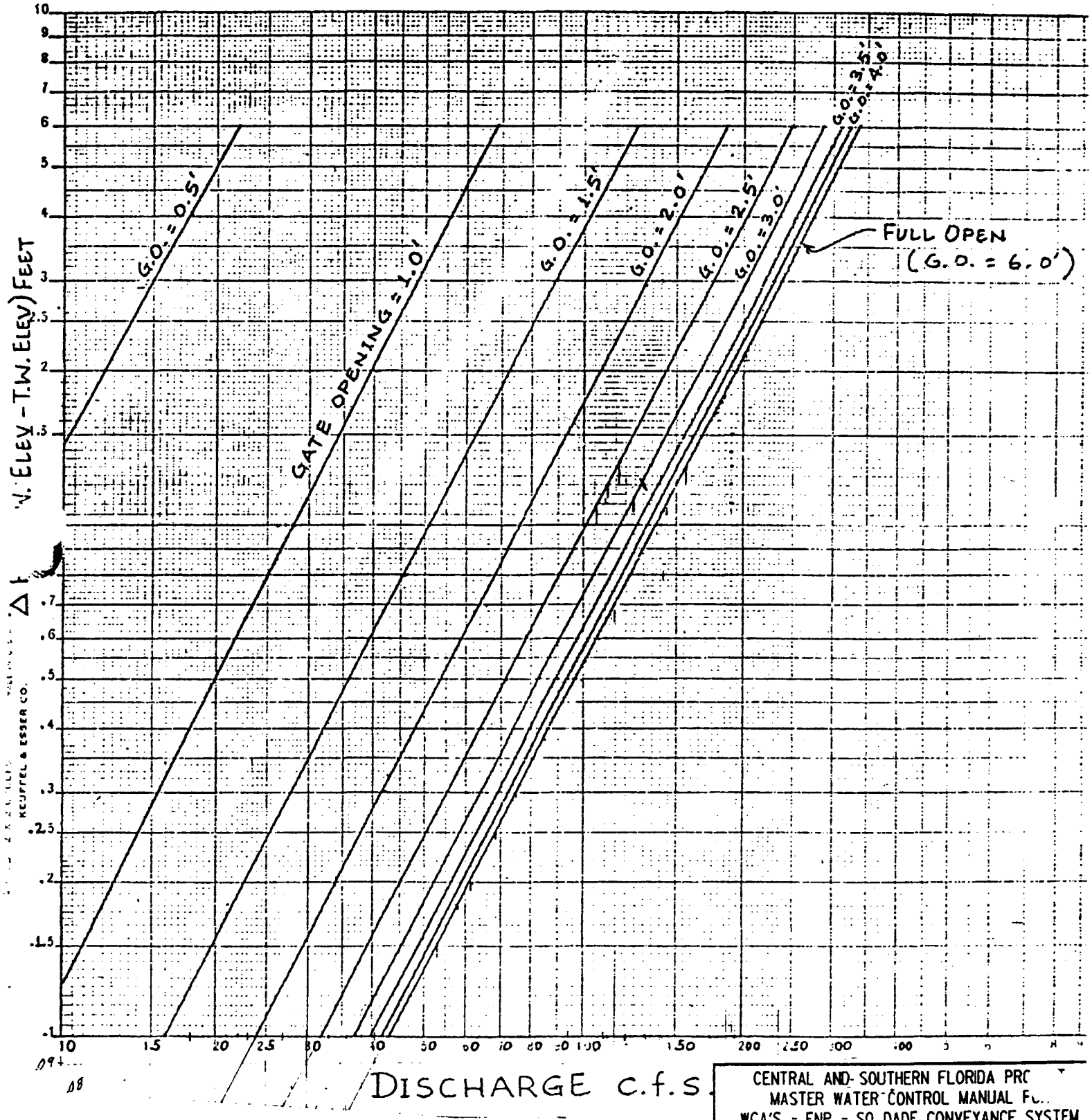


CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE

STRUCTURES 144, 145, AND 146

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS



A-S144-4

CENTRAL AND SOUTHERN FLORIDA PRC
MASTER WATER CONTROL MANUAL F...
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 144

JACKSONVILLE DISTRICT

STRUCTURE 145 (S-145)

Location. S-145 is located in Levee 35B, an interior levee of WCA No. 2 which separates WCA No. 2A from WCA No. 2B.

Description. S-145 is a one barrel, 72-inch, corrugated metal pipe culvert with a standard manual slide gate. The structure has a timber operating platform. The structure was replaced with a new structure in 1991.

Purpose. S-145 releases water from WCA No. 2A into WCA No. 2B to regulate water levels. South Florida Water Management District operates S-145 with prior concurrence of the U.S. Army Corps of Engineers, Jacksonville District.

Normal Regulation. The gate at S-145 is usually closed. The structure is used with S-144 and S-146 to provide water to WCA No. 2B. S-145 also serves to remove excess water from WCA No. 2A.

Flood Control Regulation. This structure can be operated to maintain stages in WCA No. 2A according to the regulation schedule. When the WCA No. 2A stage is in Zone A, S-145 may release up to the maximum discharge of 210 cfs. Releases to WCA No. 2B from S-145 should stop if the WCA No. 2B stage (measured at gage 99) exceeds 11.0 ft.

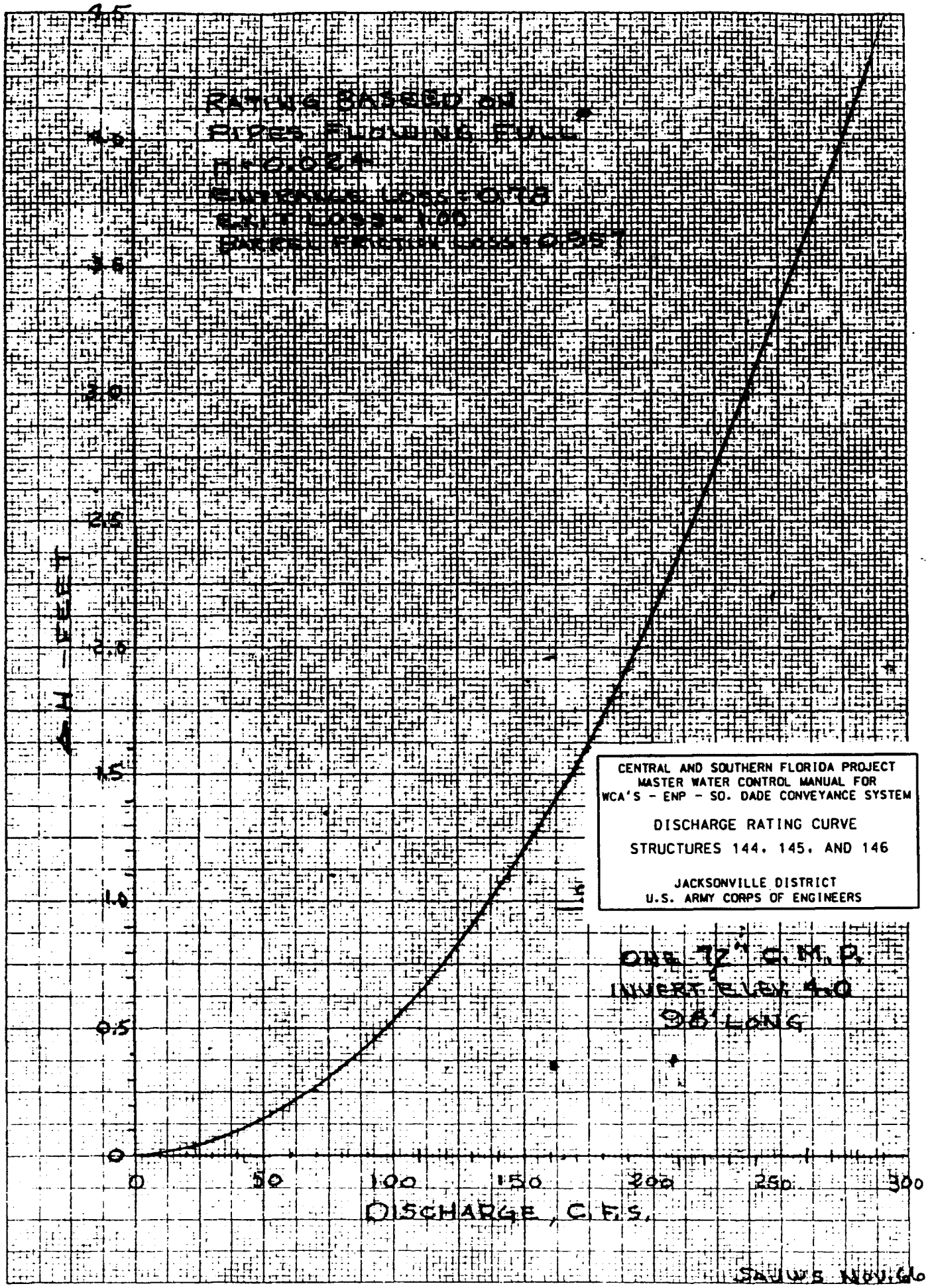
Low Flow Regulation. When WCA No. 2A is below the regulation schedule, releases may be made from S-145 when benefits from releases are greater than benefits from the storage in and the demands on WCA No. 2A. In Zone B only releases for water supply are made.

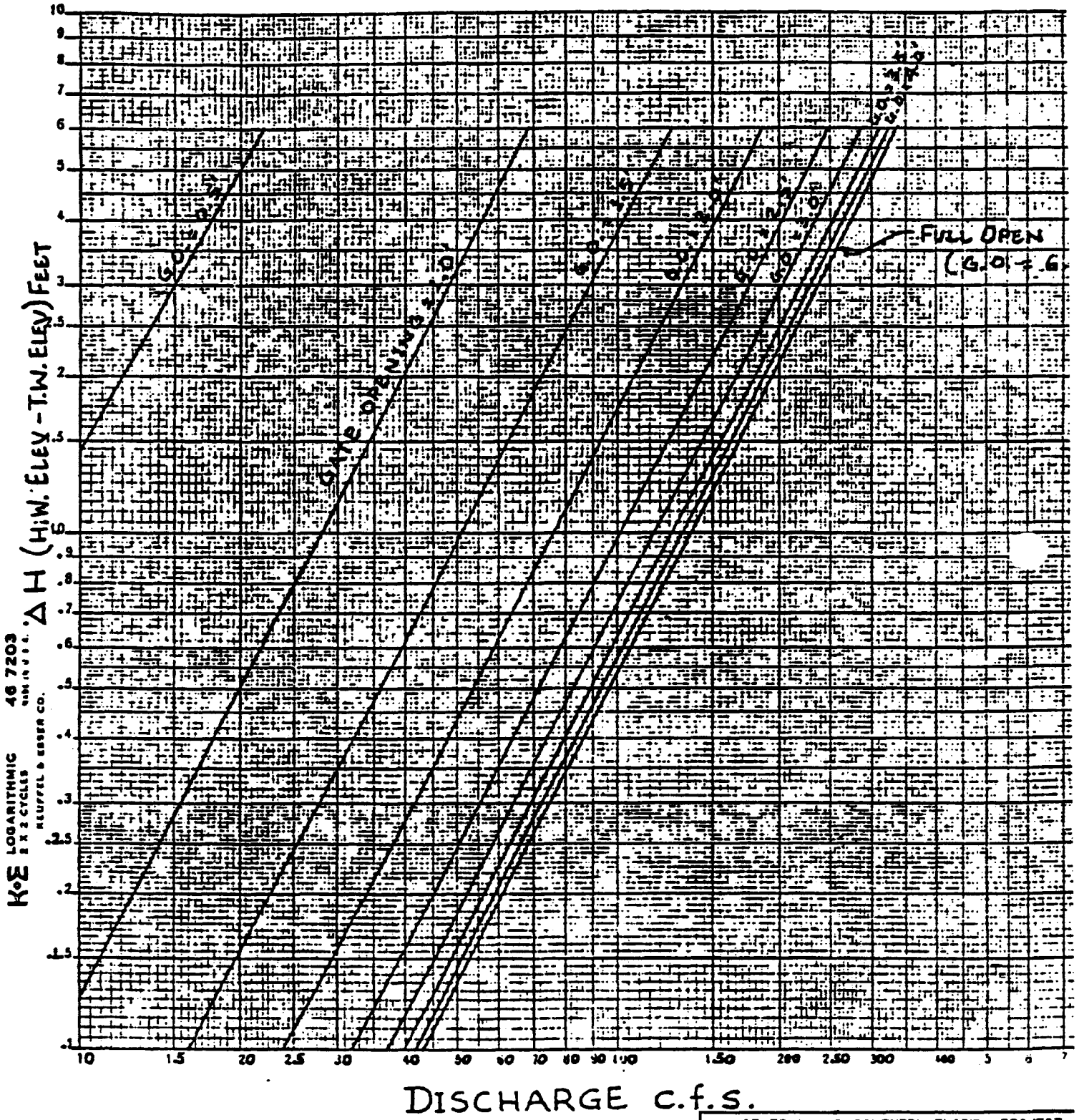
Constraints. Discharges from S-145 should be stopped when the WCA No. 2B stage (measured at gage 99) exceeds 11.0 ft.

STRUCTURE 145 (S-145)

Summary of Hydraulic Design

Location	L-35B
Design Conditions	
Discharge (cfs)	210
Type	controlled submerged
Headwater Elevation (ft.)	12.0
Tailwater Elevation (ft.)	10.0
Critical Design Conditions	
Headwater Elevation (ft.)	14.5
Tailwater Elevation (ft.), approx.	10.5
Minimum Tailwater, no flow	8.5
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	72
Net Length (ft.)	98
Invert Elevation (ft.)	4.0
Gates	
Type of Control	manual slide gate
Number	1
Size (dia. inches)	72


RATING BASED ON
PIPES FLOWING FULL
ENTRANCE LOSS = 0.78
EXIT LOSS = 1.00
PARTIAL FRICTION LOSS = 0.957
H - FEET
DISCHARGE, C.F.S.
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
50
100
150
200
250
300
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
STRUCTURES 144, 145, AND 146
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
ONE 72" C.M.P.
INVERT ELEV. 4.0
98' LONG
SAJWS NOV.66

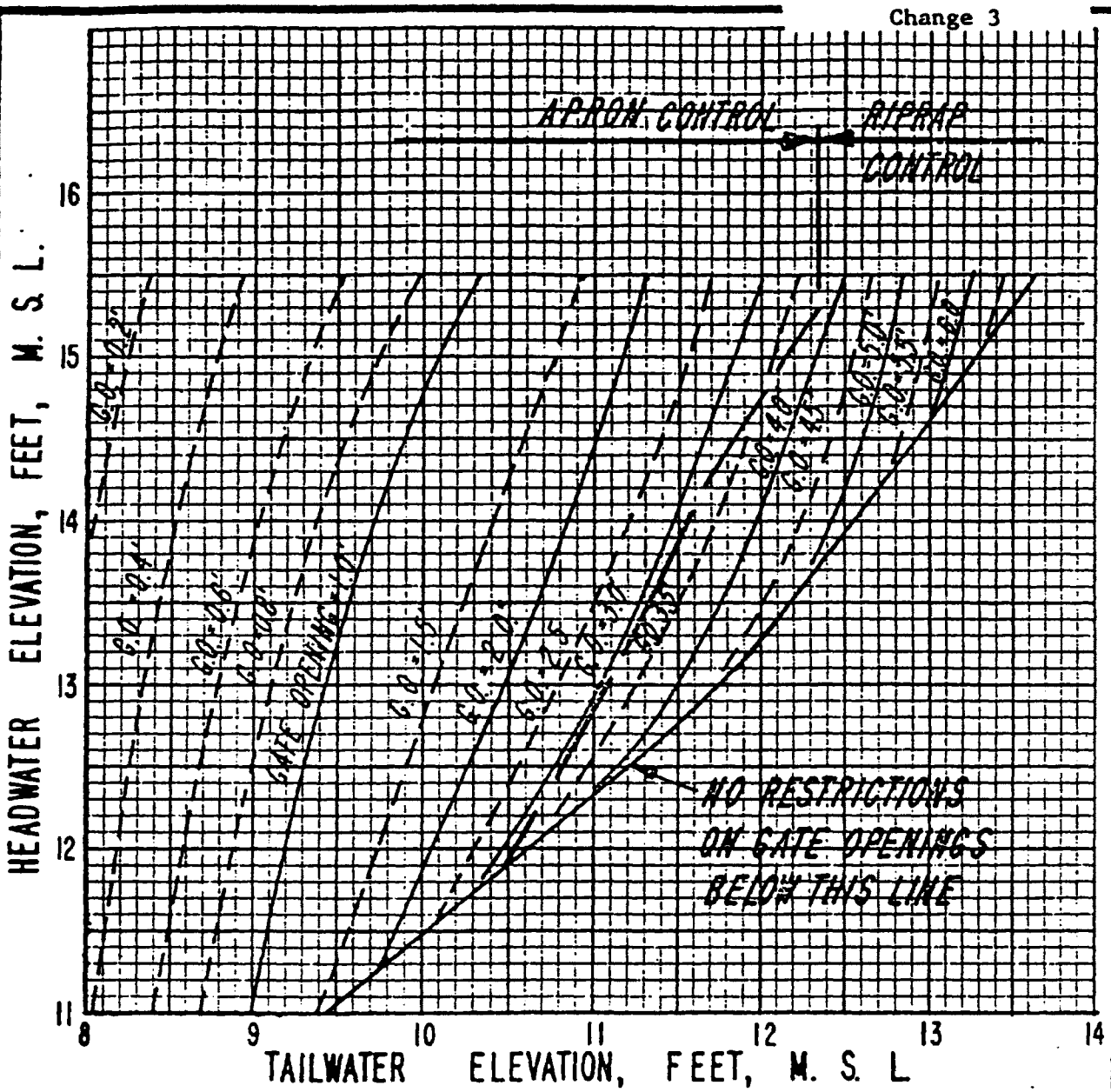


A-S145-4

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 145 AND 146

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS



NOTE:

SPILLWAY GATES TO BE OPENED UNIFORMLY.

EXAMPLE:

H.W. = 14.0 T.W. = 12.0
GATE OPENING SHOULD NOT EXCEED 4 FEET.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

MAXIMUM ALLOWABLE GATE OPENING
STRUCTURE II

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MAY 1972

STRUCTURE 146 (S-146)

Location. S-146 is located in Levee 35B, an interior levee of WCA No. 2 which separates WCA No. 2A from WCA No. 2B.

Description. S-146 is a single barrel, 72-inch, corrugated metal pipe culvert with a standard manual slide gate. The structure has a timber operating platform. S-146 was replaced by a new structure in 1991.

Purpose. S-146 releases water from WCA No. 2A into WCA No. 2B to regulate water levels. South Florida Water Management District operates S-146 with prior concurrence of the U.S. Army Corps of Engineers, Jacksonville District.

Normal Regulation. The gate at S-146 is usually closed. The structure is used with S-144 and S-145 to provide water to WCA No. 2B. S-146 also serves to remove excess water from WCA No. 2A.

Flood Control Regulation. This structure can be operated to maintain stages in WCA No. 2A according to the regulation schedule. When the WCA No. 2A stage is in Zone A, S-146 may release up to the maximum discharge of 210 cfs. Releases to WCA No. 2B from S-145 should stop if the WCA No. 2B stage (measured at gage 99) exceeds 11.0 feet.

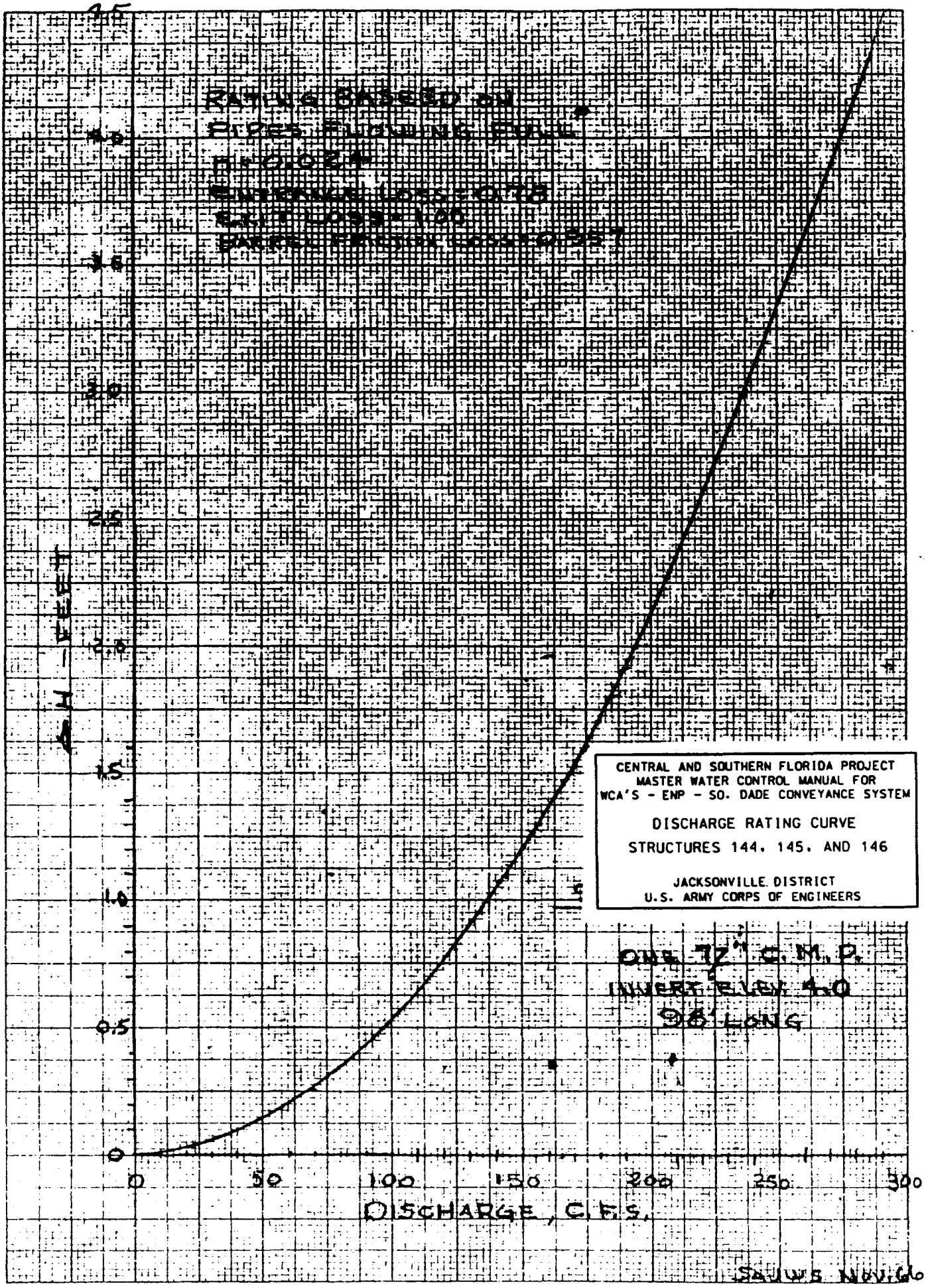
Low Flow Regulation. When WCA No. 2A is below the regulation schedule, releases may be made from S-146 when benefits from releases are greater than benefits from the storage in and the demands on WCA No.2A. In Zone B only releases for water supply are made.

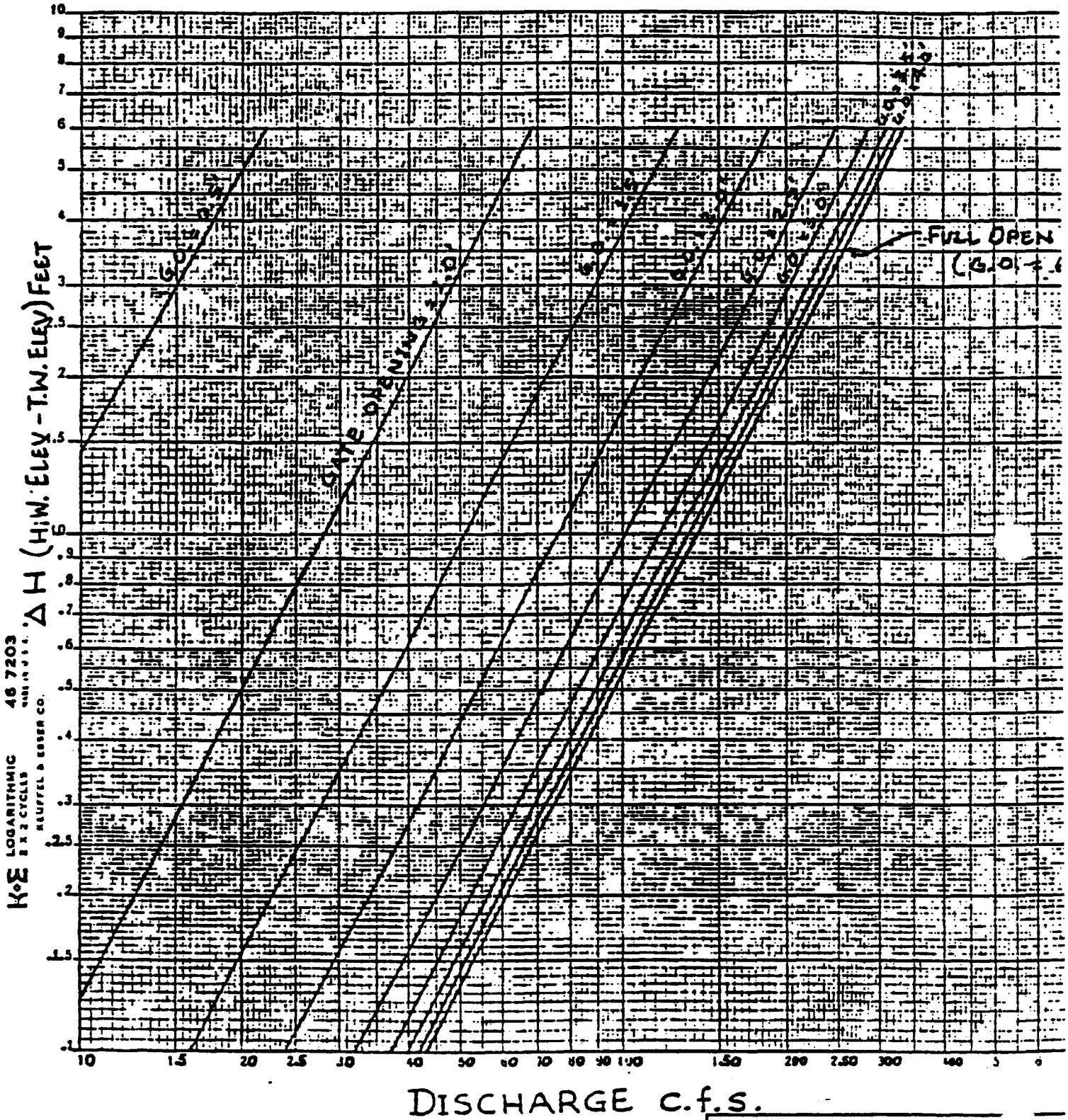
Constraints. Releases through S-146 should be stopped when the WCA No. 2B stage (measured at gage 99) exceeds 11.0 feet.

STRUCTURE 146 (S-146)

Summary of Hydraulic Design

Location	L-35B
Design Conditions	
Discharge (cfs)	210
Type	controlled submerged
Headwater Elevation (ft.)	12.0
Tailwater Elevation (ft.)	10.0
Critical Design Conditions	
Headwater Elevation (ft.)	14.5
Tailwater Elevation (ft.), approx.	10.5
Minimum Tailwater (ft.), no flow	8.5
Culvert	
Type	CMP
Number of Barrels	1
Size (dia., inches)	72
Net Length (ft.)	98
Invert Elevation (ft.)	4.0
Gates	
Type of Control	manual slide gate
Number	1
Size (dia. inches)	72

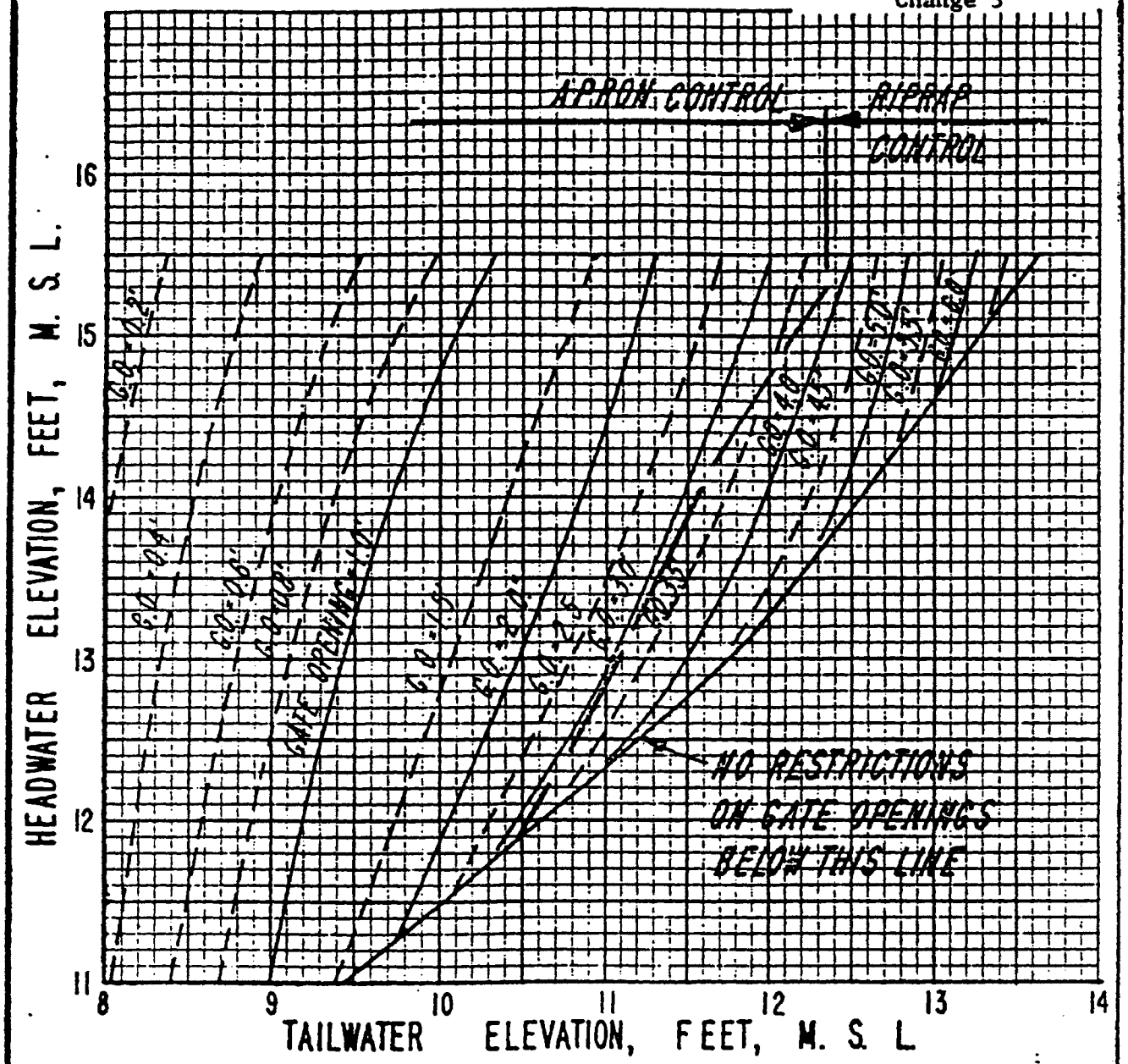

RATING BASED ON
PIPES FLOWING FULL
n=0.024
ENTRANCE LOSS=0.75
EXIT LOSS=1.00
PARTIAL FRICTION LOSS=0.95
ΔH - FEET
DISCHARGE, C.F.S.
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
50
100
150
200
250
300
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
STRUCTURES 144, 145, AND 146
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
ONE 72" C.M.P.
INVERT ELEV. 4.0
98' LONG
SAJWS NOV.66



CENTRAL AND SOUTHERN FLORIDA
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYST

DISCHARGE RATING CURVE
STRUCTURE 145 AND 146

JACKSONVILLE DISTRICT



NOTE:

SPILLWAY GATES TO BE OPENED UNIFORMLY.

EXAMPLE:

H.W. = 14.0 T.W. = 12.0

GATE OPENING SHOULD NOT EXCEED 4 FEET.

A-S146-5

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

MAXIMUM ALLOWABLE GATE OPENING
STRUCTURE II

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MAY 1972

STRUCTURE 150 (S-150)

Location. Structure 150 is located in Levee 5 at the North New River Canal. It is on the north perimeter of Water Conservation Area No. 3A, 950 ft. west of U.S. Highway 27, and about 24 miles south of South Bay.

Description. S-150 is a five barrel, 84-inch corrugated metal pipe culvert structure with manually operated slide gates. The structure also has a timber operating platform.

Purpose. S-150 provides gravity flow from Lake Okeechobee and the agricultural area to the south into WCA No. 3A, as needed, helping to maintain water levels in WCA No. 3A.

Normal Regulation. S-150 may be used to supplement the discharge of S-8 into WCA No. 3A, when the headwater elevation exceeds the tailwater elevation and when this discharge will not interfere with the discharge of S-7 into WCA No. 2A.

Flood Control Regulation. S-150 may be manually operated to remove excess water from the agricultural area or Lake Okeechobee when WCA No. 3A stages are low and the water is not needed to fill available storage in WCA No. 2A. The 5 gated culverts will pass up to 1000 cfs.

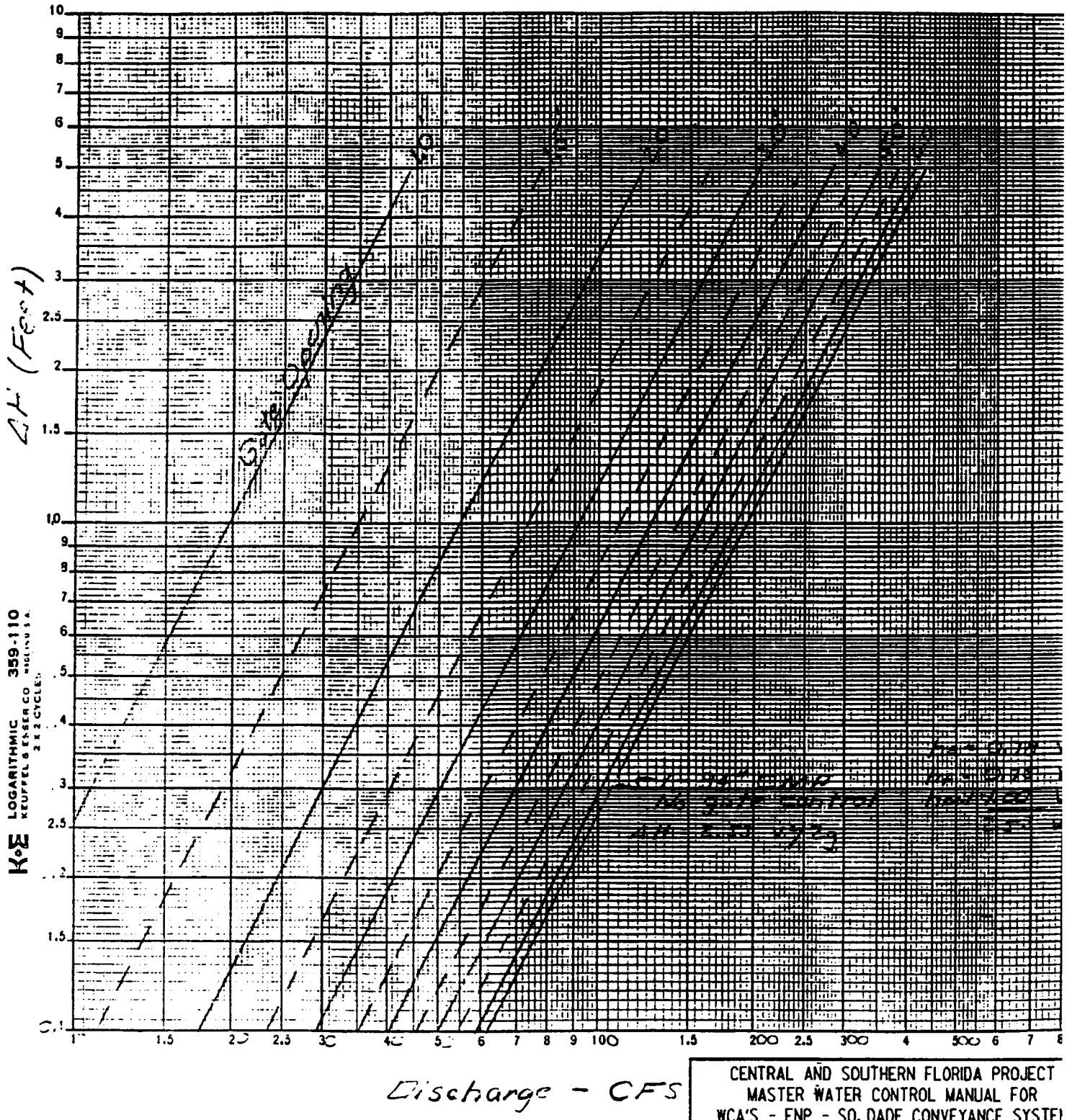
Low Water Regulation. Instead of pumping, S-150 may be used when possible to transfer up to 1,000 cfs by gravity from Lake Okeechobee to meet demands on WCA No. 3A under existing interim or future agreements.

Constraints. Gates may be opened when the water is not needed to meet the regulation schedule of WCA No. 2A, WCA No. 3A is below the regulation schedule and water is available in the North New River Canal.

STRUCTURE 150 (S-150)

Summary of Hydraulic Design Data

Location	L-5
Design Conditions	
Discharge (cfs)	1,000
Type	Controlled submerged
Headwater Elevation (ft.)	11.0
Tailwater Elevation (ft.)	10.0
Maximum Headwater Elevation (ft.)	13.0
Maximum Head	10.0
Culvert	
Type	CMP
Number of Barrels	5
Size (inches)	84
Net Length (ft.)	92
Invert Elevation (ft.)	3.0
Gates	
Number	5
Type of Control	Manual slide gate
Size (dia. inches)	84
Instrumentation	
Headwater Recorder and Staff Gage	No
Tailwater Recorder and Staff Gage	Yes
Gate Position Recorders	No
Operating Platform	
Type	Timber
Elevation (ft.)	19.0

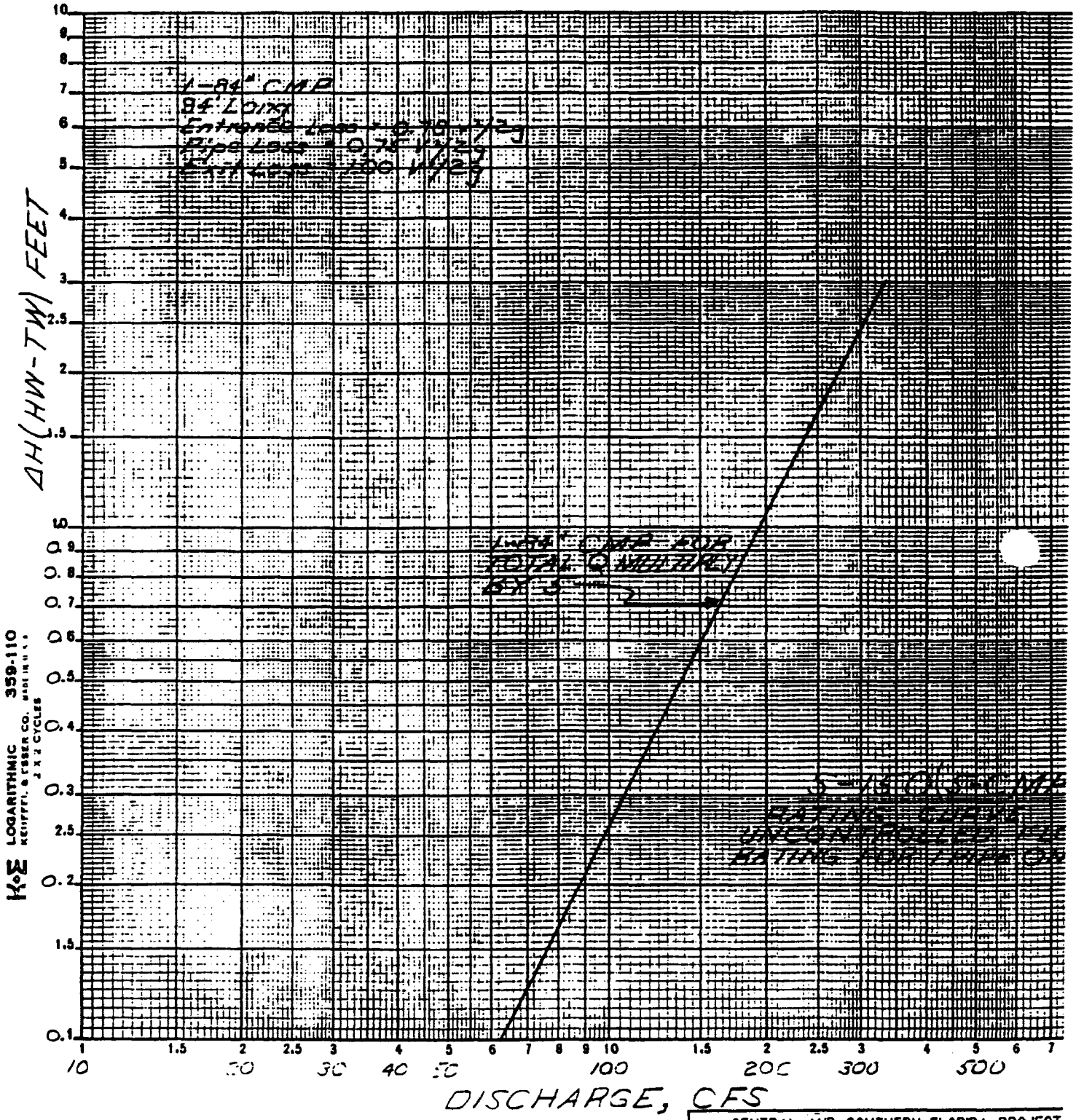


CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

A-S150-3

DISCHARGE RATING CURVE
STRUCTURE 150

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
UNCONTROLLED FLOW
STRUCTURE 150

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 151 (S-151)

Location. S-151 is located in Levee 67A in the Miami Canal. It is about 5.7 miles southwest of Pumping Station 9 and about 6.2 miles west of U.S. Highway 27.

Description. S-151 is a gated, six barrel, 84-inch corrugated metal pipe culvert. It was originally built as a 3 barrel cmp culvert and was later modified by adding 3 barrels adjacent to the existing structure. The structure has a timber operating platform and manual slide gates.

Purpose. S-151 permits releases from WCA No. 3A to supply water needs to South Dade County and along the Miami Canal (C-6), C-7 and C-8 during the dry season. It can also be used to make releases from Water Conservation Area No. 3A to maintain water levels in WCA No. 3B. S-151 also provides capacity for water releases through S-31 to the east coast.

Normal Regulation. The gates of S-151 may be manually operated to release water, as necessary, to fulfill downstream water requirements in Dade County and to maintain the necessary water levels in WCA No. 3B.

Flood Control Regulation. When requested by the Corps of Engineers, S-151 may be used to increase flexibility in making regulatory releases from WCA No. 3A. Four gaps in the southwest berm and disposal mounds along C-304 will allow water discharged through S-151 to overflow into WCA No. 3B when canal stages exceed 8.3 feet.

Low Water Regulation. Whenever S-151 is not required for regulatory or water supply releases, the headwater and tailwater may fluctuate in response to water conditions in WCA No. 3A and 3B. The structure's design discharge capacity is 1,105 cfs, 500 cfs of which could be subsequently released at S-31 and the remaining 605 cfs could be released at S-337, with a headwater elevation of 7.5 feet, and a tailwater elevation of 6.4 feet.

Constraints. S-151's tailwater elevation shall not exceed 10.0 feet.

STRUCTURE 151 (S-151)

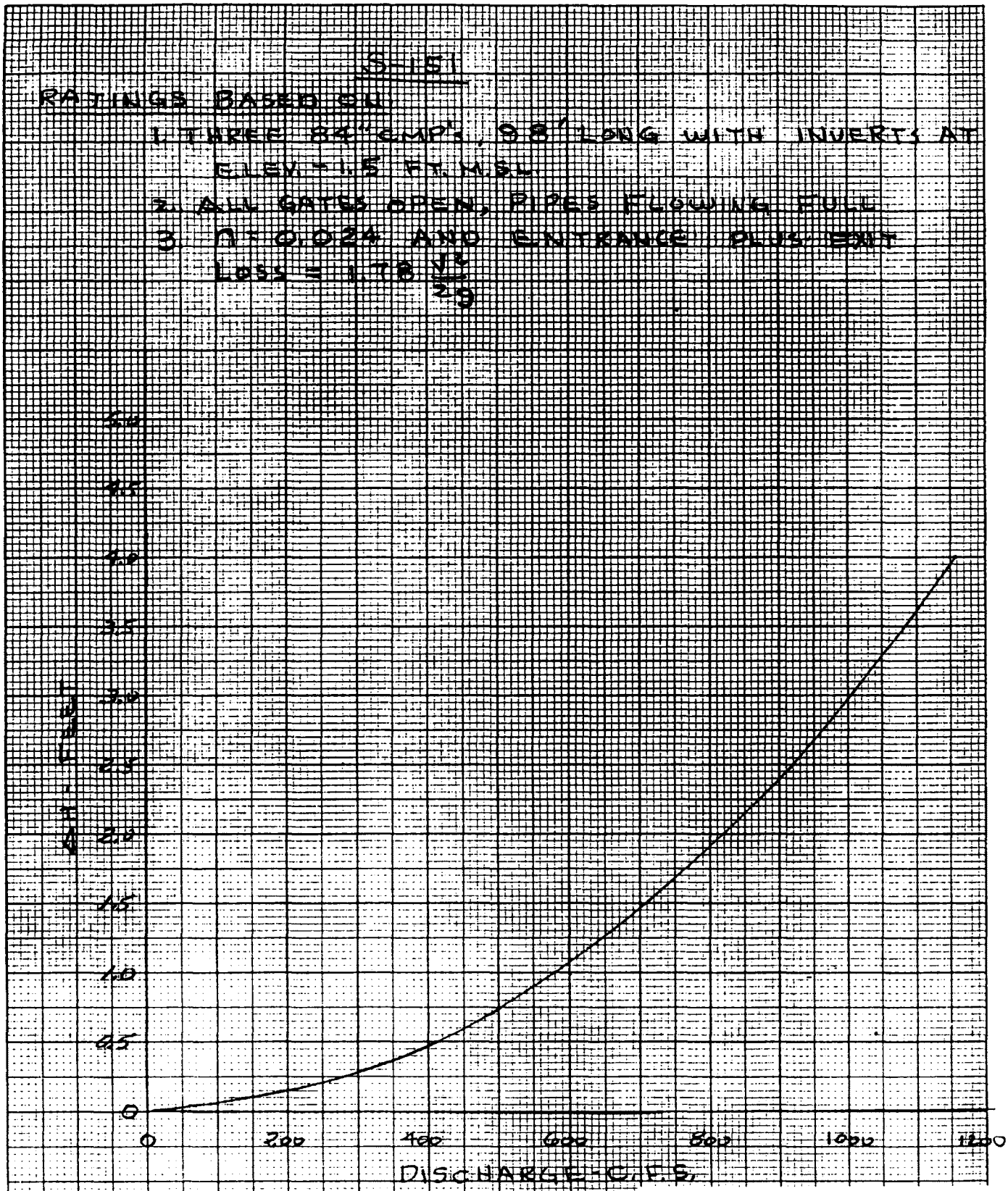
Summary of Hydraulic Design Data (Culvert) (4&2)

Location	L-67A
Design Conditions	
Discharge (cfs)	1,105
Type	Controlled submerged
Headwater Elevation (ft.)	7.5
Tailwater Elevation (ft.)	6.4
Culvert	
Type	CMP
Number of Barrels	6
Size (dia., inches)	84
Net Length (ft.)	98
Invert Elevation (ft.)	-1.5
Gate	
Number	6
Size (dia., inches)	84
Type of Control	Manual slide gate
Operating Platform	
Type	Timber
Elevation (ft.)	17.0

S-151

RATINGS BASED ON:

1. THREE 84" CMP'S, 98' LONG WITH INVERTS AT ELEV. -1.5 FT. M.S.L.
2. ALL GATES OPEN, PIPES FLOWING FULL
3. $n = 0.024$ AND ENTRANCE PLUS EXIT LOSS $= 1.78 \frac{V^2}{2g}$

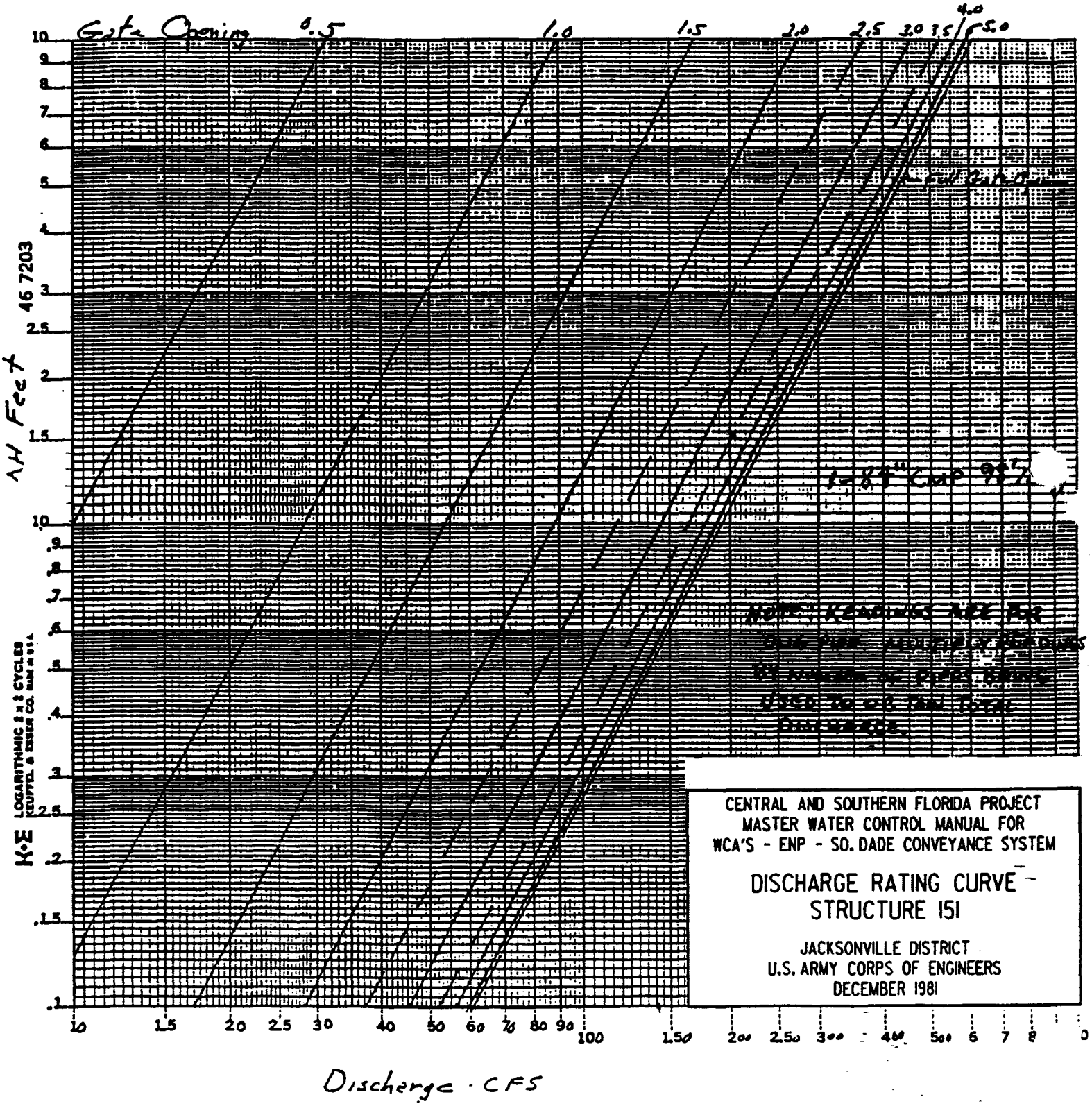


CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 151

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1966

K+E 10 X 10 TO ½ INCH 46 1323
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 151

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
DECEMBER 1981

STRUCTURE 173 (S-173)

Location. Structure 173 is located in the Levee 31 North borrow canal adjacent to the east boundary of the Everglades National Park about 9.0 miles northwest of Homestead, Florida.

Description. S-173 is a single-barreled, 72-inch reinforced concrete pipe culvert with a manually operated sluice gate on a reinforced concrete head structure at the northeast end of the structure.

Purpose. S-173 is used in conjunction with pump station S-331 to pass water to the south so as to protect areas to the west of L-31N

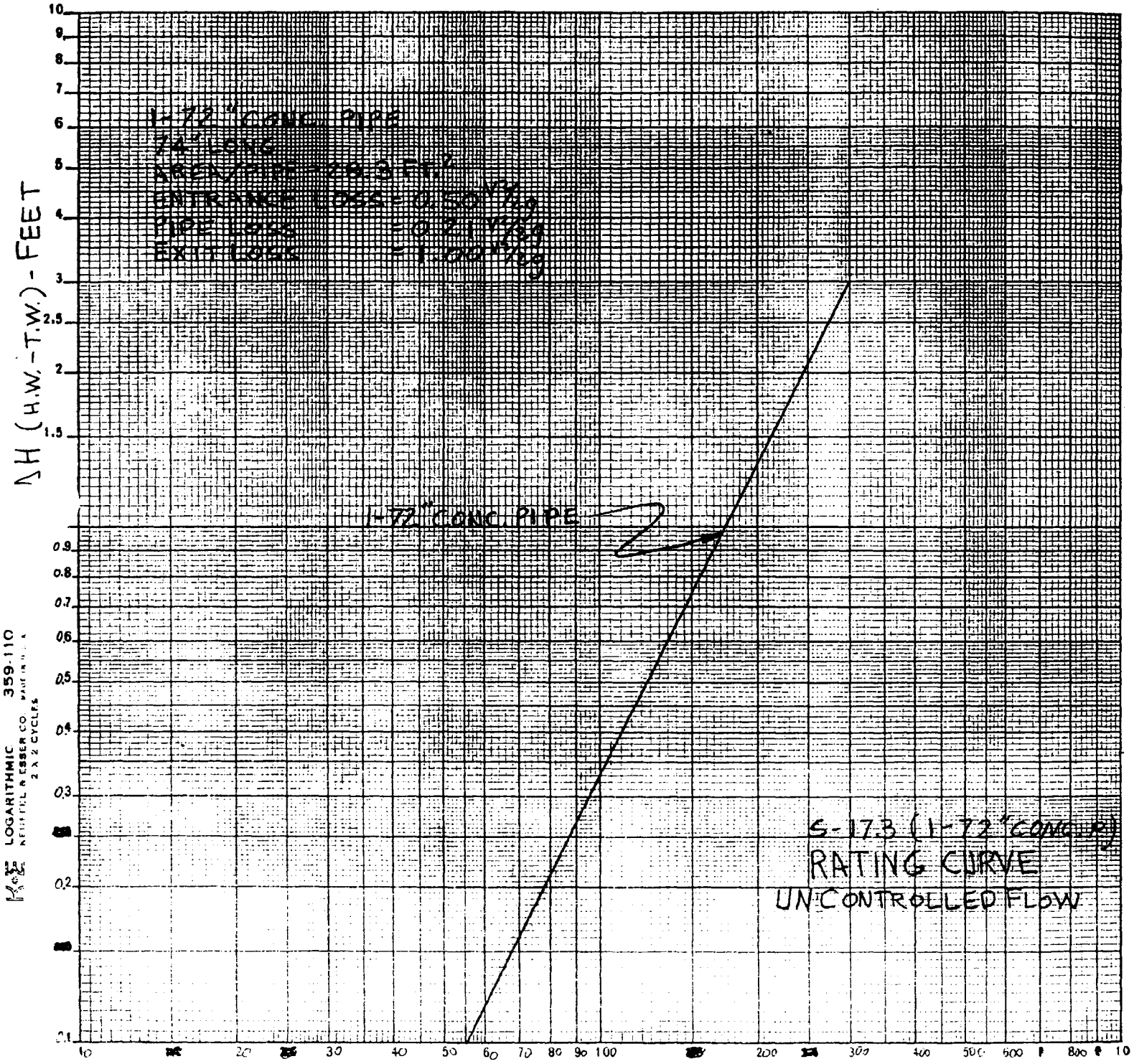
Regulation. This structure is operated in either the water supply or flood control mode in conjunction with S-331 which is regulated according to an agreement between the U. S. Army Corps of Engineers, the Everglades National Park and the South Florida Water Management District. The agreement is part of the experimental water delivery program as authorized by PL 91-282.

See structure description and operation for structure S-331, appendix A, pages A-S331-1,2, and 3.

STRUCTURE 173 (S-173)

Summary of Hydraulic Design

Location	L-31N
Design Conditions	
Discharge (cfs)	100
Type	controlled submerged
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	4.5
Culvert	
Type	RCP
Number of Barrels	1
Size (dia., inches)	72
Net Length (ft.)	70
Invert Elevation (ft.)	-2.5
Gates	
Type of Control	sluice gate
Number	1
Size (dia., inches)	72



S-173

DISCHARGE - C.F.S.

A-S173-3

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
UNCONTROLLED FLOW
STRUCTURE 173

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 174 (S-174)

Location. S-174 is located in the northern end of the L-31(W) borrow canal, approximately 5 miles west of Homestead.

Description. Structure 174 is a 1-bay, reinforced concrete, U-shaped spillway with an automatically controlled vertical-lift gate. The gate has two manual slide gates, over one and one-half-feet-high, which provide overflow and water control above elevation 4.5 ft, NGVD to minimize vertical-lift gate movement. The structure has an operating platform and a service bridge. S-174 has sheet-pile wingwalls protected by riprap on the side slopes of the canal.

Purpose. Prior to construction of S-332B, S-332C, and S-332D; this structure, together with S-176, maintained a desirable water control stage upstream in the L-31(N) borrow canal. It passed the design flood (40 percent of the SPF) without exceeding the upstream flood design stage, and restricted downstream flood stages and discharge velocities to non-damaging levels. It also passed the required flows (up to 500 cfs) to Taylor Slough in ENP. It now no longer performs its original purpose.

Regulation. Closed.

STRUCTURE 174 (S-174)

Summary of Hydraulic Design

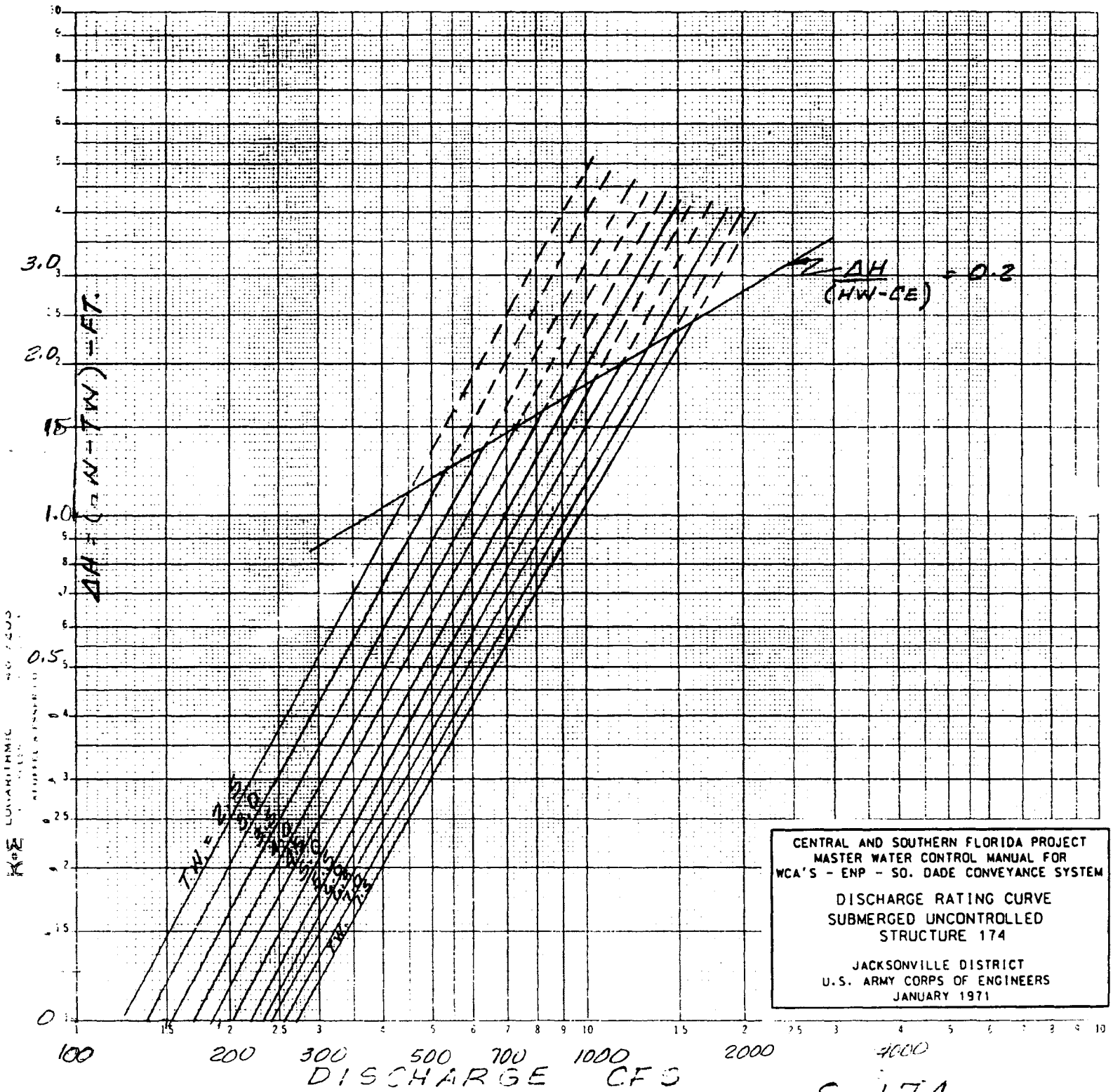
Location	L-31(W)
Design Conditions	
Discharge (cfs)	500
Type	Uncontrol submerged
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	5.5
S.P.F. Condition	
Discharge (cfs)	850
Type	Uncontrol submerged
Headwater Elevation (ft.), est.	7.5
Tailwater Elevation (ft.), est.	6.5
Optimum Conditions	
Headwater Elevation (ft.)	5.3
Tailwater Elevation (ft.)	4.3
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	3.0
Tailwater Elevation (ft.)	2.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-1.5
Net Length (ft.)	16.0
Gates	
Number	1
Type of Control	Automatic vert. lift
Width x Height (ft.)	16.0 x 8.0
Elevation of low steel in fully open position	10.7
Top of gates in the closed position	6.5
Overflow slot elevation (ft.)	4.5 to 6.0
Canal Section	
Upstream Bottom Width (ft.)	20.0
Upstream Bottom Elevation (ft.)	-12.0
Upstream Side Slopes	1 on 1
Downstream Bottom Width (ft.)	20
Downstream Bottom Elevation (ft.)	-12.0
Downstream Side Slopes	1 on 1
Protection Elevation (ft.)	11.0
Apron	
Elevation (ft.)	-3.5
Length (ft.)	20.0
End sill elevation (ft.)	-2.5
Service Bridge Elevation (ft.)	11.0
Operating Platform Elevation (ft.)	27.0
Dewatering Facilities	Yes

RATING BASED ON:

$Q = KA\sqrt{2g\Delta H + V^2}$

$K = 0.1 \times \Delta H + 0.725$

V = Approach Velocity



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED UNCONTROLLED
STRUCTURE 174

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 1971

S-174

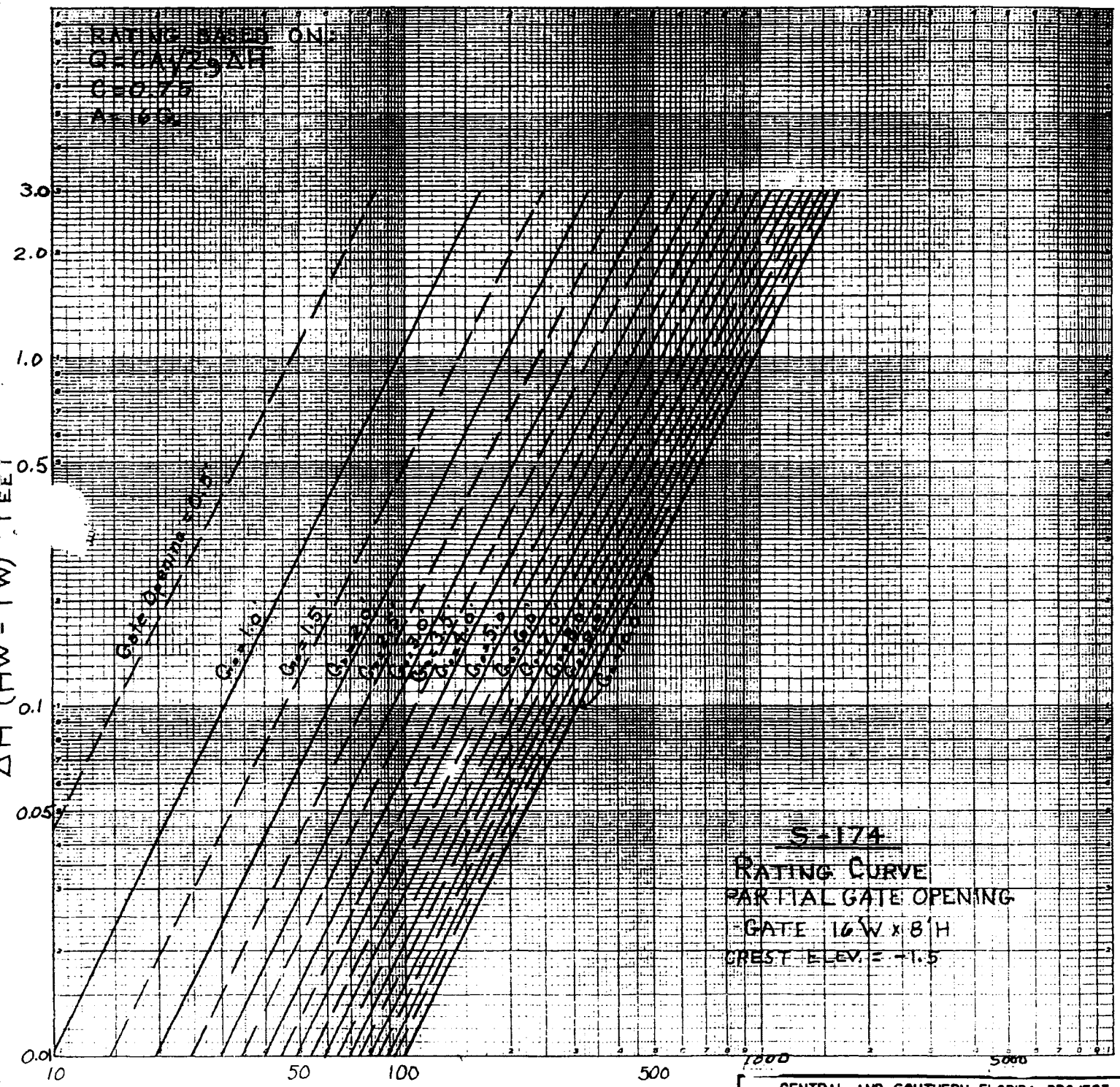
RATING CURVE

SUB. UNCONTROLLED FLOW

1 GATE 16'W x 8'H CREST EL. -1.5

A-S174-4

Partial Gate Opening



A-S174-5

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 174

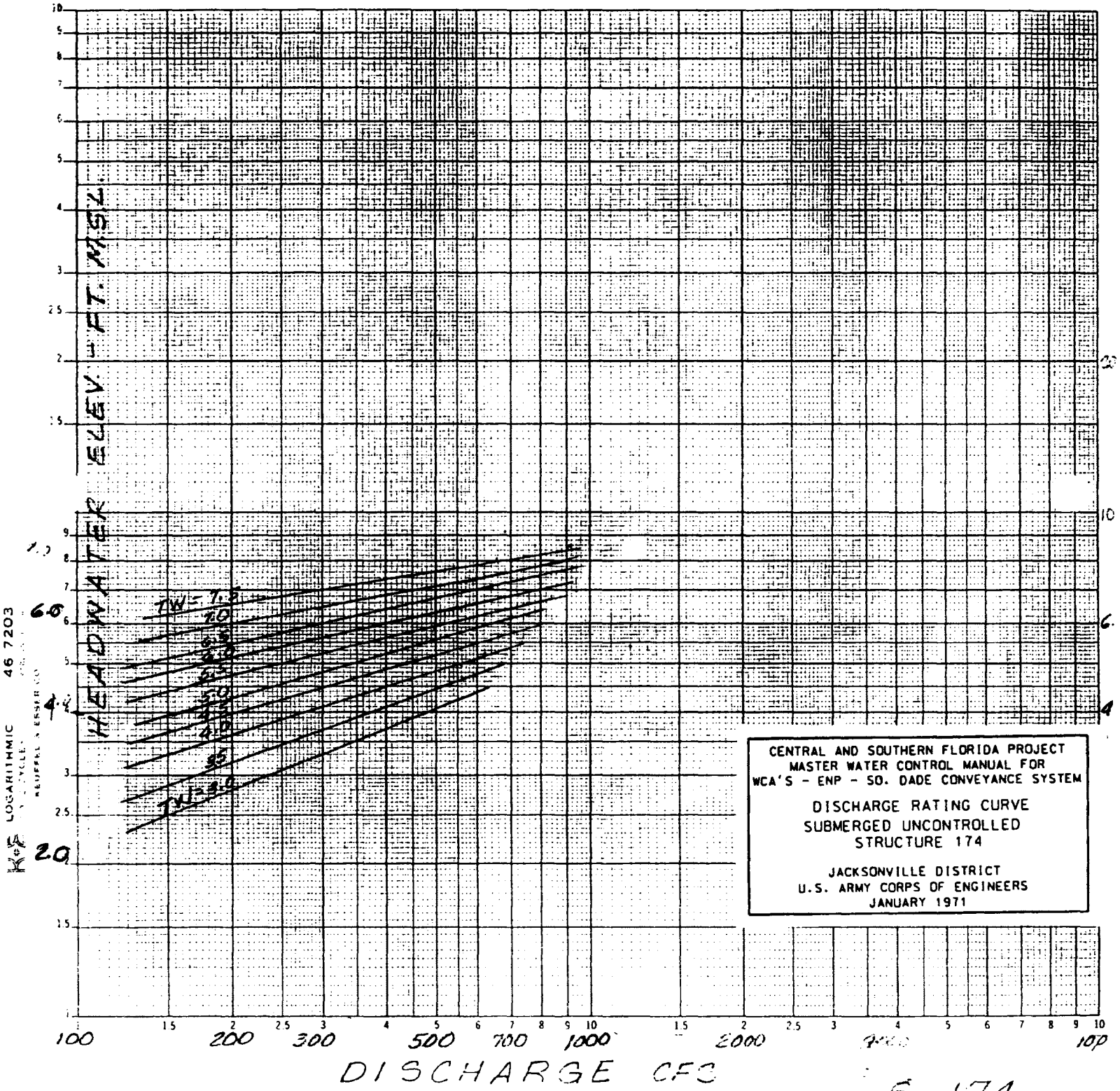
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

RATING BASED ON:

$Q = KA\sqrt{2g\,\Delta H + V^2}$

$K = 0.1 \times \Delta H + 0.725$

V. = Approach Velocity



S-174

RATING CURVE

SUBMERGED UNCONTROLLED FLOW

1-GATE 16'W x 5'H

CREST ELEV. = -1.5

A-S174-6

STRUCTURE 175 (S-175)

Location. Structure 175 is located in the Levee 31 West borrow canal adjacent to the east boundary of the ENP approximately one and one-quarter miles north of S.R. 27.

Description. S-175 is a gated, three barrel, 84-inch CMP culvert with reinforced concrete headwalls and manually-operated slide gates.

Purpose. Prior to removal of L-31(W) near S-332, this structure maintained optimum upstream water control stages in the L-31(W) borrow canal. It passed the design flood (40 percent of the SPF) without exceeding the upstream flood design stage, and restricted downstream flood stages and channel velocities to non-damaging levels. S-175 also prevents salt water intrusion into the canal. S-175 is no longer operated for flood control purposes.

Regulation. Closed.

STRUCTURE 175 (S-175)

Summary of Hydraulic Design

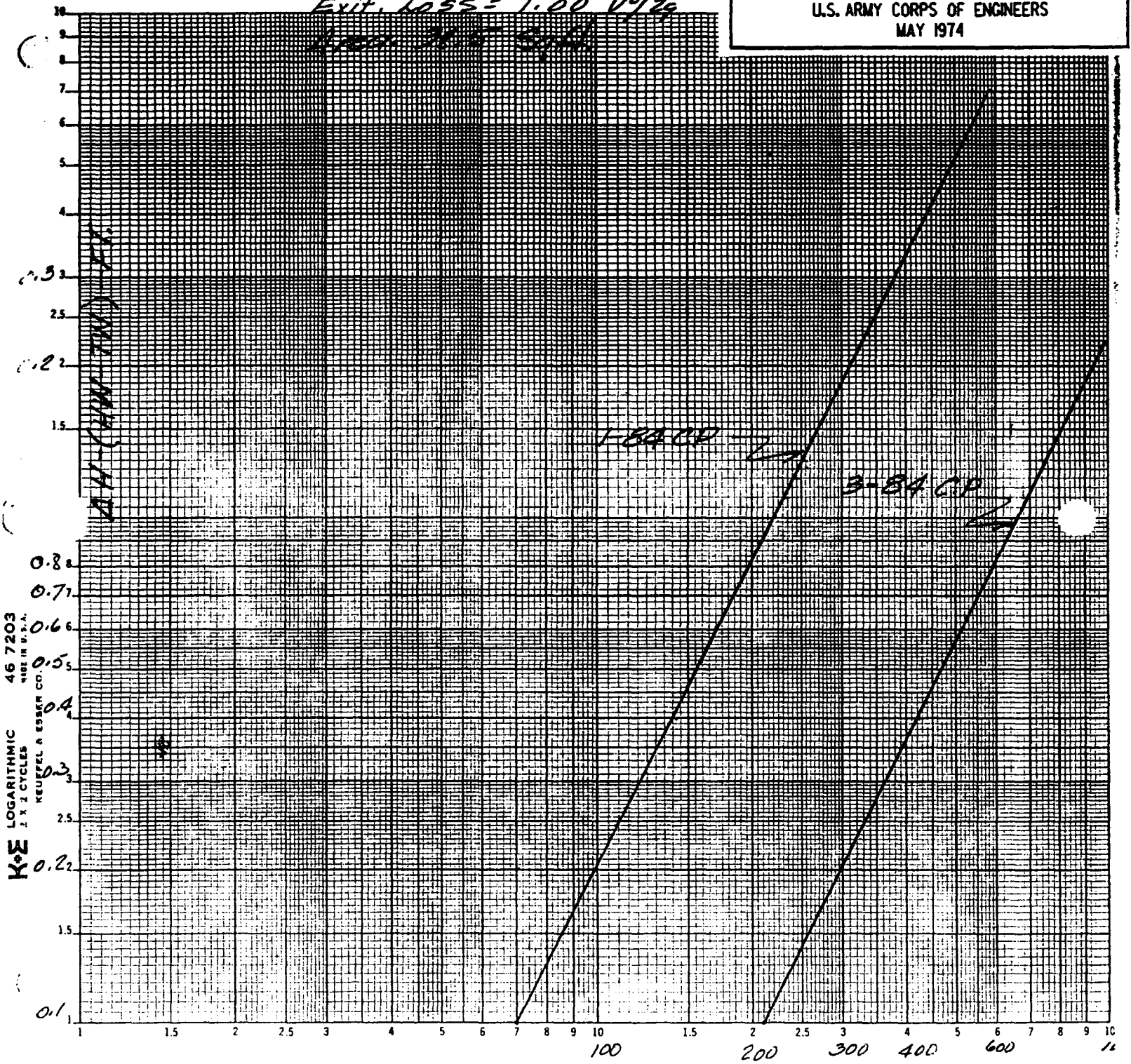
Location	L-31W
Design Conditions	
Discharge (cfs)	500
Type	controlled submerged
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	4.5
S.P.F. Condition	
Discharge (cfs)	500
Type	submerged
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	5.5
Optimum Conditions	
Headwater Elevation (ft.)	4.5
Minimum Water Surface Conditions	
Headwater Elevation (ft.)	2.0
Tailwater Elevation (ft.)	-1.0
Culvert	
Type	RCP
Number of Barrels	3
Size (dia., inches)	84
Net Length (ft.)	56
Invert Elevation (ft.)	-5.0
Gates	
Type of Control	manual sluice gate
Number	3
Size (dia., inches)	84

RATING CURVE CIV.
84" Conc. Pipe
L-66'
Invert Elev. -3.5
n = 0.012
Ent. Loss = 0.78 $V^2/2g$
Exit. Loss = 1.00 $V^2/2g$
Area 38.5 Sq.ft.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 175

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MAY 1974



S-175
RATING CURVE
1-84" C.P. & 3-84" C.P.
INVERT EL. -3.5

A-S175-4

STRUCTURE 176 (S-176)

Location. S-176 is located on Canal 111 about 5 miles west of Homestead, Florida.

Description. Structure 176 is a reinforced concrete, one bay, U-shaped spillway with automatically controlled vertical-lift gate and manually operated slide gates. The gate hydraulic operating system operates the gate according to headwater level criteria. The structure has an operating platform and a service bridge. S-176 has sheet-pile wingwalls protected by riprap on the side slopes of the canal.

Purpose. This structure, together with S-174, maintains a desirable water control stage upstream in L-31N borrow canal. It passes the design flood (40 percent of the SPF) without exceeding the upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels. During low-flow periods, S-176 can pass sufficient discharges to maintain stages downstream.

Regulation. S-176, together with S-174, is regulated according to an agreement between the U. S. Army Corps of Engineers, the Everglades National Park and the South Florida Water Management District. The agreement is part of the experimental water delivery program as authorized by PL 91-282.

The terms of this agreement require that the operation will be as follows:

Wet Season Criteria
S-176 will remain closed unless the headwater stage exceeds 5.0 ft.. Under normal conditions, S-176 will begin closing when the headwater stage drops to 4.85 ft., and be fully closed when the headwater stage drops to 4.75 ft.. During flood conditions, S-176 will begin closing when the headwater stage reaches 4.8 ft., and be fully closed when the headwater stage reaches 4.6 ft..

Normal Dry Season Criteria
Dry season criteria will go into effect following the cessation of wet season rainfall, and L-31W borrow canal stages have receded naturally to 3.5 ft. S-176 will normally remain closed. Supplemental water supply deliveries can be made to the Eastern Panhandle basin and Florida Bay, if adequate water is available. If S-176 headwater stage exceeds 5.0 ft., the structure will be operated according to the dry season flood control criteria.

Dry Season Flood Control Criteria
S-176 will remain closed unless the headwater stage exceeds 5.0 ft.. S-176 will begin closing when the headwater stage drops to 4.8 ft. and be fully closed when the headwater stage reaches 4.6 ft..

Transition from the Dry Season into the Wet Season
Beginning at 0800 on June 1st, the wet season operating criteria would go into effect.

Transition from the Wet Season into the Dry Season
The goal of the transition is to reach elevation 3.5 ft. on December 1st as measured at the S-175 HW.

S-176 shall normally remain closed. If the S-176 HW is greater than or equal to 5.0 ft., then S-176 shall be operated according to the dry season flood control criteria.

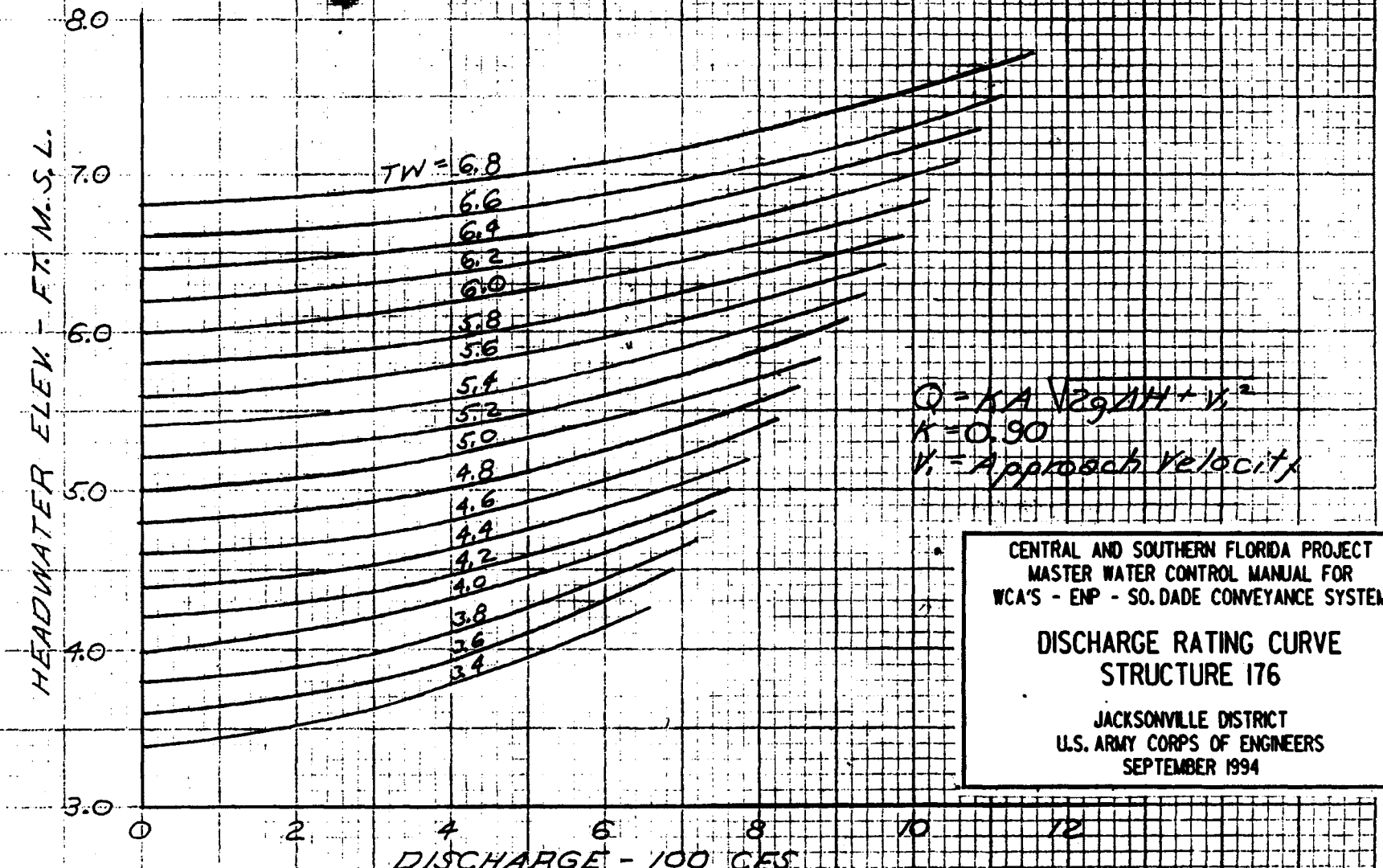
Low Flow Regulation. The main gate has two manual slide gates, over 1.5-foot-high, which provide overflow and water control above elevation 4.5 ft. to minimize vertical-lift gate movement.

Constraints: Design criteria for the structure require that the hydrostatic head not exceed 6.5 ft.

STRUCTURE 176 (S-176)

Summary of Hydraulic Design

Location	Canal 111
Design Conditions	
Discharge (cfs)	630
Type	Uncontrolled submerged
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	5.5
Maximum Head	6.5
S.P.F. Condition	
Discharge (cfs)	1,100
Type	Uncontrolled submerged
Headwater Elevation (ft.), est.	7.5
Tailwater Elevation (ft.), est.	6.3
Optimum Conditions	
Headwater Elevation (ft.)	5.5
Tailwater Elevation (ft.)	4.5
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	3.0
Tailwater Elevation (ft.)	2.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-1.0
Net Length (ft.)	20.0
Gates	
Number	1
Type of Control	Automatic vertical lift
Width x Height (ft.)	20.0 x 8.5
Elevation of low steel in fully open position	9.0
Top of gates in the closed position (ft.)	7.5
Overflow slot elevation (ft.)	5.5 to 7.0
Apron	
Elevation (ft.)	-2.0
Length (ft.)	20.0
End sill elevation (ft.)	-1.0
Service Bridge Elevation (ft.)	11.0
Operating Platform Elevation (ft.)	27.5
Dewatering Facilities	Yes



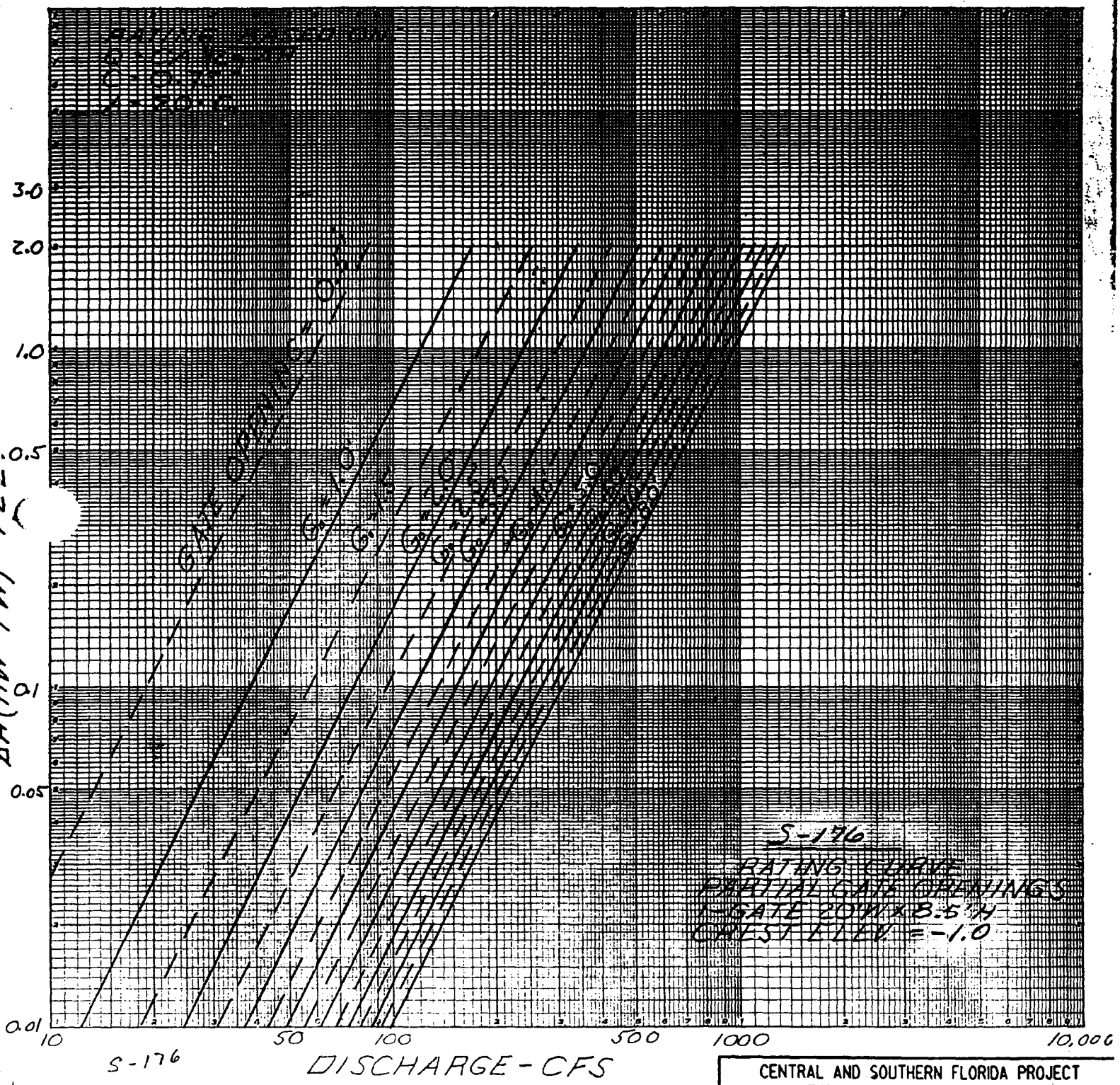
$Q = KA\sqrt{2g\Delta H + V_1^2}$
$K = 0.90$
V_1 = Approach velocity

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 176

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994

S-176
Rating Curve
1-Gate 20'W x 8.5'H
Crest El. = -1.0



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 176

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994

A-S176-5

STRUCTURE 177 (S-177)

Location. S-177 is located in Canal 111, 300 feet south of State Road 27.

Description. Structure 177 is a reinforced concrete, one bay, U-shaped spillway with an automatically controlled vertical-lift gate and auxiliary manually-operated slide gates. The gate hydraulic operating system operates the gate according to headwater level criteria. S-177 has an operating platform, a service bridge, and sheet-pile wingwalls protected by riprap on the side slopes of the canal. The structure has dewatering capabilities.

Purpose. This structure maintains optimum water levels upstream in Canal 111. It passes the design flood (40 percent of the SPF) without exceeding the upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels. During low-flow periods, S-177 can maintain desirable water control conditions upstream in Canal 111.

Regulation. S-177 is normally operated to maintain the optimum headwater elevation when sufficient water is available.

The gate hydraulic operating system operates the gate according to headwater level criteria. When the headwater elevation rises 4.2 ft. the gate will begin to open at six inches per minute; when the headwater elevation rises or fall to 3.9 ft. the gate will become stationary; and when the headwater elevation falls to 3.6 ft. the gate will begin to close at six inches per minute.

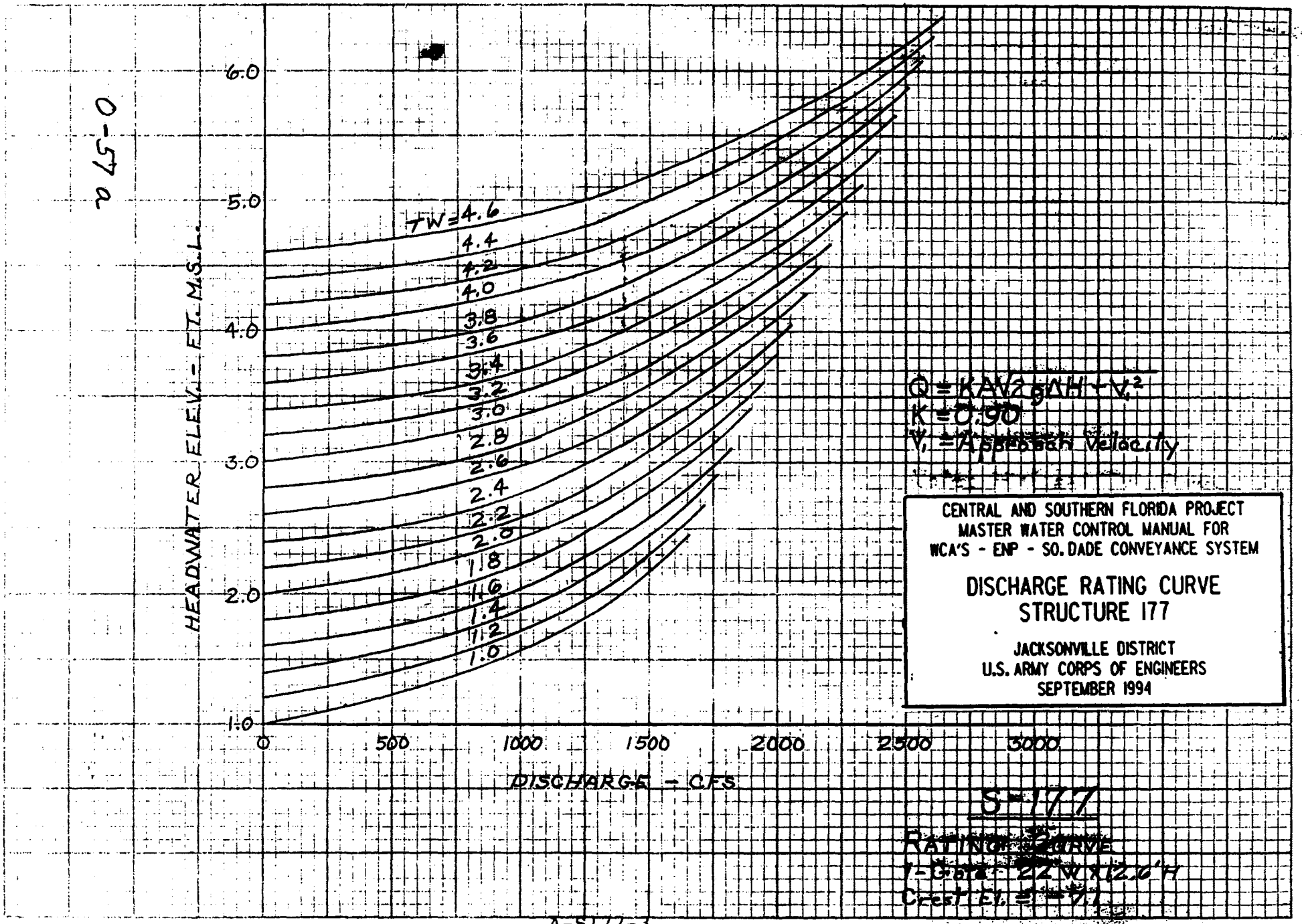
Flood Regulation. S-177 discharges the design flood (40 percent of the SPF) without exceeding the upstream flood design stage, and restricts downstream flood stages and discharge velocities to non-damaging levels.

Low Flow Regulation. During low-flow periods, S-177 can maintain desirable water control conditions upstream in Canal 111.

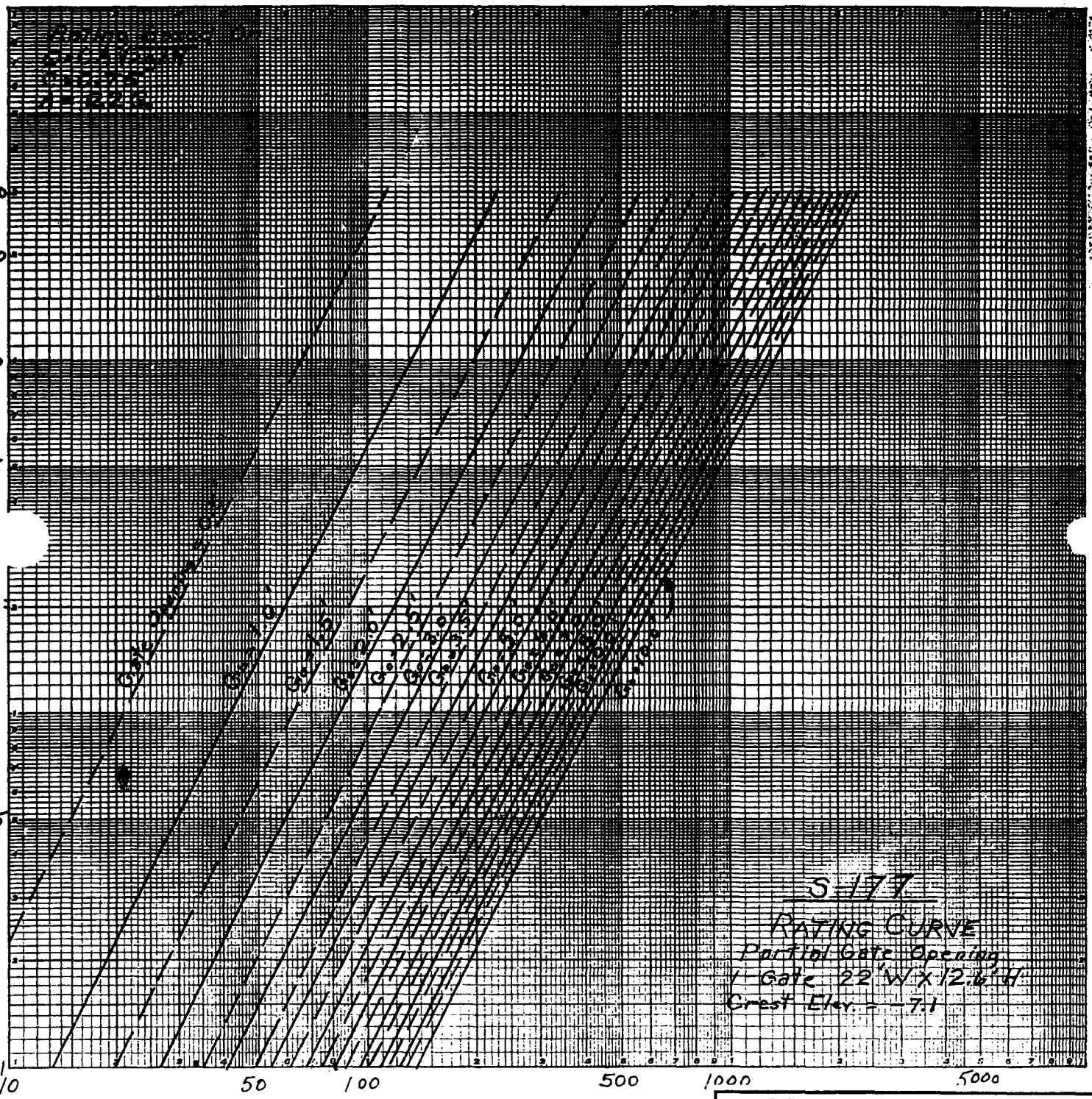
STRUCTURE 177 (S-177)

Summary of Hydraulic Design

Location	Canal 111
Design Conditions	
Discharge (cfs)	1,400
Type	uncontrolled submerged
Headwater Elevation (ft.)	4.3
Tailwater Elevation (ft.)	3.7
S.P.F. Condition	
Discharge (cfs)	2,900
Type	uncontrolled submerged
Headwater Elevation (ft.), est.	6.0
Tailwater Elevation (ft.), est.	4.3
Optimum Conditions	
Headwater Elevation (ft.)	4.5
Tailwater Elevation (ft.)	2.0
Crest	
Shape	trapezoidal
Elevation (ft.)	-7.1
Net Length	22.0
Gates	
Number	1
Type of Control	automatic vertical lift
Width x Height (ft.)	22.8 x 12.6
Clearance elevation	6.9
Top of gates in the closed position	5.5
Overflow slot elevation	3.5 to 5.0
Protection Elevation (ft.)	9.0
Apron	
Elevation (ft.)	-8.0
Length (ft.)	20.0
End sill elevation (ft.)	-7.0
Service Bridge Elevation (ft.)	9.0
Operating Platform Elevation (ft.)	29.0
Dewatering Facilities	Yes


HEADWATER ELEV. - FT. M.S.L.
6.0
5.0
4.0
3.0
2.0
1.0
0
500
1000
1500
2000
2500
3000
DISCHARGE - CFS
TW=4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
Q = KA√2gΔH - V₁²
K = 0.90
V₁ = Approach Velocity
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
STRUCTURE 177
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994
S-177
RATING CURVE
Gate - 22'W x 12.6'H
Crest El. = -7.1

0-57a



DISCHARGE, C.F.S.

0-57b

A-S177-4

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE S.

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 177

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994

STRUCTURE 178 (S-178)

Location. S-178 is located in Canal 111E, about 110 feet upstream of State Road 27.

Description. S-178 is a single barreled concrete box culvert with a reinforced concrete overflow intake box. The structure has two standard, manually operated slide gates which are mounted on the headwall. The operating platform is on the upstream end of the intake box.

Purpose. This structure maintains optimum water control stages upstream in Canal 111E, passes the design flood (40% of the SPF) without exceeding upstream flood design stages, and restricts downstream flood stages and channel velocities to non-damaging levels.

Normal Regulation. S-178 is operated to maintain an upstream water surface elevation of 4.5 feet.

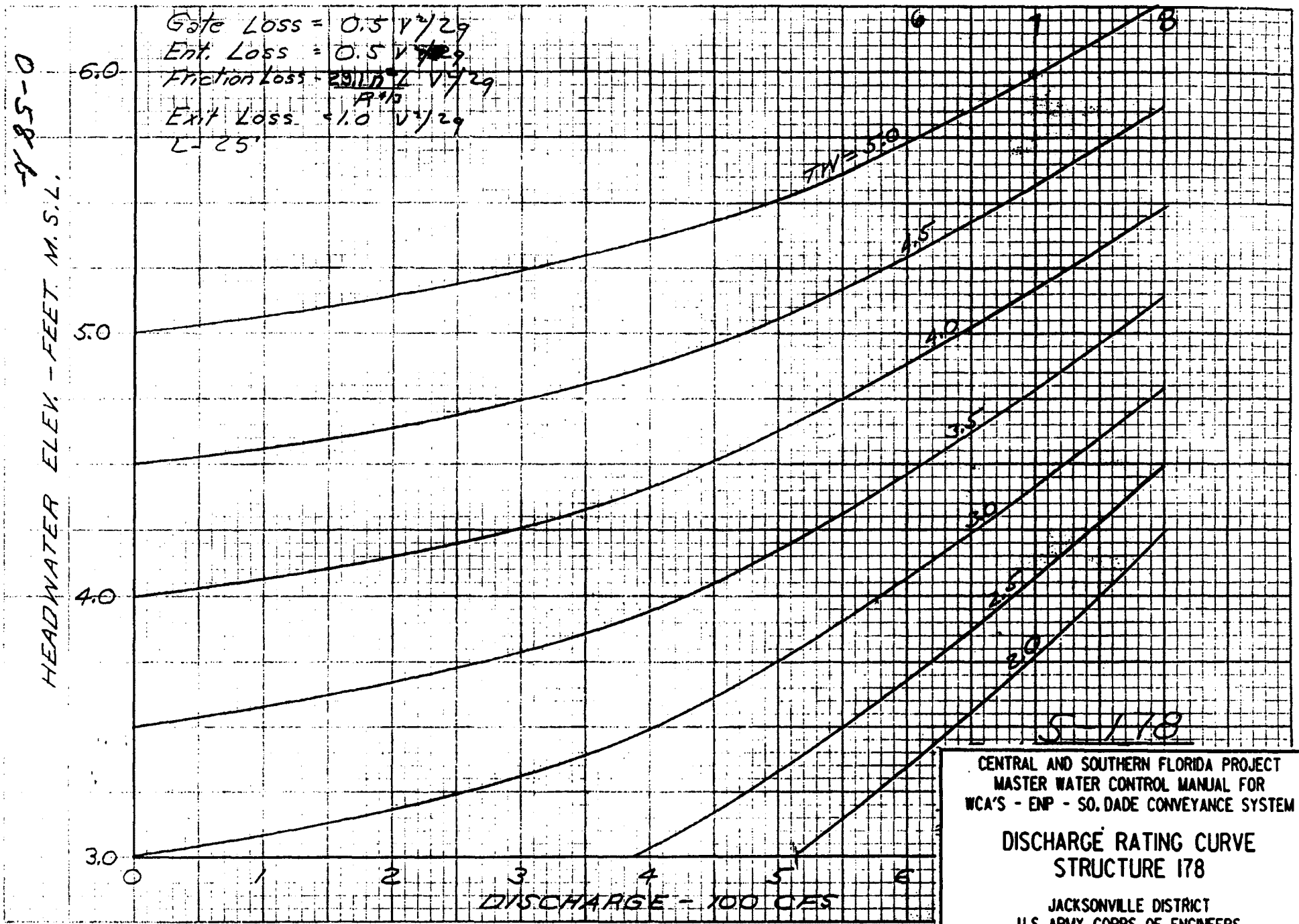
Flood Control Regulation. The gates should be manually operated to maintain an optimum headwater elevation of 4.5 feet and to continuously pass the design discharge of 510 cfs or up to the amount which will reach the structure.

Constraints. Headwater elevations above 5.0 feet will overflow the top of the structure uncontrolled.

STRUCTURE 178 (S-178)

Summary of Hydraulic Design

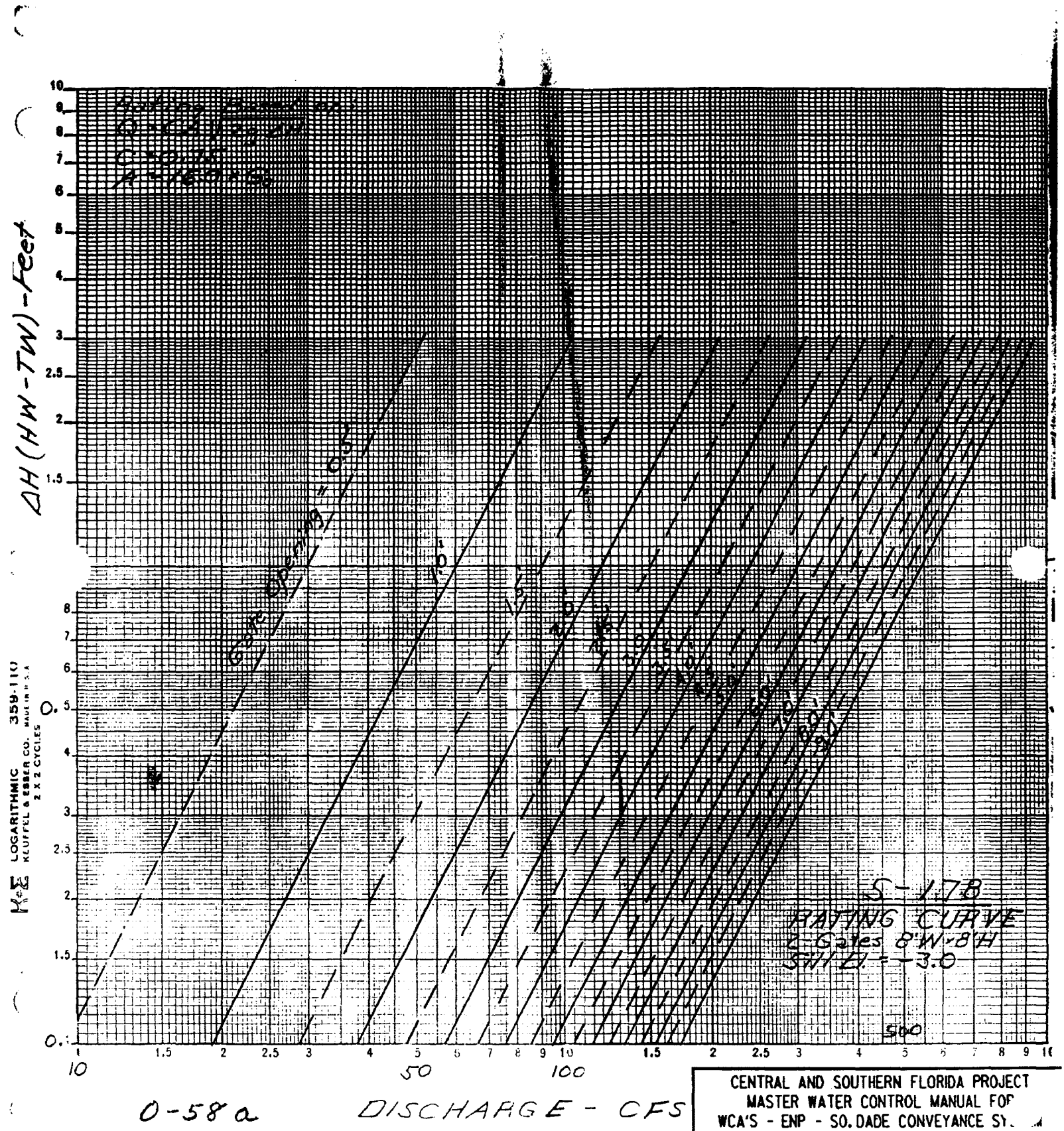
Location	C-111E
Design Conditions	
Discharge (cfs)	510
Type	controlled submerged
Headwater Elevation (ft.)	4.6
Tailwater Elevation (ft.)	3.9
S.P.F. Condition	
Discharge (cfs)	510
Headwater Elevation (ft.)	5.5
Tailwater Elevation (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	2.0
Minimum Water Surface Condition	
Headwater Elevation (ft.)	2.0
Tailwater Elevation (ft.)	1.0
Culvert	
Type	concrete box
Number of Barrels	1
Width x Height (ft.)	10.0 x 12.0
Net Length (ft.)	25
Invert Elevation (ft.)	-7.0
Gates	
Type of Control	manual sluice gates
Number	2
Width x Height (ft.)	8 x 8



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 178

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994



0-58a

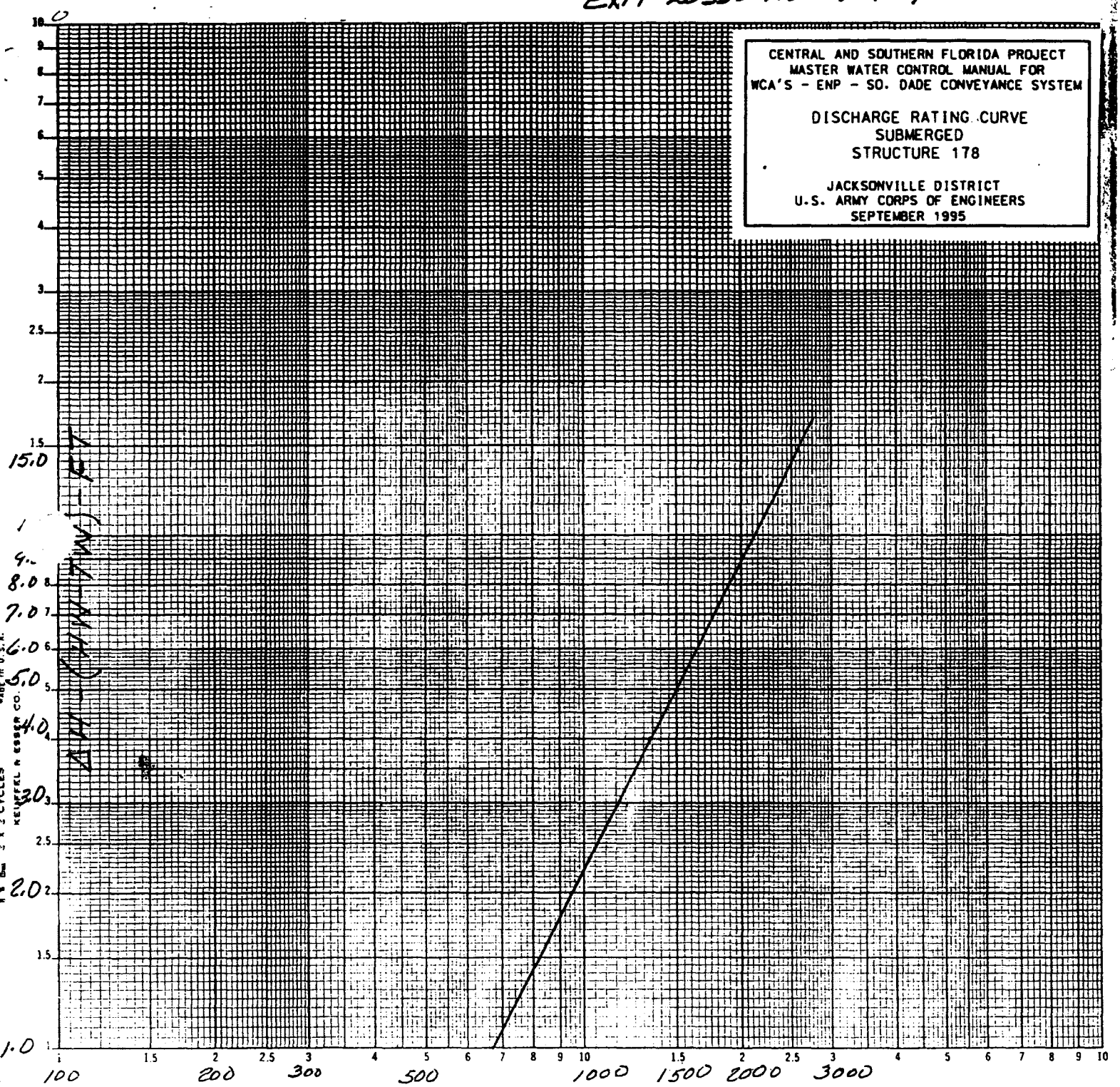
A-S178-4

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SY.

DISCHARGE RATING CURVE
PARTIAL GATE OPENING
STRUCTURE 178

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994

RATING CURVE ON
CONC. BOX. CULVERT 10'W x 12'H
L-25'
GATE LOSS = 0.5 $V^2/2g$
ENT. LOSS = 0.5 $V^2/2g$
Frict. LOSS = .02 $V^2/2g$
EXIT LOSS = 1.0 $V^2/2g$



S-178
RATING CURVE
CONC. BOX CULVERT 10W x 12H
INVERT EL. -7.0
SUBMERGED FLOW

A-S178-5

STRUCTURE 190 (S-190)

Location. S-190 is located in the L-28 Interceptor Canal about one-half mile south of the junction of the West and North Feeder Canals.

Description. Structure 190 is a reinforced concrete, U-shaped, gated, two -bay spillway with an ogee-weir with automatically controlled vertical-lift gates. The structure has an operating platform and a service bridge.

Purpose. This structure maintains optimum upstream water control stages in the North and West Feeder Canals and prevents overdrainage of these canals.

Regulation. This structure will be operated on either a low or a high setting, through automatic controls as follows:

During the normal condition, the low setting is used. When the headwater elevation rises to 14.8 ft., NGVD, the gates will open at six inches per minute but the maximum gate opening will be limited to the amounts shown on the "Limiting Gate Opening" curve. When the headwater elevation rises or falls to 14.5 ft., NGVD, the gates will become stationary. When the headwater elevation fall to 14.2 ft., NGVD, the gates will close at six inches per minute.

During the dry condition, the high setting is used. When the headwater elevation rises to 15.8 ft., NGVD, the gates will open at six inches per minute. When the headwater elevations rises or fall to 15.5 ft., NGVD, the gates will become stationary. When the headwater elevation fall to 15.2 ft., NGVD, the gates will close at six inches per minute.

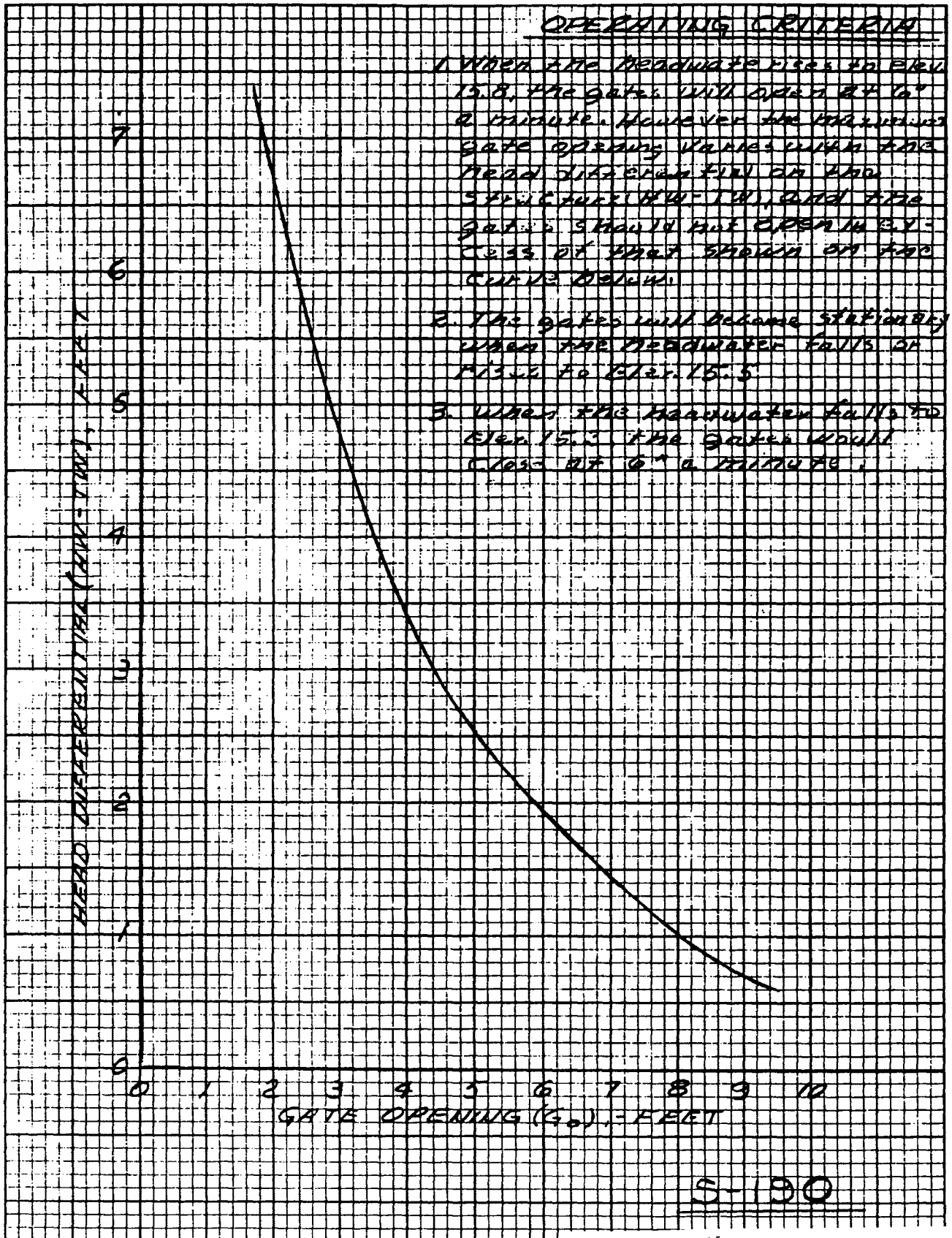
During low water periods, releases will be made to meet downstream irrigation requirements even though necessary releases will violate the optimum headwater criteria.

Constraints: To meet structural and stability requirements, the maximum allowable hydrostatic head on the structure should not be allowed to exceed 7.5 ft., NGVD, with a headwater elevation of 15.5 ft., NGVD, and a tailwater elevation of 8.0 ft., NGVD.

STRUCTURE 190 (S-190)

Summary of Hydraulic Design

Location	L-28
Design Conditions	
Discharge (cfs)	2,960
Type	Uncontrol submerged
Headwater Elevation (ft.)	16.6
Tailwater Elevation (ft.)	16.1
Optimum Conditions	
Headwater Elevation (ft.)	15.5
Tailwater Elevation (ft.)	10.0
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	8.0
Tailwater Elevation (ft.)	8.0
Crest	
Shape	Ogee
Elevation (ft.)	3.5
Net Length (ft.)	48.0
Gates	
Number	2
Type of Control	Automatic vert. lift
Width x Height (ft.)	24.0 x 12.0
Bottom Elevation, (ft.), fully open position	18.4
Top Elevation, (ft.), closed position	15.5
Clearance Elevation (ft.)	17.6
Protection Elevation (ft.)	20.4
Apron	
Elevation (ft.)	-0.1
Length (ft.)	30.0
End sill elevation (ft.)	1.0
Service Bridge Elevation (ft.)	20.5
Operating Platform Elevation (ft.)	20.5



S-190

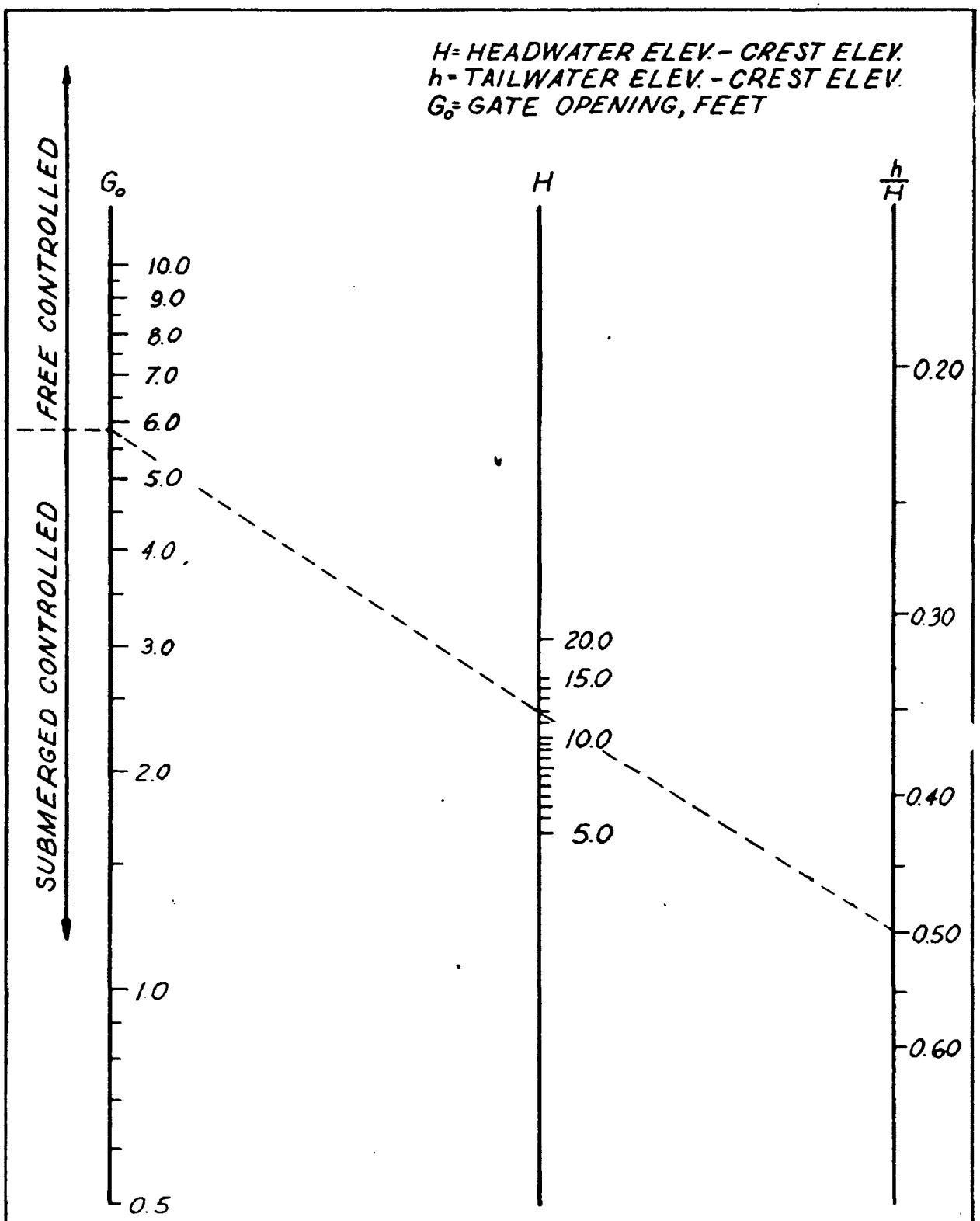
A-S190-3

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
LIMITING GATE OPENING
STRUCTURE 190

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1968

K+E 5 x 5 TO ½ INCH 46 0863
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.



EXAMPLE:
H= 12.0'
h= 6.0
h/H 0.5
$G_o > 5.8$ FREE CONTROLLED
$G_o < 5.8$ SUBMERGED CONTROLLED

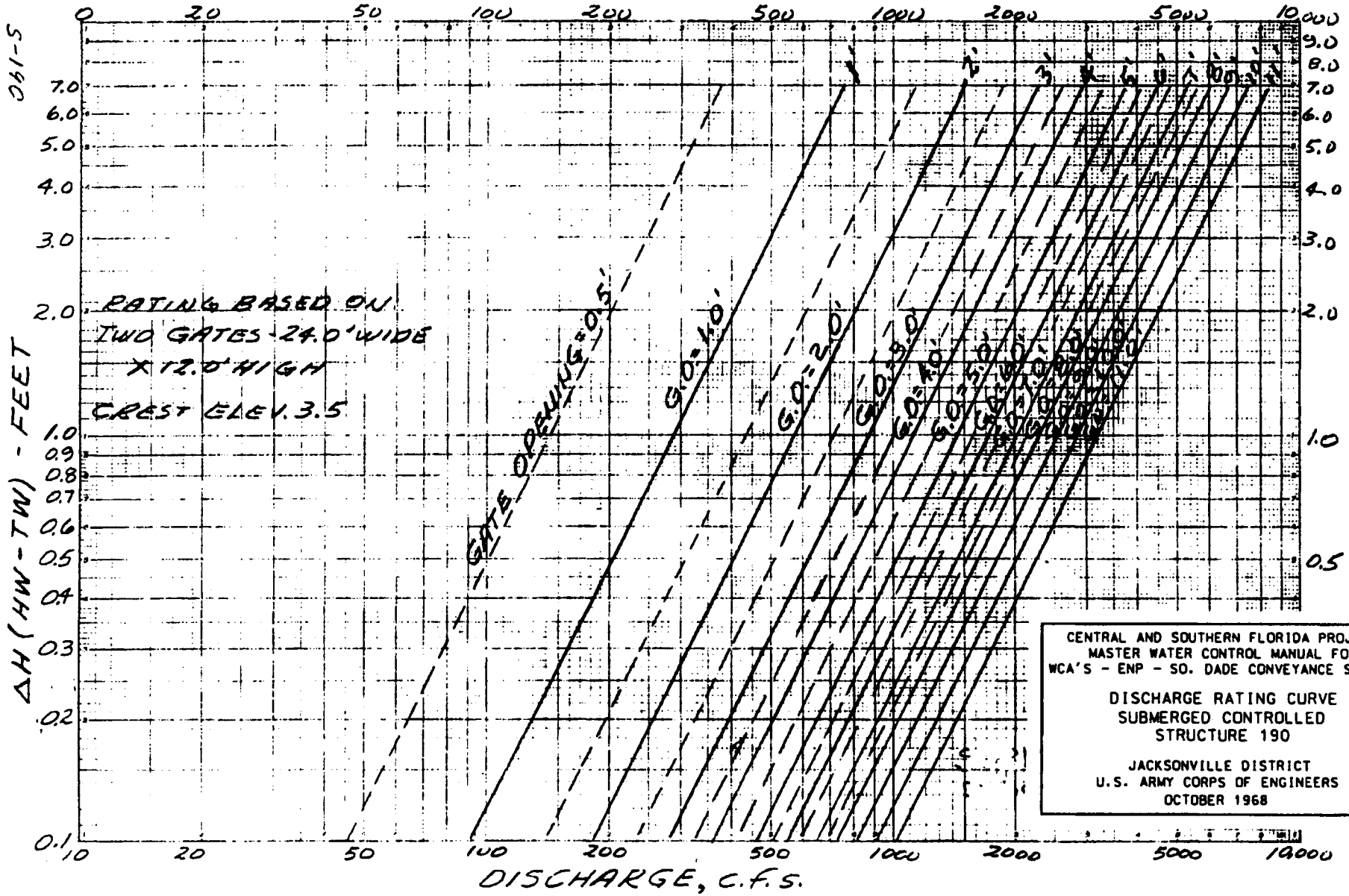
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

CONTROLLED FLOW NOMOGRAPH

STRUCTURE 190

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1968

S-190



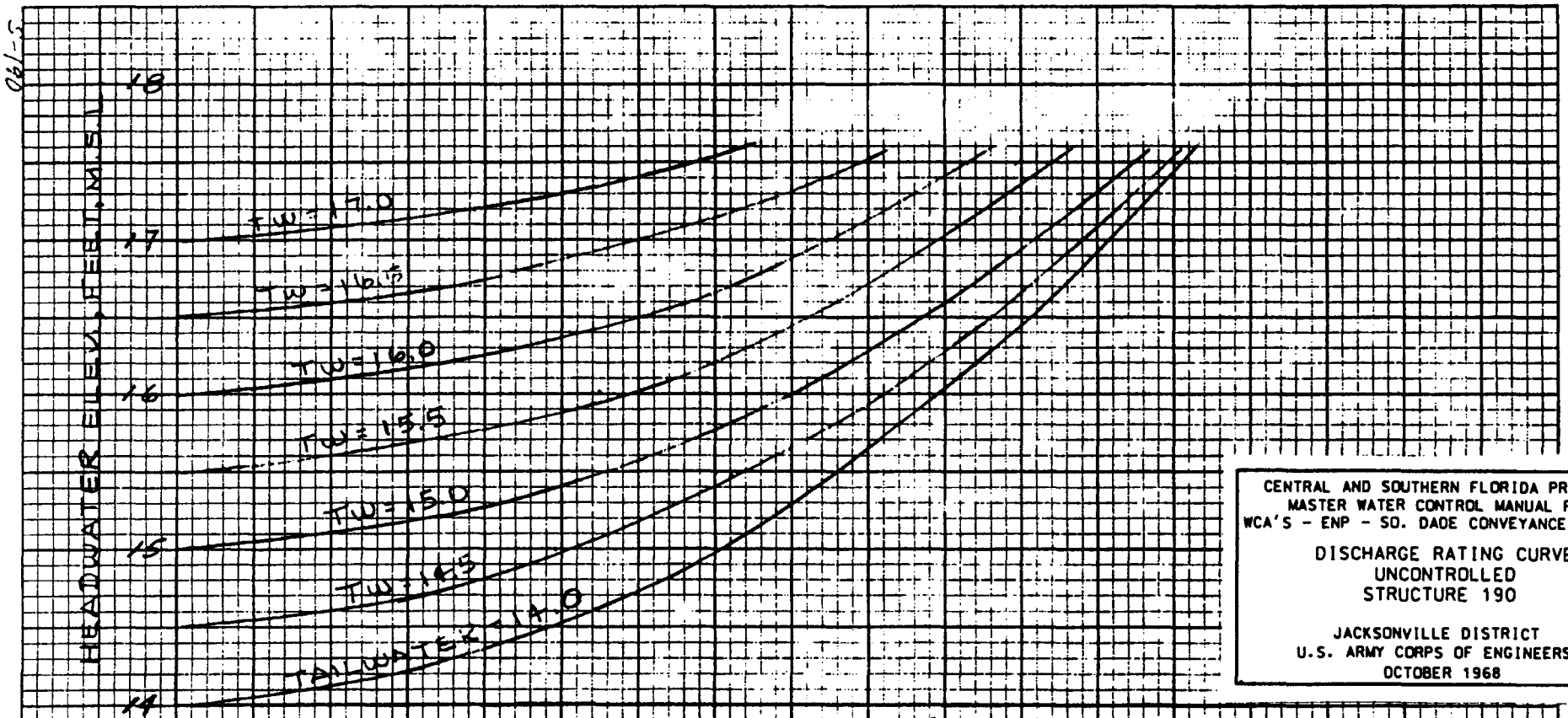
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE 190

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1968

A-S190-5

K+E 5 x 5 TO ½ INCH 46 0863
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
UNCONTROLLED
STRUCTURE 190

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
OCTOBER 1968

RATING BASED ON:
TWO GATES 24.0 WIDE X 12.0 HIGH
CREST ELEV. 3.5

S-190

UNCONTROLLED DISCHARGE
RATING CURVES

SAJWH OCT.68

STRUCTURE 194 (S-194)

Location. S-194 is located in Canal 102 at Krome Avenue, about 7 miles north of Homestead, Florida.

Description. S-194 is a double-barreled reinforced concrete pipe culvert with standard manual slide gates, a reinforced concrete intake headwall and an operating platform on the upstream side.

Purpose. S-194 acts as a drainage divide structure and a control structure for stages in C-102. It allows limited runoff to the east when capacity is available and provides a supplemental supply during dry periods.

Normal Regulation. S-194 is manually operated to supplement water to eastern Dade County from WCA No. 3 when the headwater stage at S-165 drops below 4.0 feet. The optimum headwater at S-194 is 6.5 feet and the optimum tailwater is 6.0 feet.

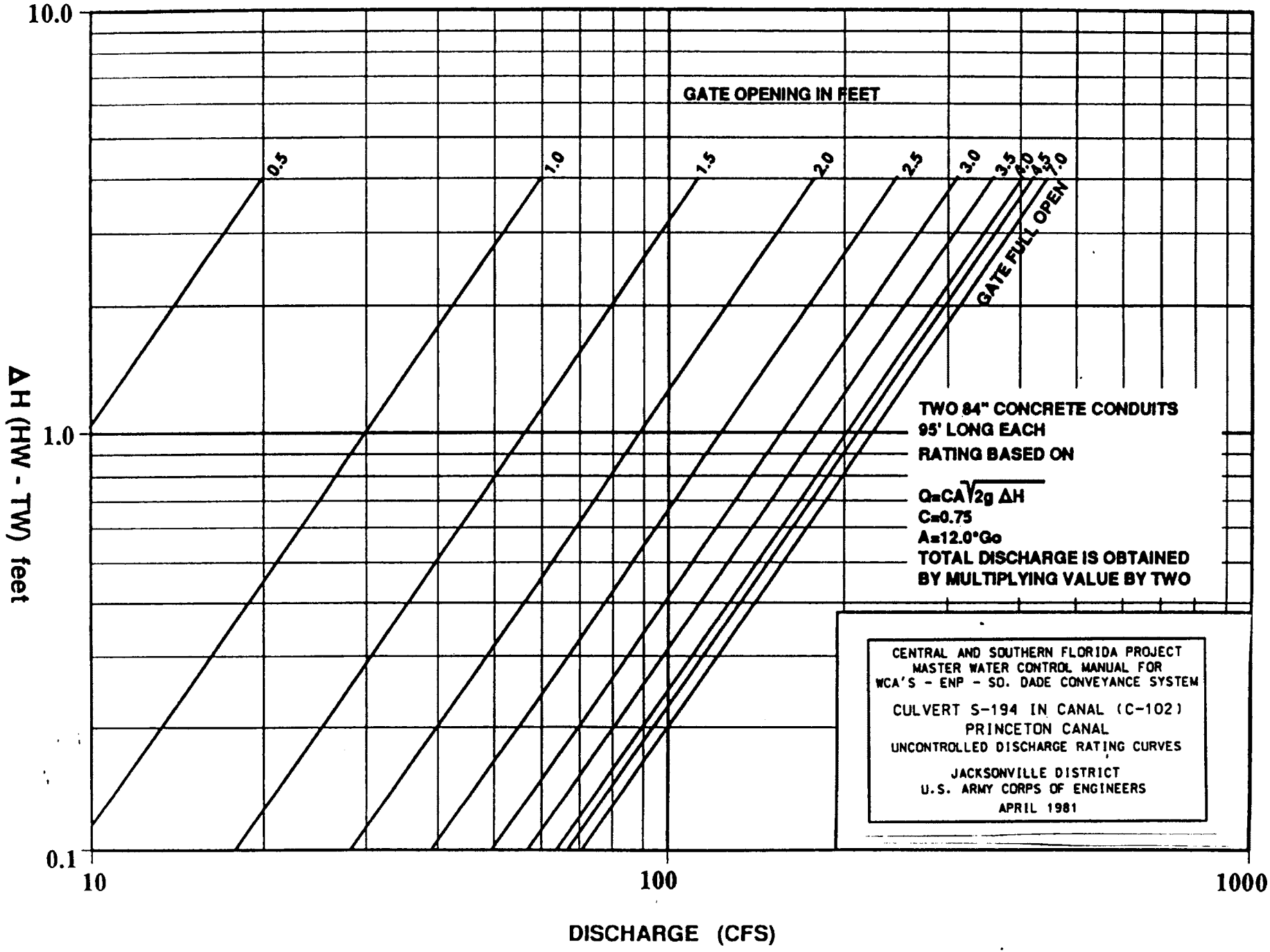
Flood Control Regulation. S-194 is used to pass flood waters to the west when flood conditions will not be created to the south and east in the C-102 basin. The discharge should be limited so as not to cause damaging velocities or stages downstream. The design headwater and tailwater is 6.5 ft. and 5.5 ft., respectively. The design discharge is 200 cfs.

Low Flow Regulation. During low flow conditions the design headwater is 3.9 feet, the design tailwater is 3.7 feet, and the design discharge is 190 cfs. To prevent saltwater intrusion, discharges should be made through S-194 for minimum releases at the eastward structures.

STRUCTURE 194 (S-194)

Summary of Hydraulic Design

Location	C-102
Design Conditions	
Discharge (cfs)	190
Type	Uncontrolled submerged
Headwater Elevation (ft.)	3.9
Tailwater Elevation (ft.)	3.7
Low-Flow Condition	
Discharge (cfs)	190
Headwater Elevation (ft.)	3.9
Tailwater Elevation (ft.)	3.7
S.P.F. Condition	
Discharge (cfs)	200
Headwater Elevation (ft.)	6.5
Tailwater Elevation (ft.)	5.5
Optimum Conditions	
Headwater Elevation (ft.)	5.5
Tailwater Elevation (ft.)	5.5
Culvert	
Type	RCP
Number of Barrels	2
Size (dia., in.)	84
Net Length (ft.)	190
Invert Elevation (ft.)	
Upstream	-2.5
Downstream	-3.5
Gates	
Type of Control	Manual slide gate
Number	2
Size (width x height, in.)	84 x 84


10.0
1.0
0.1
10
100
1000
ΔH (HW - TW) feet
DISCHARGE (CFS)
GATE OPENING IN FEET
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
7.0
GATE FULL OPEN
TWO 84" CONCRETE CONDUITS
95' LONG EACH
RATING BASED ON
Q=CA√2g ΔH
C=0.75
A=12.0*Go
TOTAL DISCHARGE IS OBTAINED
BY MULTIPLYING VALUE BY TWO
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
CULVERT S-194 IN CANAL (C-102)
PRINCETON CANAL
UNCONTROLLED DISCHARGE RATING CURVES
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
APRIL 1981

A-S194-3

STRUCTURE 196 (S-196)

Location. S-196 is located in C-103 about 350 feet upstream from Richards Roads.

Description. Structure 196 is a one-barrel, 84-inch concrete pipe culvert with a reinforced concrete headwall and an operating platform upstream. S-196 has a manually operated slide gate.

Purpose. S-196 is a drainage divide structure and a control for stages in western C-103. It allows limited runoff to the east when capacity is available. It also provides supplemental water supply when needed and when water is available.

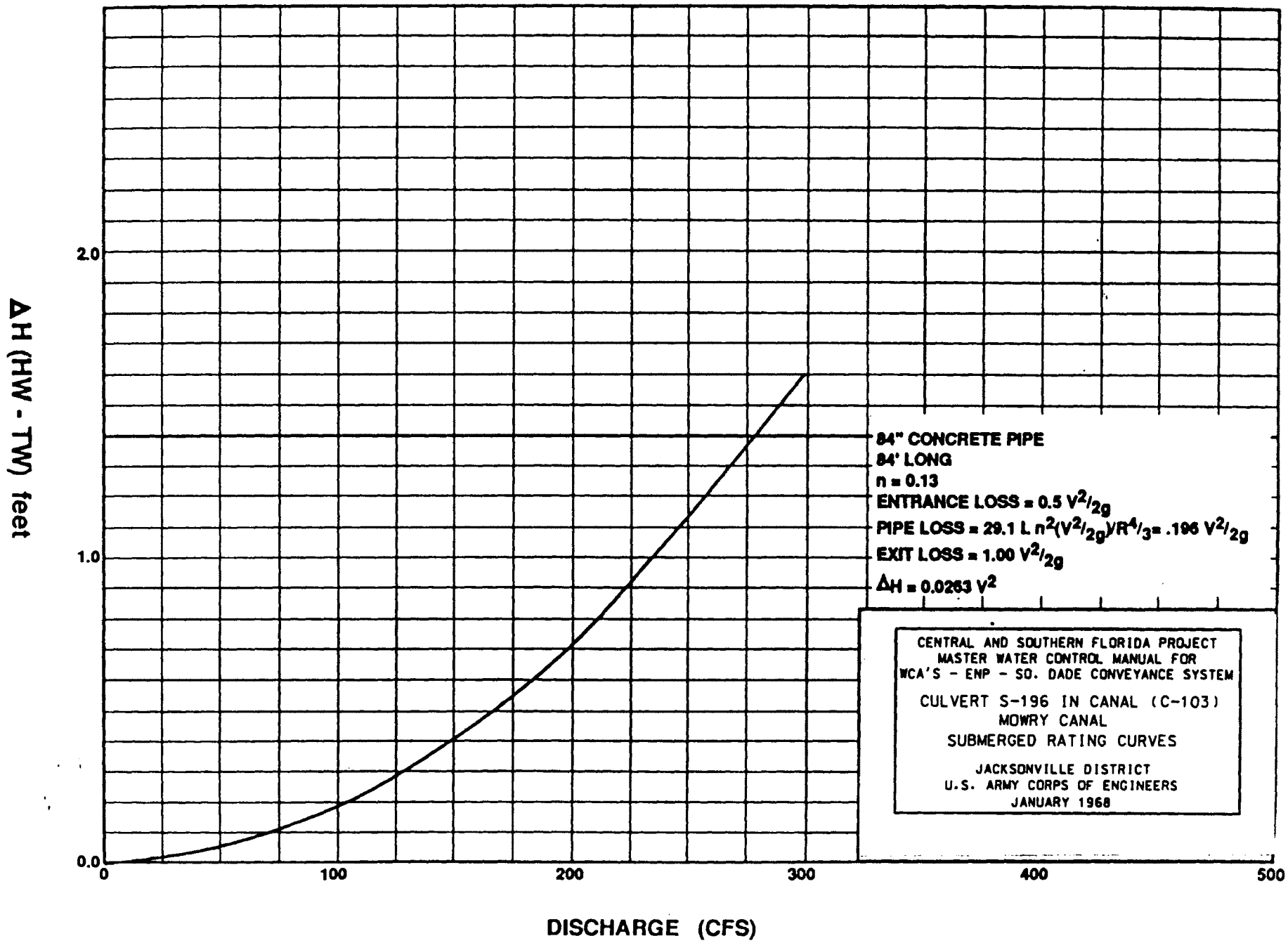
Normal Regulation. S-196 is manually operated to maintain an optimum headwater elevation of 5.5 feet and an optimum tailwater elevation of 5.5 feet.

Flood Control Regulation. S-196 should be manually operated to maintain a headwater elevation of 6.5 feet. The structure should continuously pass the design discharge (40% of the SPF), 200 cfs, or up to the amount that will reach the structure.

STRUCTURE 196 (S-196)

Summary of Hydraulic Design

Location	C-103
Design Conditions	
Discharge (cfs)	200
Type	Uncontrolled submerged
Headwater Elevation (ft.)	6.5
Tailwater Elevation (ft.)	5.5
Optimum Conditions	
Headwater Elevation (ft.)	5.5
Tailwater Elevation (ft.)	5.5
Culvert	
Type	Concrete pipe
Number of Barrels	1
Size (inches)	84
Net Length (ft.)	58
Invert Elevation (ft.)	
Upstream	-2.5
Downstream	-3.5
Gates	
Type of Control	Manual slide gate
Number	1
Size (inches)	84 x 84
Canal Section	
Upstream Bottom Width (ft.)	10.0
Upstream Bottom Elevation (ft.)	-3.5
Downstream Bottom Width (ft.)	10.0
Downstream Bottom Elevation (ft.)	-5.0
Side Slopes (vert. on hor.)	1 on 1
Operating Platform Elevation (ft.)	15.5
Dewatering Capabilities	No


ΔH (HW - TW) feet
2.0
1.0
0.0
0
100
200
300
400
500
DISCHARGE (CFS)
84" CONCRETE PIPE
84' LONG
n = 0.13
ENTRANCE LOSS = 0.5 V²/2g
PIPE LOSS = 29.1 L n²(V²/2g)/R^4/3 = .196 V²/2g
EXIT LOSS = 1.00 V²/2g
ΔH = 0.0263 V²
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
CULVERT S-196 IN CANAL (C-103)
MOWRY CANAL
SUBMERGED RATING CURVES
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 1968

A-S196-3

STRUCTURE 197 (S-197)

Location. S-197 is located in Canal 111 near the mouth of the canal. The structure is about 3 miles from Manatee Bay and 750 feet east of U.S. Highway 1.

Description. Structure 197 was originally built as a gated, three barrel, 84-inch, corrugated metal pipe culvert with an invert elevation of minus 8.0 feet. It originally had three manually operated slide gates attached to the upstream ends of the pipes. In 1990, ten additional culverts were built with two metal slide gates at the face of each riser. The gates can be operated from the timber operating platform.

Purpose. S-197 maintains optimum water control stages in Canal 111 and prevents saltwater intrusion during high tides.

Normal Regulation. Normally S-197 is closed and diverts discharge from S-18C overland to the panhandle of the Everglades National Park.

Flood Control Regulation. During flood conditions, S-197 should be operated as shown below.

Open Culverts: Opening of S-197 culverts should begin when water levels exceed specified levels at the referenced structure:

1) S-177 HW > 4.10 feet after gates have been opened full* or S-18C HW > 2.8 feet; open 3 culverts

2) S-177 HW > 4.2 feet for 24 hours or S-18C > 3.10 feet; open 7 culverts

3) S-177 HW > 4.3 feet or S-18C HW > 3.3 feet; open 13 culverts

* Due to discharge capacity of S-177, headwater stages upstream of the structure may decline abruptly once the structure is opened. Culverts at S-197 will remain closed until S-177 has been completely opened. This lag time will allow the canal levels to equalize and provide an opportunity for flood waters to first discharge through the C-111 gaps. After S-177 gates have been fully opened and canal stage level continues to exceed the flood control criteria, culverts at S-197 will be opened according to the criteria above.

Close Culverts: Closing of the culverts at S-197 should begin after the following conditions have been met:

1. When headwater canal stage (stage upstream of the structure) at S-176 has declined below 5.2 feet, NGVD and

headwater stage at S-177 has declined below 4.2 feet, NGVD. Stage levels above 5.2 feet and 4.2 feet, respectively, at these structures trigger mandatory flood control releases. A declining trend in water levels below this stage would indicate the peak of the storm event has passed.

2. Position of the 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 the S-177 headwater stage declines below 4.1 feet, NGVD and the above conditions are satisfied.

Constraints. Due to structural and stability requirements, the hydrostatic head should not exceed 0.8 feet with a headwater of 1.4 feet and a tailwater of 0.6 feet. The water level which will by-pass the structure is 5 feet.

STRUCTURE 197 (S-197)

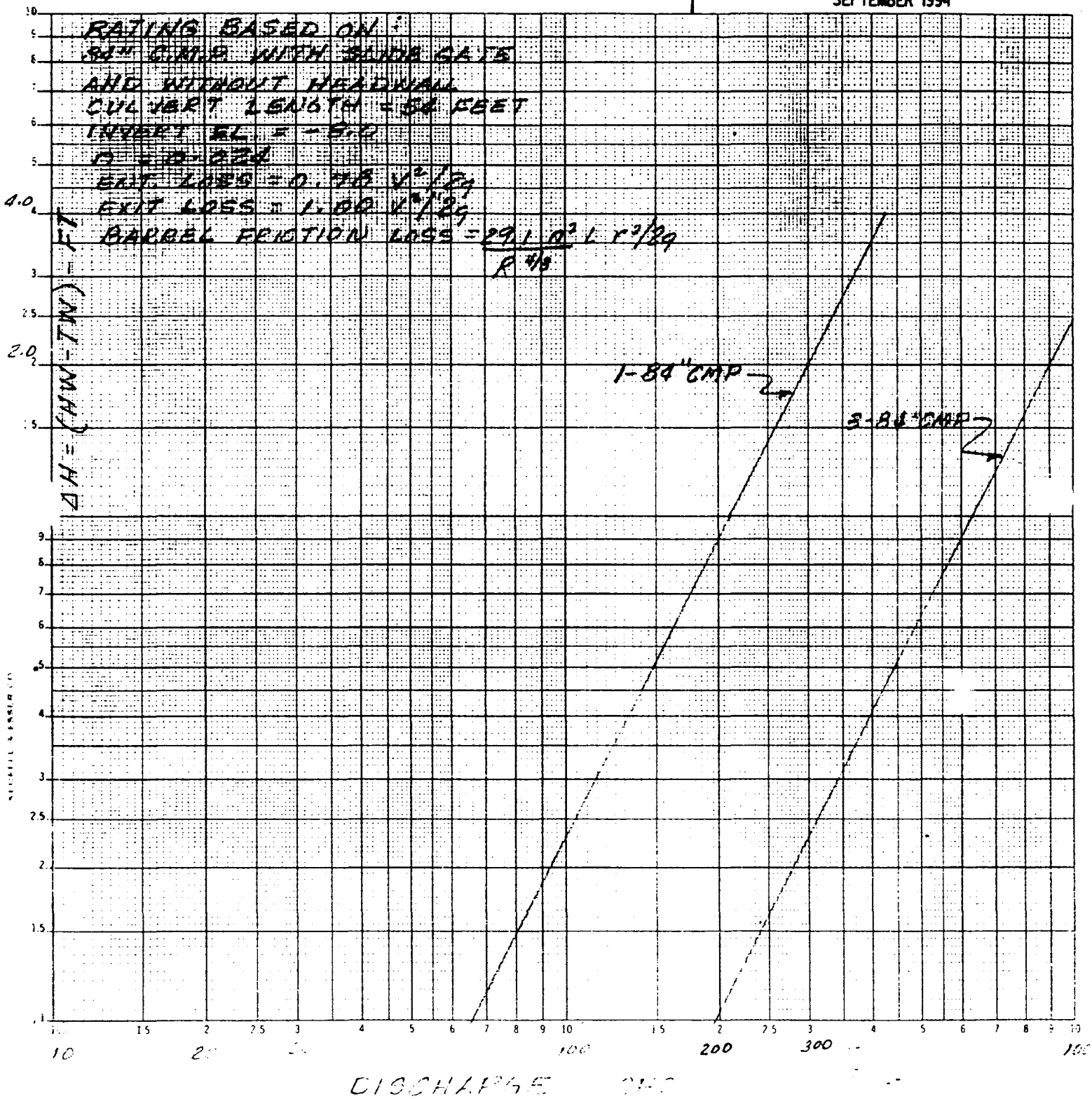
Summary of Hydraulic Design

Location	C-111
Design Conditions	
Discharge (cfs)	2400
Type	Uncontrolled submerged
Headwater Elevation (ft.)	1.4
Tailwater Elevation (ft.)	0.6
Culvert	
Type	CMP
Number of Barrels	13
Size (inches)	84
Net Length (ft.)	66
Invert Elevation (ft.)	-8.0
Gates (Original)	
Type of Control	Manual sluice gate
Number	3
Width x Height (inches)	84x84
Gates (Additional)	
Type of Control	Manual sluice gate
Number	20
Width x Height (feet)	4 X 12

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 197

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994



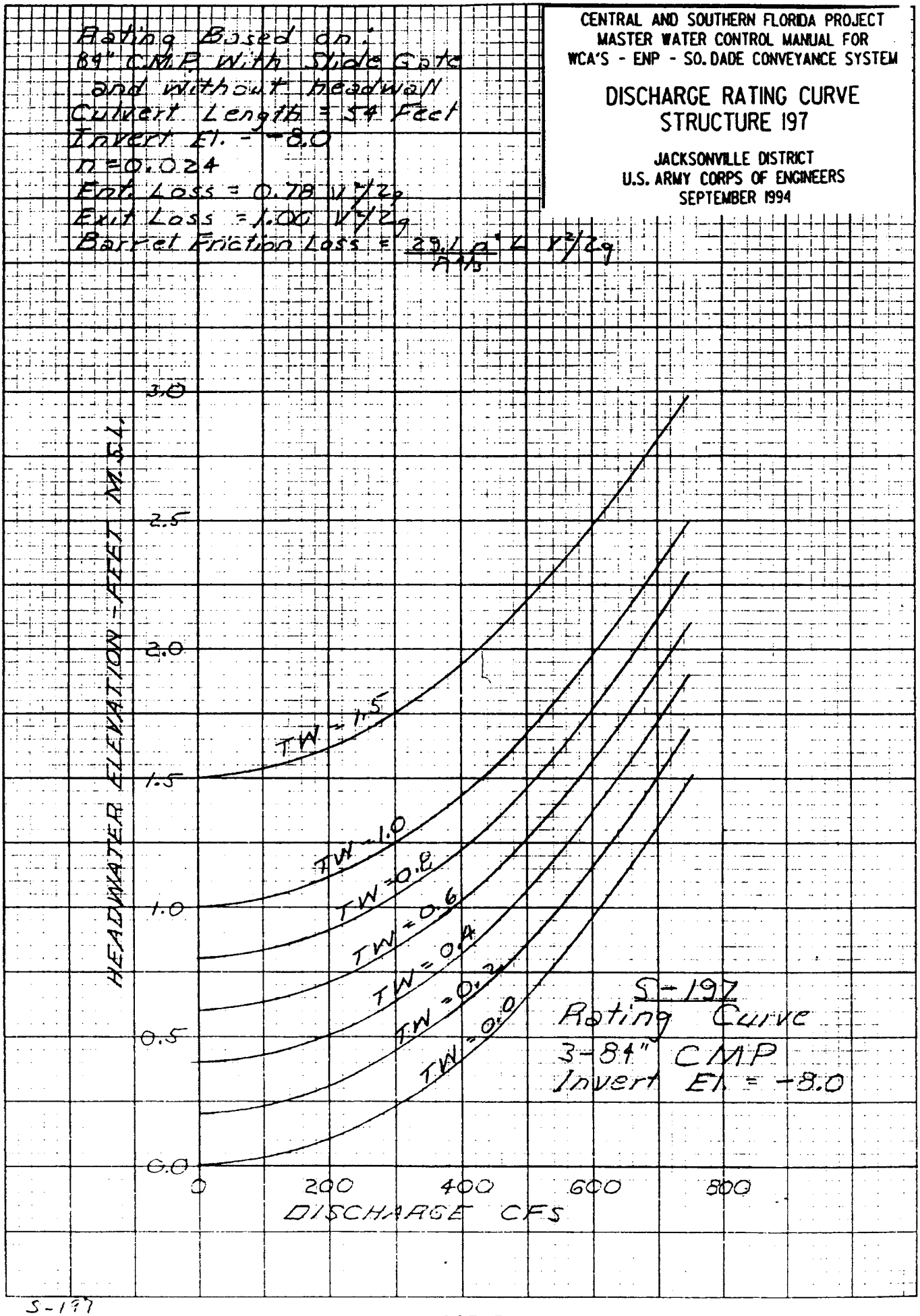
2-197

RATING CURVES
1-84" CMP & 3-84" CMP

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 197

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1994



S-197

STRUCTURE 199 (S-199)

Note: This is an inoperative spillway and included for informational purposes only. It is also included in Volume 5, East Coast Canals Water Control Manual.

Location. S-199 is located about 9 miles south of Homestead, Florida at Canal 110.

Description. Control structure S-199 is a one bay, U-shaped spillway, with a trapezoidal weir and an automatically controlled vertical lift gate. The structure also has a service bridge, steel-sheet-pile wingwalls, and a concrete block control house. Riprap is provided upstream and downstream to protect against erosion.

Purpose. S-199 would have maintained optimum water control stages in C-110 and passed up to 1100 cfs during flood conditions. S-199 would also have provided the necessary salinity control to prevent salt water intrusion along the canal.

Normal Regulation. None.

Flood Control Regulation. None.

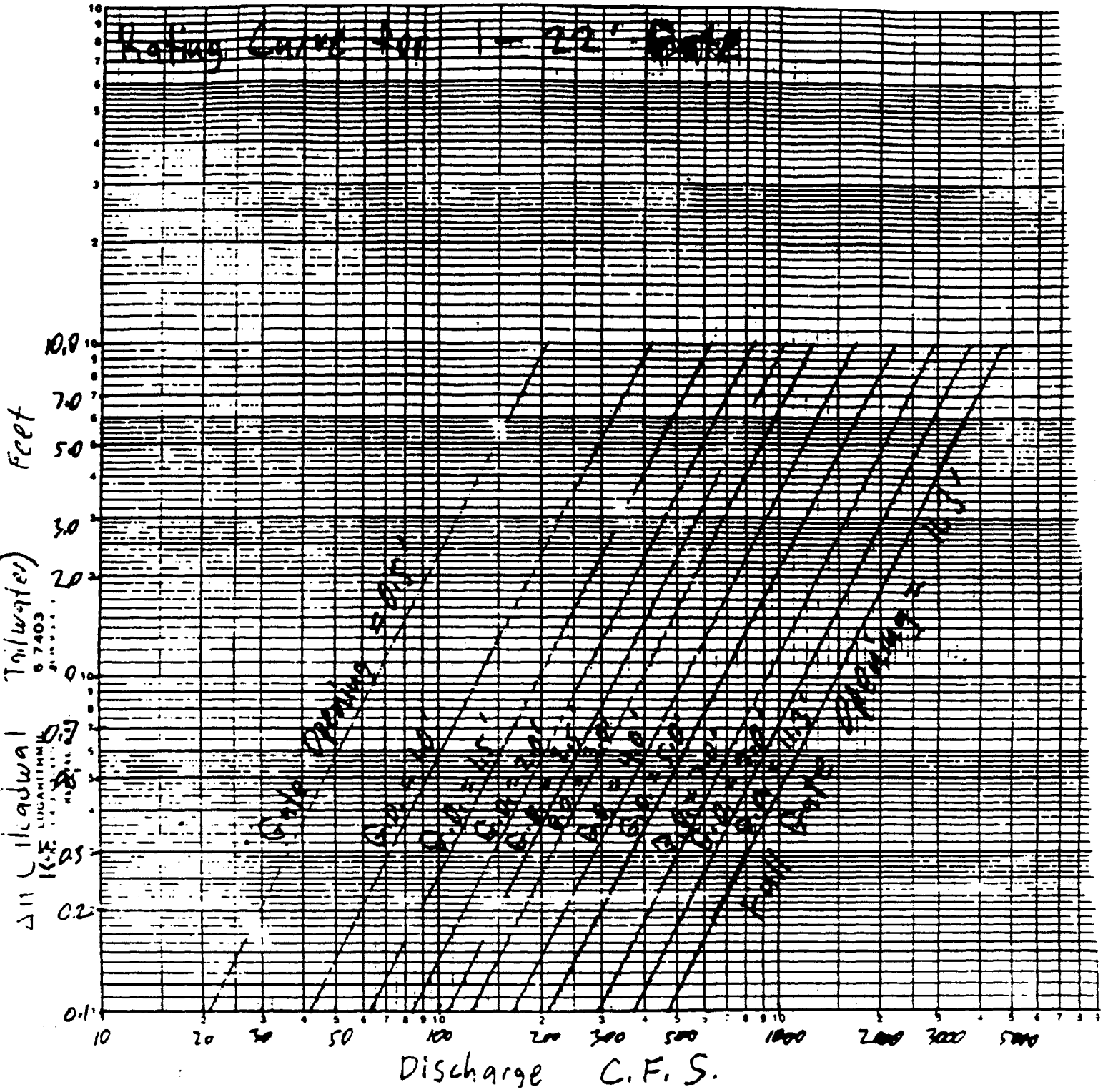
Note: Construction of C-110 was completed south of S-199 with the exception of a 50 ft. plug immediately north of the junction with C-111. No canal excavation was done from S-199 north to 424th Street.

STRUCTURE 199 (S-199)

Summary of Hydraulic Design

Location	C-110
Design Conditions	
Discharge (cfs)	690
Headwater Elevation (ft.)	2.8
Tailwater Elevation (ft.)	2.6
Maximum Head	3.9
S.P.F. Condition	
Discharge (cfs)	1100
Headwater Elevation (ft.)	3.9
Tailwater Elevation (ft.)	3.5
Optimum Conditions	
Headwater Elevation (ft.)	1.7
Tailwater Elevation (ft.)	0.9
Hurricane Conditions	
Maximum Tide Elevation (ft.), est.	7.0
Maximum Reverse Head	4.2
Minimum Water Surface Condition, estimated	
Headwater Elevation (ft.)	1.0
Tailwater Elevation (ft.)	-2.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-7.3
Net Length (ft.)	22.0
Gates	
Type of Gate	Vertical lift with slide gates
Number	1
Width x Height (ft.)	22.0 x 11.3
Clearance Elevation (ft.)	4.9
Overflow Slot Elevation (ft.)	1.0 - 2.5

S-199



Submerged Controlled

A-S199-3

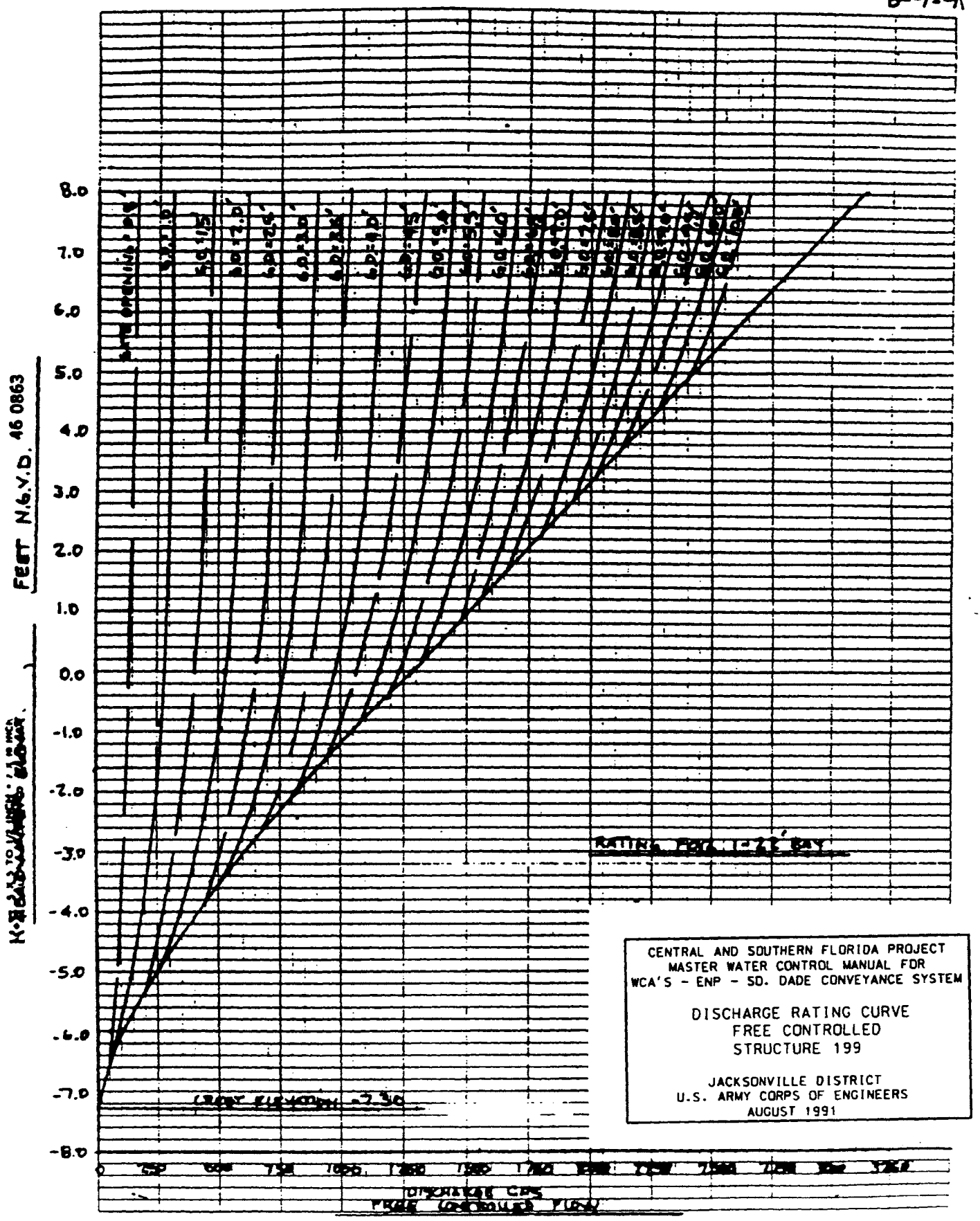
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED
STRUCTURE 199

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JULY 1991

S-199

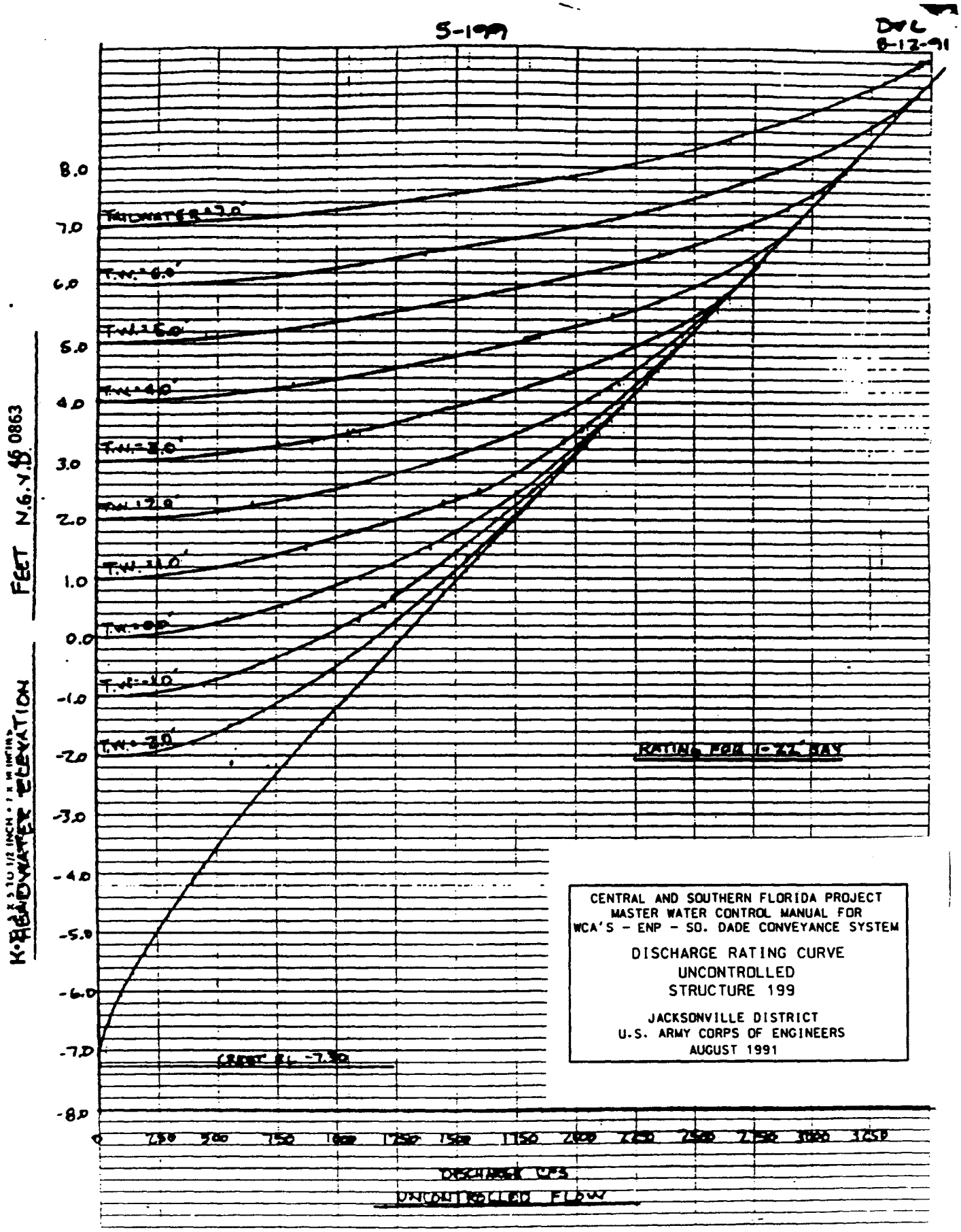
8-9-91



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SD. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
FREE CONTROLLED
STRUCTURE 199

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1991


S-199
DWL
8-12-91
HEADWATER ELEVATION FEET N.G.V.D. 1929
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
T.W.=7.0'
T.W.=6.0'
T.W.=5.0'
T.W.=4.0'
T.W.=3.0'
T.W.=2.0'
T.W.=1.0'
T.W.=0.0'
T.W.=-1.0'
T.W.=-2.0'
RATING FOR 10-22-MAY
CREST EL -7.30
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
DISCHARGE CFS
UNCONTROLLED FLOW
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
DISCHARGE RATING CURVE
UNCONTROLLED
STRUCTURE 199
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1991

STRUCTURE 331 (S-331)

Location. Structure 331 is located in the L-31N borrow canal about 9 miles north of Homestead, Florida.

Description. S-331, a three unit pumping plant with an adjacent CMP gated culvert (S-173). Each unit rates 387 cfs for a 3.0 foot static head and is driven by a 250 horsepower diesel engine.

Purpose. This structure's original purpose was to function as a component of the South Dade Conveyance System to deliver supplementary water supply to South Dade County and to provide a continuous supply to the Everglades National Park at Taylor Slough and the Panhandle. This purpose was augmented by an Agreement dated July 11, 1985. With the new agreement, S-331 serves to control the level in L-31N north of S-331 as a function of the water levels in the Rocky Glades residential area.

Normal Regulation. The discharge of S-331 is accomplished by syphoning through the pumps by using the adjacent culvert (S-173), or by pumping. In the water supply mode, discharge through the structure is performed when the stage at any downstream, inland structure drops more than 1.5 ft. below optimum. Optimum and critical levels of these structures are as follows:

CANAL	STRUCTURE	OPTIMUM STAGE (ft.)	CRITICAL STAGE (ft.)
L-31(N)	S-174/176	5.5	4.0
C-111	S-177	4.5	3.0
L-31(W)	S-332	4.5	3.0
	S-175	4.5	3.0
C-103	S-196	5.5	4.0
	S-167	5.5	4.0
	S-179	3.5	2.0
C-102	S-194	5.5	4.0
	S-165	5.5	4.0

Flood Regulation. S-331 is regulated according to an agreement between the U. S. Army Corps of Engineers, the Everglades National Park and the South Florida Water Management District.

The agreement is part of the experimental water delivery program as authorized by PL 91-282. S-331 discharges in response to the stage at a groundwater monitoring well known as Angel. If the stage at Angel is below 6.0 feet, discharge through S-331 should maintain an average headwater stage of 5.0 feet. If the stage at Angel's well exceeds 6.0 feet, S-331's discharge should maintain an average headwater stage of 4.5 feet until Angel drops to 5.7 feet, whereupon the headwater at S-331 may be allowed to rise to 5.0 feet. During any of these operations, the discharge from S-331 will be limited so as not to cause downstream structures to exceed their design stages as follows:

CANAL	STRUCTURE	HEADWATER DESIGN STAGE (FT.)
L-31(N)	S-174	6.0
	S-176	6.0
C-111	S-177	4.3
	S-18C	3.3
L-31(W)	S-175	5.0

<u>L-31(N) borrow canal north of S-331</u>
If the level at Angel's well is between 5.5 and 6.0 feet, the average daily water level upstream of S-331 should be maintained at or below 5.0 feet, if permitted by downstream conditions. If the level at Angel's well is above 6.0 feet, the average daily water level upstream of S-331 should be maintained at or below 4.5 feet, until the water level at Angel's well recedes below 5.7 feet, if permitted by downstream conditions.

<u>L-31(N) borrow canal south of S-331</u>
Between June 1 and October 31, the L-31(N) canal between S-331 and S-176 will be managed to maintain a daily average stage of approximately 4.3 feet, upstream of S-176.

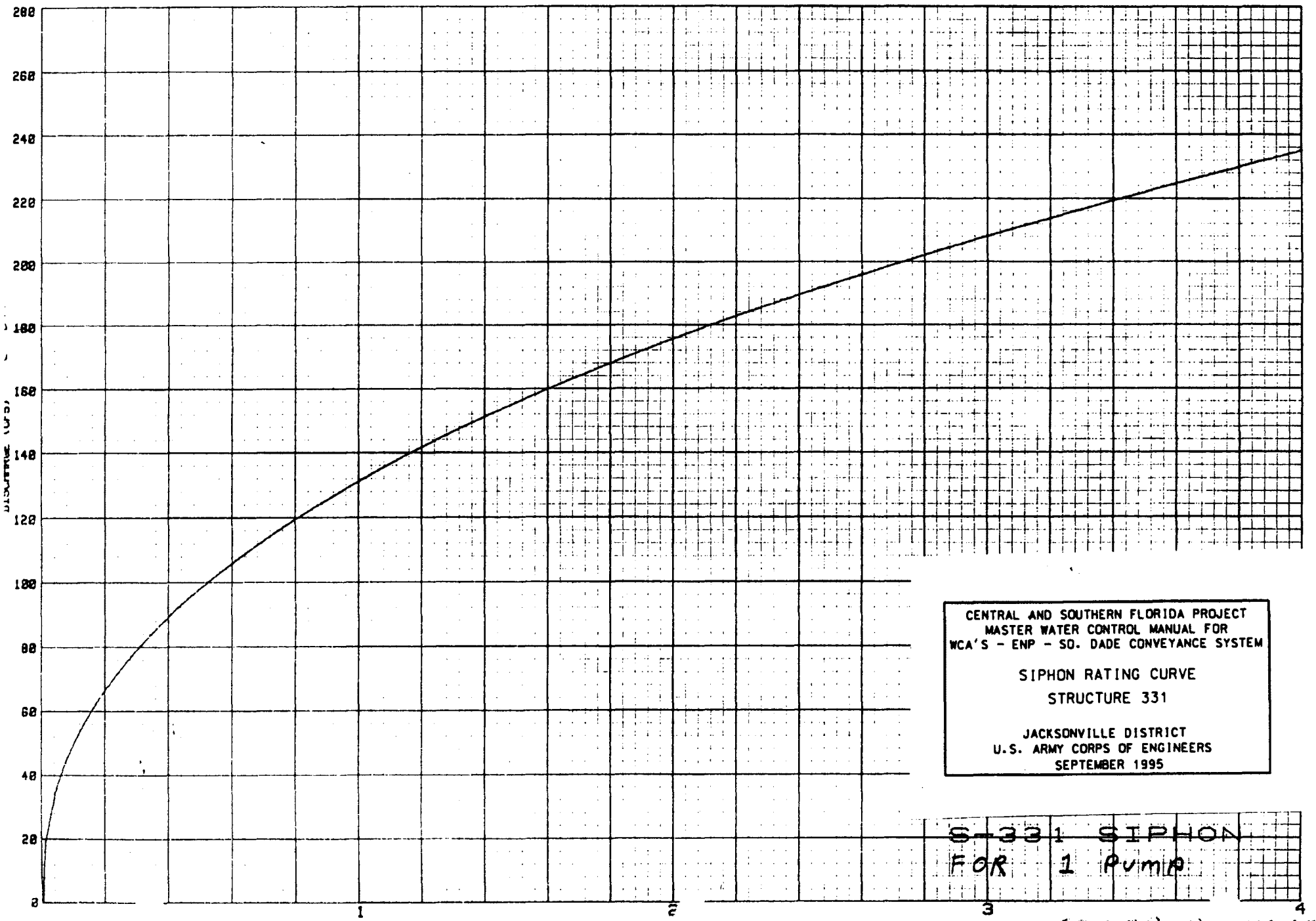
Between November 1 and May 31, the L-31(N) Canal between S-331 and S-176 will be managed to maintain a daily stage of approximately 4.8 feet, upstream of S-176.

<u>Constraints</u>. Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 ft. and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 should be terminated until the S-176 headwater stage recedes to 5.0 feet. If heavy rainfall is expected, S-331 discharges should be terminated when the S-176 headwater stage is between 5.0 and 5.5 feet.

STRUCTURE 331 (S-331)

Summary of Hydraulic Design

Location	L-31(N)
Pump Design	
Discharge Rate (cfs)	1,160
Headwater Elevation (ft.)	3.0
Tailwater Elevation (ft.)	6.0
Gravity Design (S-173)	
Discharge Rate (cfs)	100
Type	controlled submerged
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	4.5
Design Heads Elevation (ft.)	
Normal	1.5
Discharge Water Surface Elevation (ft.)	
Normal pumping	6.0
Minimum non-pumping	3.5
Intake Water Surface Elevation (ft.)	
Start Pumps	3.0 to 5.0
Normal Drawdown	3.0
Minimum non-pumping	3.5
Pumps	
Type	Vertical axial flow
Number & Size (inches)	3 @ 96
Design Rating (cfs)	387
Impeller Speed (rpm)	100
Engine Horsepower (ea)	250
Engine Speed (rpm)	1,800


280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
1
2
3
4
HEAD (FT)
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
SIPHON RATING CURVE
STRUCTURE 331
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1995
S-331 SIPHON
FOR 1 PUMP

A-S331-4

STRUCTURE 332 (S-332)

Location. Structure 332 is located on the west side of the L-31W borrow canal at the head of Taylor Slough in the Everglades National Park (ENP) about 6 miles west of Homestead, Florida.

Description. S-332 is an electric motor-driven pumping station with a variable pump arrangement. The upstream wingwalls are steel sheet pile walls capped with steel channels. The downstream wingwalls are reinforced concrete inverted "T" walls. The concrete apron and end sill are on the downstream side of the structure. A service bridge over the pumping station provides access for service vehicles.

Purpose. The purpose of S-332 is to function as a component of the conveyance canal system to ENP and South Dade County. The system is designed to provide supplemental water supply from WCA No. 3A to satisfy the peak dry season demands of ENP and South Dade County agricultural users during a 1-in-10 year drought.

Regulation. S-332, together with S-174, S-176, and S-177, is regulated according to an agreement between the U. S. Army Corps of Engineers, the Everglades National Park and the South Florida Water Management District. The agreement is part of the experimental water delivery program as authorized by PL 91-282.

The terms of this agreement require that the operation will be as follows:

Wet Season Criteria
S-332 and the auxiliary pumps will be operated as needed to maintain S-176 and S-175 at their optimum levels (5.0 ft and 4.5 ft., respectively).

Normal Dry Season Criteria
Dry season criteria will go into effect following the cessation of wet season rainfall, and L-31W borrow canal stages have receded naturally to 3.5 ft. When water supply deliveries are being mad, S-332 and the auxiliary pumps will be operated to keep the S-174 tailwater stage from exceeding 3.7 ft, and concurrently S-175 headwater equal to 3.5 ft.. S-174 and S-332 will be operated to meet the minimum delivery criteria when S-175 headwater stage drops below 3.0 ft.. This stage-based approach is intended to approximately balance inflows and outflows, while maintaining the L-31W average stage at or near 3.5 ft..

Dry Season Flood Control Criteria
S-332 and the auxiliary pumps may be operated up to their maximum capacity, to maintain the S-175 headwater stage at or below 3.5 ft..

Transition from the Dry Season into the Wet Season
Beginning at 0800 on June 1st, the wet season operating criteria would go into effect. From June 1 until June 15, pumping at S-332 shall not exceed 165 cfs.

Transition from the Wet Season into the Dry Season
The goal of the transition is to reach elevation 3.5 ft. on December 1st as measured at the S-175 HW.

S-332 and the temporary pumps shall be operated to allow a smooth recession of stages in the L-31W borrow canal.

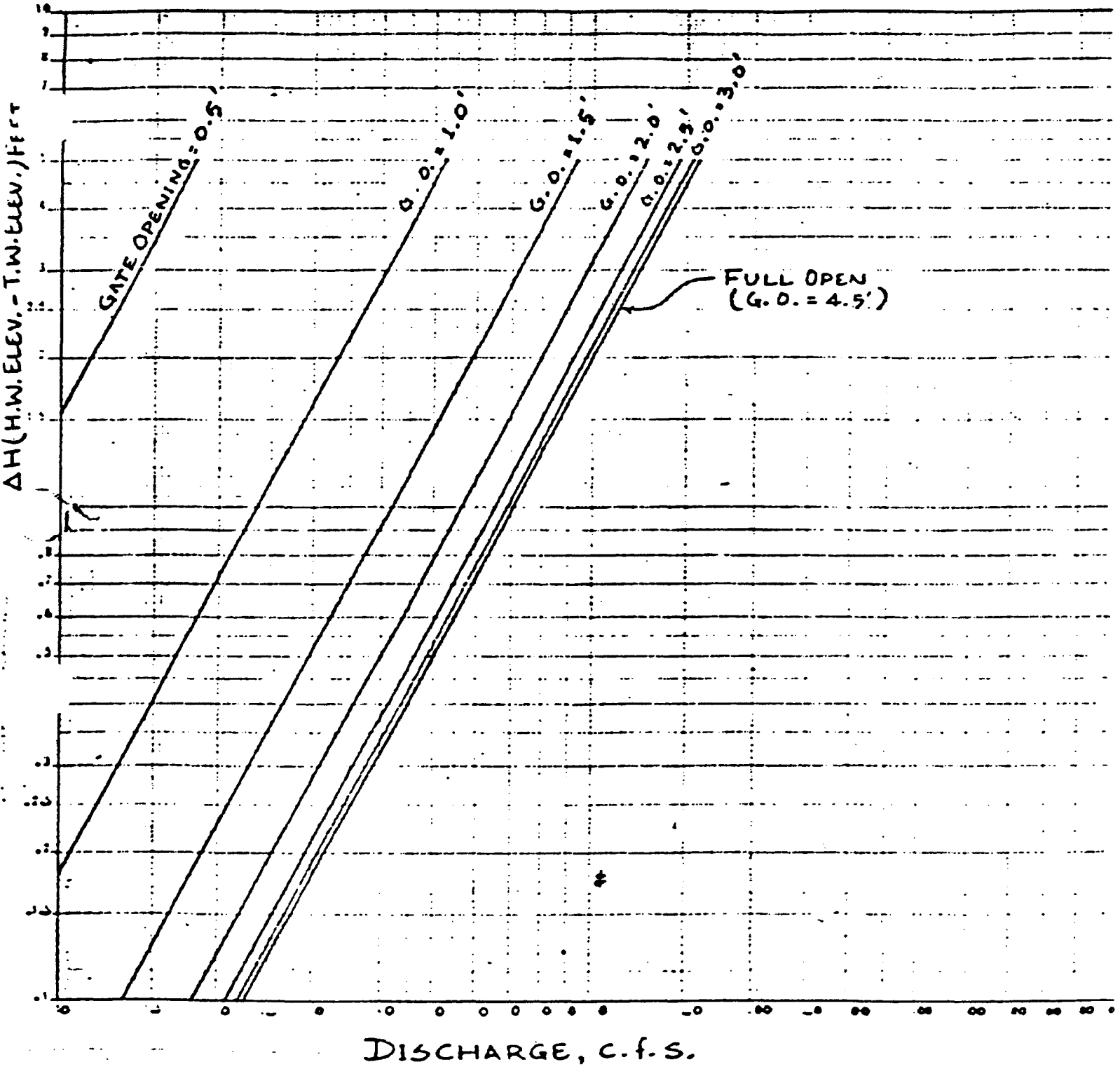
Low Flow Regulation. The main gate has two manual slide gates, over 1.5-foot-high, which provide overflow and water control above elevation 4.5 ft. to minimize vertical-lift gate movement.

Constraints. The pumps are designed to operate between headwater stages of 2.0 and 5.0 feet. If the headwater stage drops to 2.0 feet, the sump float causes the power to the motor to be cut off.

STRUCTURE 332 (S-332)

Summary of Hydraulic Design

Location	L-31W
Design Conditions	
Discharge (cfs)	165
Headwater Elevation (ft.)	3.0
Tailwater Elevation (ft.)	Below 5.8
Intake Water Surface Elevation (ft.)	
Maximum pumping	4.5
Maximum non-pumping	5.0
Start pumping	3.0 to 4.5
Normal drawdown pumping	3.0
Minimum non-pumping	3.0
Discharge Water Surface Elevation (ft.)	
Maximum pumping	4.5
Normal pumping	6 in. above ground
Minimum pumping	Natural ground
Minimum non-pumping	Natural ground
Pumps	
Type	Vertical axial flow
Number & Size (inches)	2 @ 30
Number & Size (inches)	1 @ 24
Number & Size (inches)	1 @ 20
Number & Size (inches)	1 @ 14
Number & Size (inches)	1 @ 10
Invert Elevation (ft.)	5.75
Gates	
Type of Control	Flapgates
Number	6



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

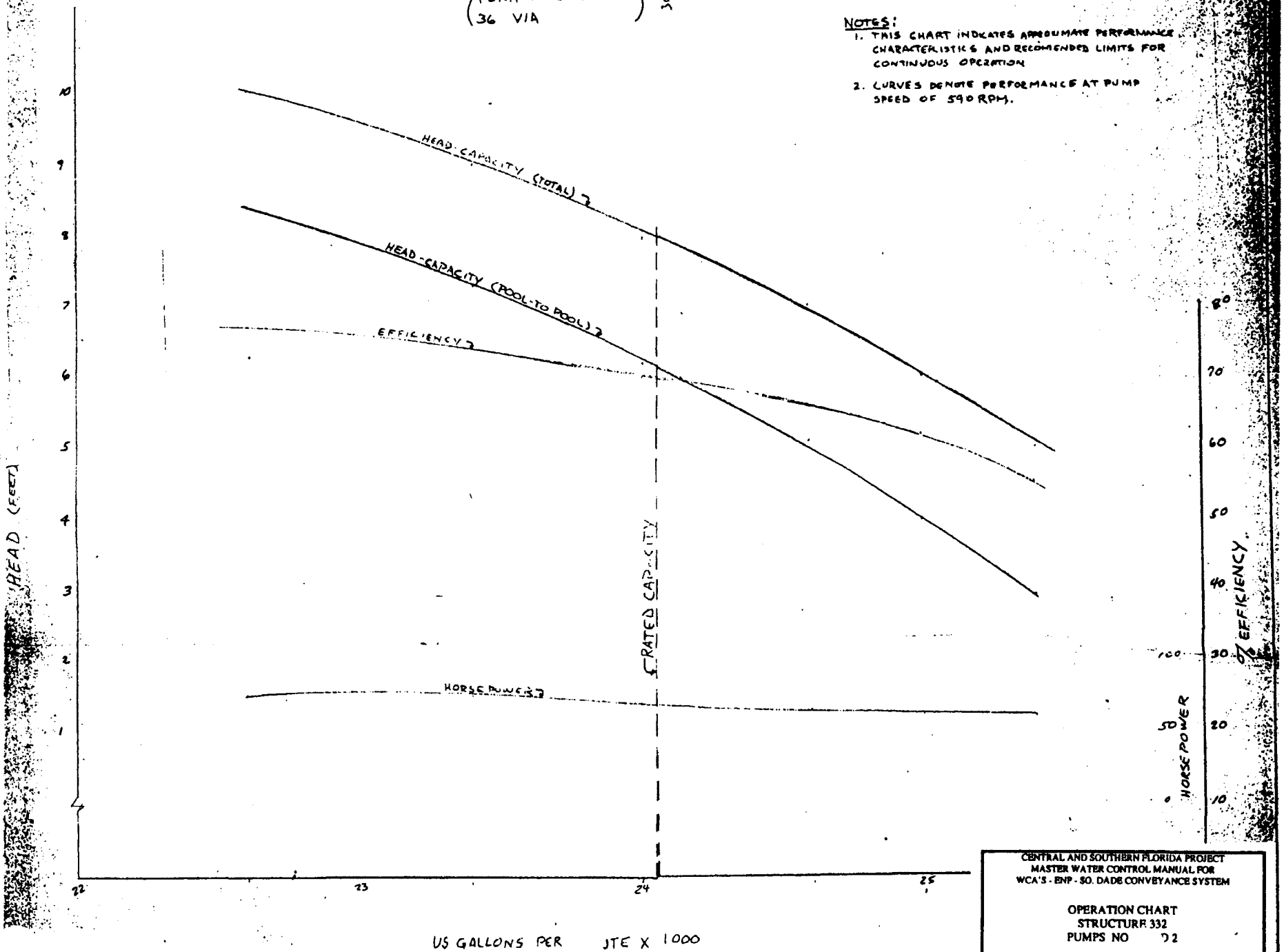
DISCHARGE RATING CURVE
STRUCTURE 32A

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
APRIL 1981

OPERATIOI ART
FOR
PUMPING STH -N 332
(PUMP NOS. 1 AND 2)
36 VIA

S -32

NOTES:
1. THIS CHART INDICATES APPROXIMATE PERFORMANCE CHARACTERISTICS AND RECOMENDED LIMITS FOR CONTINUOUS OPERATION
2. CURVES DENOTE PERFORMANCE AT PUMP SPEED OF 590 RPM.



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

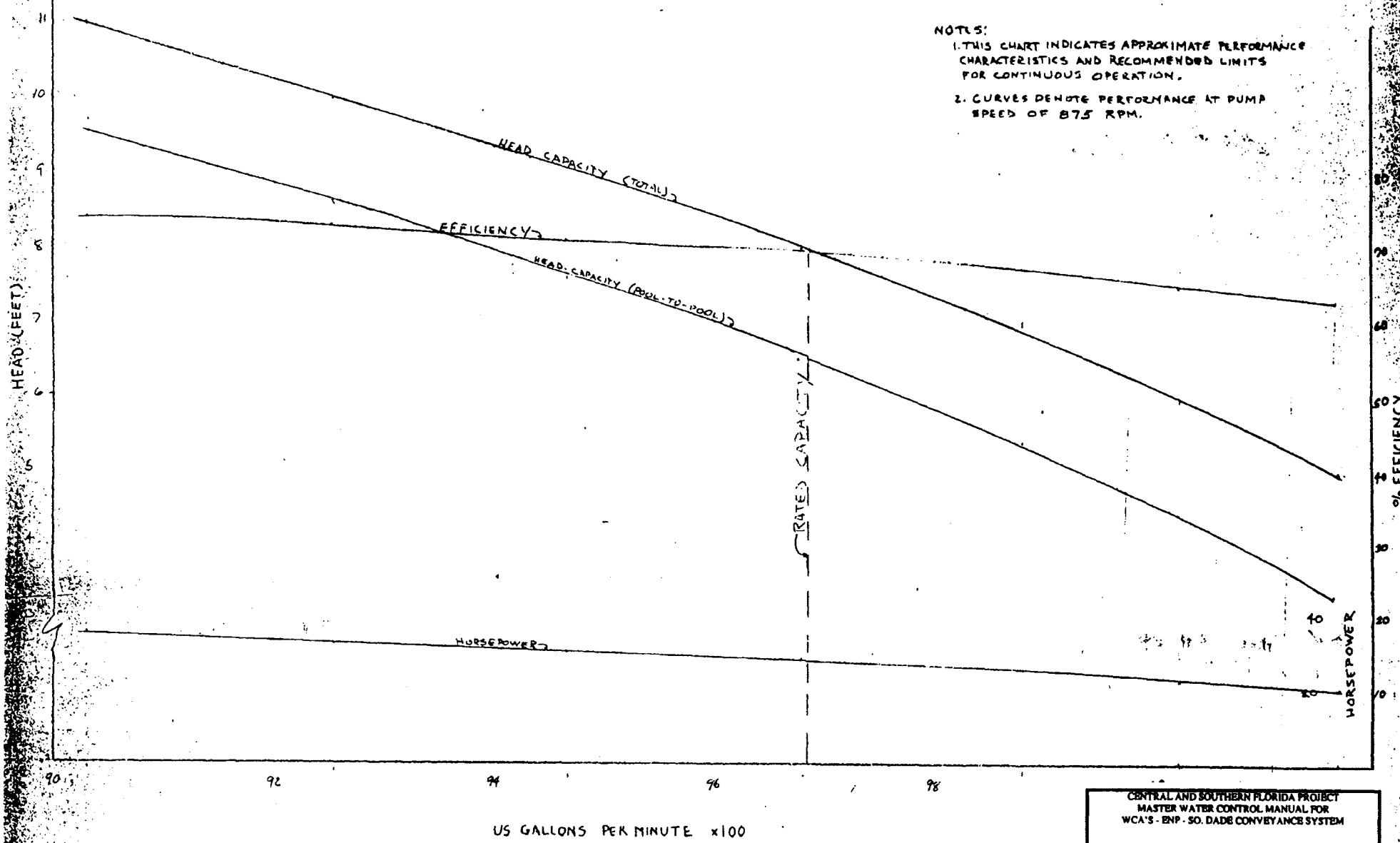
OPERATION CHART
STRUCTURE 332
PUMPS NO 2

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

5-3
Pump #3

OPERATION CHART
PUMPING STATION 332

(PUMP NO. 3)
(20 INCH VIA)



A-S332-5

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATION CHART
STRUCTURE 332
PUMP NO. 3

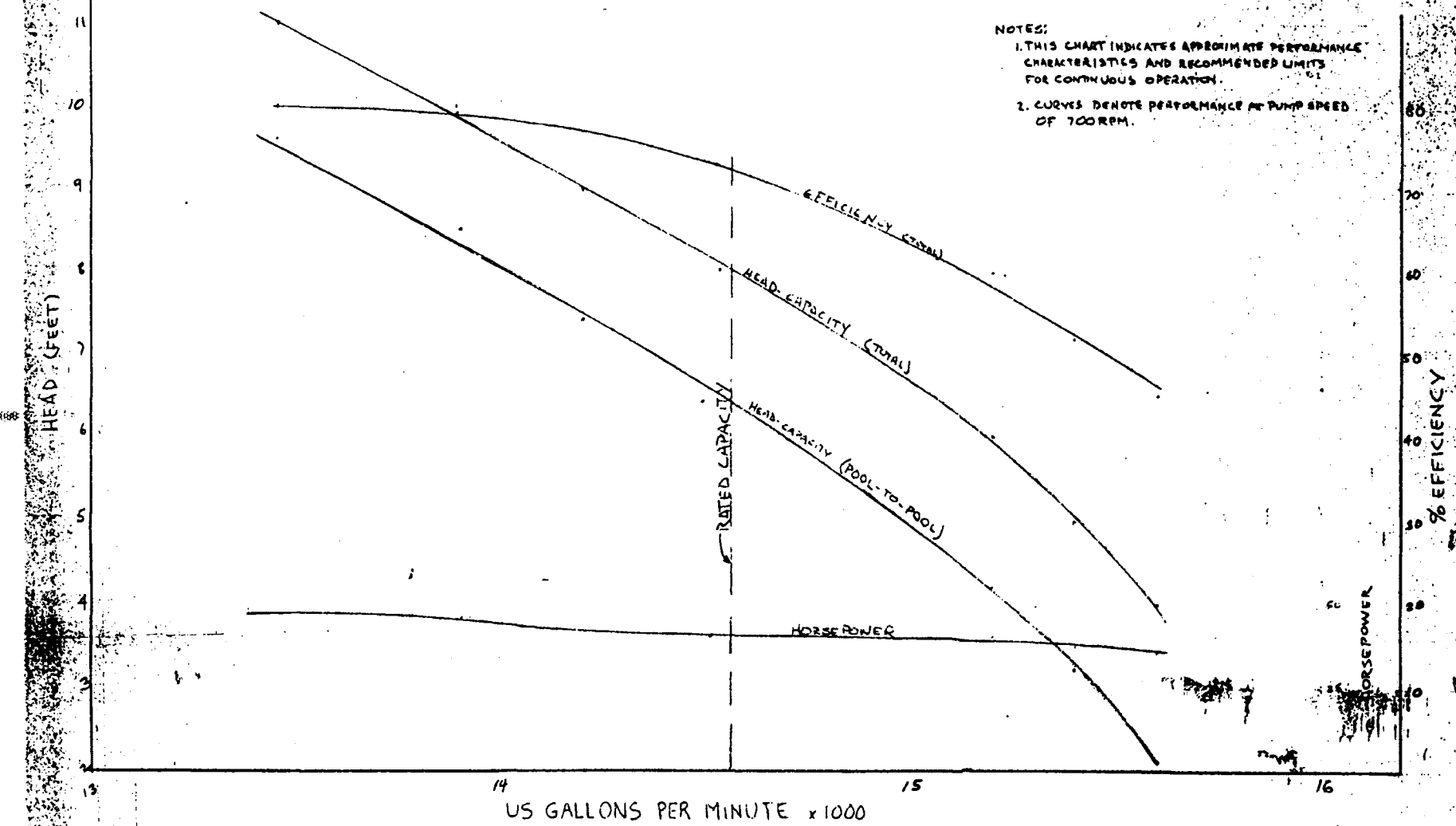
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

S 2
pump-4

OPERATION CHART

PUMPING STATION 332

(PUMP NO. 4)
(24 INCH VIA)



NOTES:
1. THIS CHART INDICATES APPROXIMATE PERFORMANCE CHARACTERISTICS AND RECOMMENDED LIMITS FOR CONTINUOUS OPERATION.
2. CURVES DENOTE PERFORMANCE AT PUMP SPEED OF 700 RPM.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATION CHART
STRUCTURE 332
PUMP NO. 4

JACKSONVILLE DISTR
U.S. ARMY CORPS OF ENG

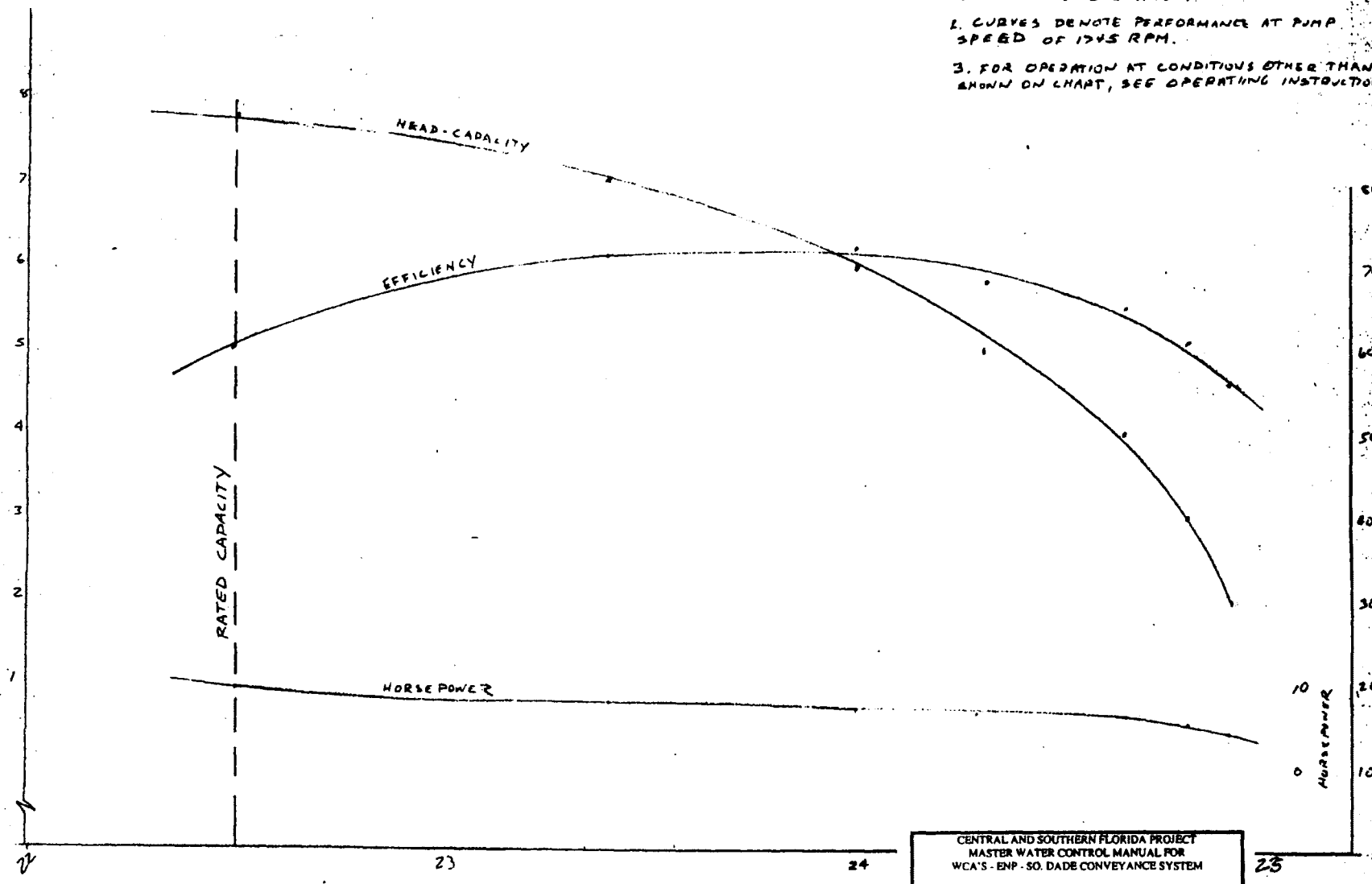
OPERI I CHART

PUMPING STATION S32
(PUMP NO. 5) 10"

S-332 Rating Curves
Pump #5

NOTES:

1. THIS CHART INDICATES APPROXIMATE PERFORMANCE CHARACTERISTICS AND RECOMMENDED LIMITS FOR CONTINUOUS OPERATION.
2. CURVES DENOTE PERFORMANCE AT PUMP SPEED OF 1745 RPM.
3. FOR OPERATION AT CONDITIONS OTHER THAN SHOWN ON CHART, SEE OPERATING INSTRUCTIONS.



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATION CHART
STRUCTURE 332
PUMP NO. 5

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

A-S332-7

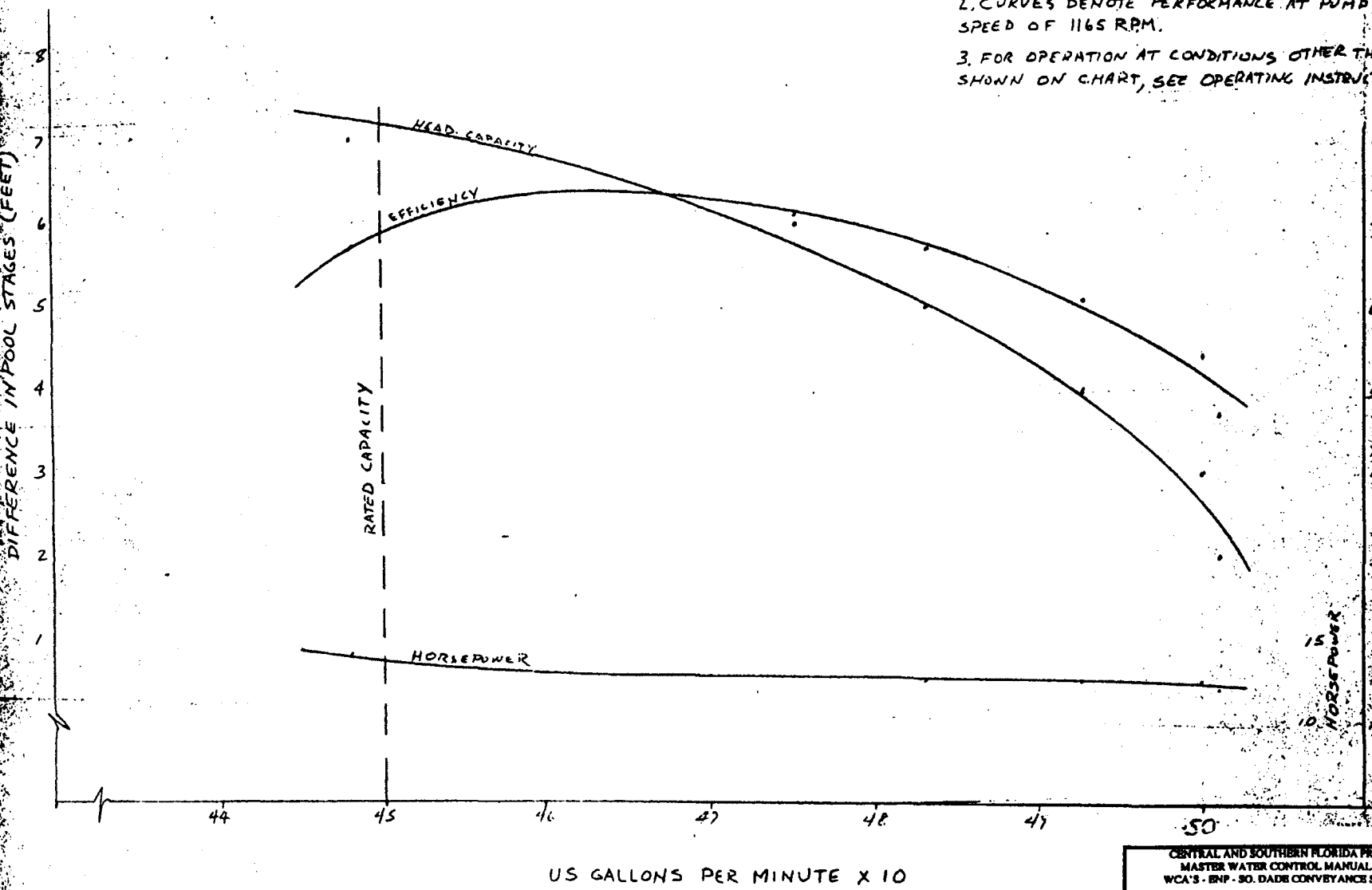
OPERA N CHART

PUMPING STATION 332
(PUMP NO. 6) 14

S-332 pump #6

NOTES:

1. THIS CHART INDICATES APPROXIMATE PERFORMANCE CHARACTERISTICS AND RECOMMENDED LIMITS FOR CONTINUOUS OPERATION.
2. CURVES DENOTE PERFORMANCE AT PUMP SPEED OF 1165 R.P.M.
3. FOR OPERATION AT CONDITIONS OTHER THAN SHOWN ON CHART, SEE OPERATING INSTRUCTIONS.



CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATION CHART
STRUCTUI
PUMP N.

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

STRUCTURE 332DX1 (S-332DX1)

Location. Structure 322DX1 is located approximately 28 miles southwest of Miami, approximately 6 miles west of Krome Avenue, and approximately 5.5 miles north of State Road 9336 (Ingraham Highway), in Levee 31W, west of the S-332D pump station.

Description. S-332DX1 is a 4 Barrel corrugated aluminum pipe (CAP) structure. The barrels are 174 feet long and are gated with vertical lift gates in the middle of the barrel along the alignment of the L-31(W) levee. The structure is designed to pass a combined total of 250 cfs. Flow can pass either way through the structure. Forward flow is defined as the flow passing from the Frog Pond High Head Cell (HCC) to the C-111 Southern Detention Area (SDA). Reverse flow would have flow flowing from the SDA to the HHC.

Purpose. The purpose of S-332DX1 is to improve the ability of the C-111 SDA to create a hydraulic ridge by allowing water conveyance to the north from the Frog Pond HHC into the C-111 SDA. This assists in improving ENP hydrology in accordance with the 2006 Interim Operating Plan (IOP).

Operation. Flow can potentially occur in both directions (North or South) through the S-332DX1 with the notable limitation that water levels in the SDA must be higher than the crest elevation of the weir that separates the FPHHC from the rest of the Frog Pond Detention Area to flow further south. Only flow from South to North through S-332DX1 may be allowed under normal conditions.

DISCHARGE CHARACTERISTICS

Design Discharge Rate (combined):	250 cfs

DESCRIPTION OF STRUCTURE

Optimal Design Head	
Design HW	8.50 ft (HHC)
Design TW	8.00 ft (SDA)
Maximum Stages	
Max HW (forward)	8.60 ft (HHC)
Max TW	10.00 ft (SDA)
Minimum Stages	
Min HW	4.50 ft (HHC)
Min TW	4.50 ft (SDA)
Gate Seating Head*	
Max HW	10.00 ft
Min TW	0.67 ft
Unseating Head	
Min HW	10.00 ft
Max TW	0.67 ft

Culvert Data

Material	Corrugated Aluminum
No. in Set	4
Diameter	60 in
Length	173 ft
Invert--HW	1.00 ft
Invert--TW	1.00 ft
Nat Grade	6 ft
Nat Wat Table**	4.5 to 6.0 ft

Gate Data

Gate Type	Vertical Slide
Top-of-Gate Ht	9.00 ft
Protection Elev	9.00 ft

HYDRAULIC AND HYDROLOGIC MEASUREMENTS

Stilling wells and staff gages located at upstream and downstream of structure.

STRUCTURE 333 (S-333)

Location. S-333 is located in the L-29 borrow canal where L-29 and L-67 cross. The structure is north of U. S. Highway 41 and about 30 miles west of Miami.

Description. S-333 is a single-bay gated spillway. It is a reinforced concrete U-shaped, trapezoidal weir-type structure. The manual vertical-lift gate has 4 auxiliary gates, each measuring 6.0 feet wide x 2.5 feet high, with a crest elevation of 8.5 feet. S-333 has a 23'8" wide service bridge, an operating platform, steel sheet pile wingwalls, and a control house.

Purpose. S-333 functions principally to make water deliveries from WCA No. 3A to south and eastern Dade County and to the Shark River and Taylor Slough areas of the ENP. It is also used to make regulatory releases from WCA No. 3A.

S-333 helps to maintain desirable stages in the L-29 borrow canal and provides a means of discharging water from WCA No. 3A into the L-29 Borrow Canal, from which it is diverted into either the L-31N Borrow Canal or C-4. S-333 functions as a component of the conveyance system which supplies water from WCA No. 3A to south Dade County and ENP. Under drought conditions, the conveyance system provides supplemental water to satisfy peak month demands for municipal, industrial, and agricultural water supply; for seepage and dilution; and for cyclical discharges to ENP.

Regulation. The headwater fluctuates with stages in WCA No. 3A. Under normal conditions S-333's gate should remain closed to allow the uninterrupted southward seepage from WCA No. 3B.

When S-333 makes water deliveries to south or east Dade County, it may operate alone or with S-337. The total delivery amount should support the appropriate stages at S-331, S-25B, and S-22; while maintaining a 5.0 foot to 6.0 foot headwater at S-334.

When S-333 is used in conjunction with S-12 to make regulatory releases to the Everglades National Park at Shark River Slough, the structure will be operated in accordance with an agreement between the U. S. Army Corps of Engineers, the Everglades National Park and the South Florida Water Management District. The agreement is part of the experimental water delivery program as authorized by PL 91-282.

(1) S-333 discharges would be limited to avoid causing the downstream water levels to exceed 7.5 ft., NGVD.

(2) When water levels at G-3273 have been above 6.8 ft.,NGVD for 24 hours, S-333 will be closed.

(3) S-333 will be closed until the water level at G-3273 has stopped rising and is below 6.8 ft., NGVD if the following conditions occur:

(a) The water level at G-3273 has been above 6.5 ft.,

NGVD for 48 hours; and

(b) The water level at G-3273 has risen in the last 24 hours at a rate that would cause it to exceed 6.8 ft., NGVD, within the next 24 hours.

(4) If the headwater stage at S-176 exceeds 5.0 ft., NGVD for more than 24 hours or the S-331 headwater stage exceeds its target level for more than 24 hours, discharges at S-333 will be reduced, if necessary, to avoid causing water levels in the L-29 borrow canal from exceeding for 24 hours.

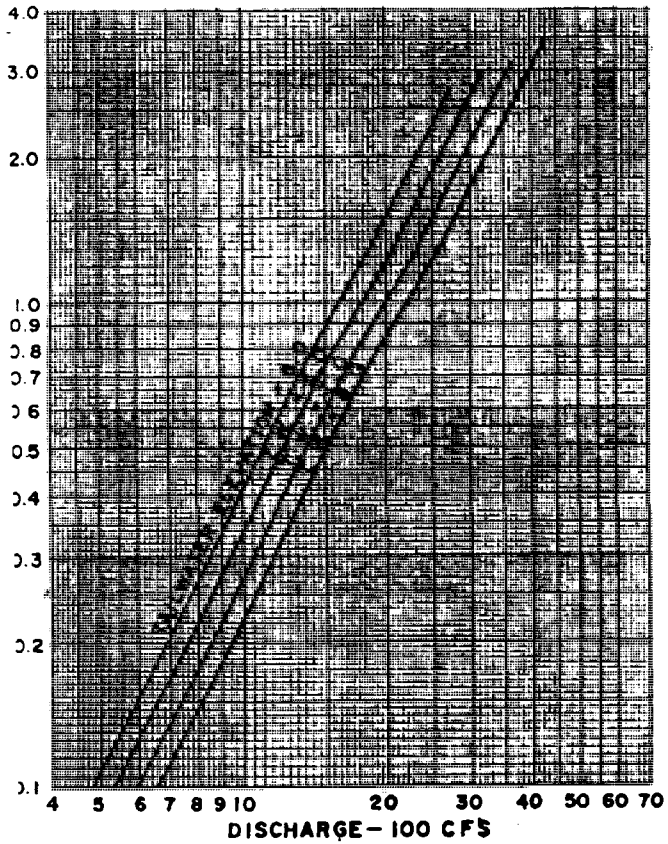
Low Flow Regulation. The structure's optimum tailwater is 5.0 feet during drought conditions. When there is insufficient water available in the WCA's, water is transferred from Lake Okeechobee through the WCA's to meet the needs of the East Coast and ENP. SFWMD can make water supply releases to the East Coast from the WCA's through S-333 and other structures. The tailwater may be raised to 7.0 feet, to expedite water delivery southward. Under design conditions (HW = 7.5 feet; TW = 7.0 feet), the spillway can discharge 1,350 cfs with the gate fully opened.

Major Constraints. To prevent impacts to privately owned lands, a number of constraints have been placed on the use of S-333 to deliver water to Northeast Shark River Slough. These constraints are listed in Table 7-1 on pages T7-1 thru T7-3. To protect the structure's stability the head should not exceed 5.0 feet.

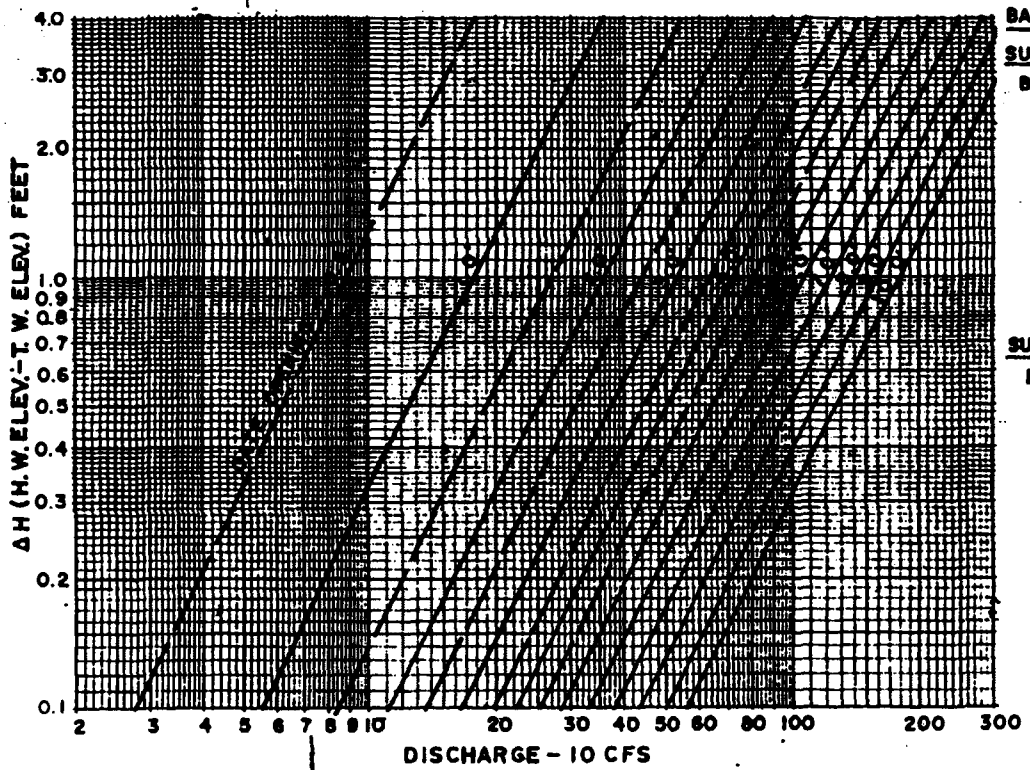
STRUCTURE 333 (S-333)

Summary of Hydraulic Design

Location	L-29
Design Conditions	
Discharge (cfs)	1,350
Type	Uncontrolled submerged
Headwater Elevation (ft.)	7.5
Tailwater Elevation (ft.)	7.0
Maximum Head (ft.)	5.0
Optimum Conditions	
Headwater Elevation (ft.)	9.5 to 10.5
Tailwater Elevation (ft.)	5.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-3.1
Net Length	29
Gates	
Type of Gate	Manual vertical lift
Number	1
Width x Height (ft.)	29 x 14.6
Low Steel Elevation (ft.) (fully open position)	8.5
Top of Gates Elevation (ft.) (fully closed position)	11.5
Overflow Slot Elevation (ft.)	8.5 to 11.0
Channel Section	
Upstream Bottom Width (ft.)	35.0
Upstream Bottom Elevation (ft.)	-10.0
Upstream Side Slopes	1v on 2h
Downstream Bottom Width (ft.)	35.0
Downstream Bottom Elevation (ft.)	-10.0
Downstream Side Slopes	1 on 2
Canal Riprap	
Upstream Length (ft.)	20
Upstream Protection Elevation (ft.)	10.5
Downstream Riprap Length (ft., min.)	20.0
Downstream Protection Elevation (ft.)	10.0
Stilling Basin	
Apron Elevation (ft.)	-6.0
Apron Length (ft.)	20.0
End Sill Elevation (ft.)	-5.0
Training Wall Elevation (ft.)	7.0



SUBMERGED UNCONTROLLED FLOW



SUBMERGED CONTROLLED FLOW

BASIS FOR DISCHARGE RATING CURVES

SUBMERGED UNCONTROLLED FLOW

BASED ON DAUBUISSON'S FORMULA

$Q = KA\sqrt{2g\Delta H + V_1^2}$

$K = 0.85$ WHEN $\Delta H \geq 1.0'$

$K = 0.80$ WHEN $\Delta H < 1.0'$

$A = (\text{TW ELEV.} - \text{CREST ELEV.}) \times 29.0'$

V = APPROACH VELOCITY

SUBMERGED CONTROLLED FLOW

BASED ON ORIFICE FORMULA

$Q = CA\sqrt{2g\Delta H}$

$C = 0.75$

A = GATE OPENING X 29.0'

S-333

ONE 29.0' WIDE X 14.6' HIGH GATE
CREST ELEVATION = –3.1

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 333

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1974

STRUCTURE 334 (S-334)

Location. S-334 is located in the east end of L-29, in section 3 of the borrow canal, near L-30.

Description. S-334 is a single-bay gated spillway. It is a reinforced concrete, U-shaped, trapezoidal weir structure. The manual vertical-lift gate is equipped with hand-operated slide gates (6.0 ft. wide x 2.0 ft. high, each) which minimize the use of the vertical-lift gate. S-334 has a 23'8" wide service bridge, an operating platform, steel sheet pile wingwalls, and a control house.

Purpose. S-334 functions principally to make supplemental water deliveries to south and east Dade County. It also makes regulation releases from WCA No. 3A.

S-334 helps maintain desirable stages in the L-29 and L-31N borrow canals and regulates discharges to the L-31N borrow canal from the L-29 borrow canal. The spillway functions as a component of the conveyance system which supplies water from WCA No. 3A to south Dade County and ENP. Under drought conditions, the conveyance system provides supplemental water to satisfy peak month demands for municipal, industrial, and agricultural water supply; for seepage and dilution; and for cyclical discharges to ENP.

Normal Regulation. The structure's optimum headwater is between 5.0 and 6.5 feet, and the optimum tailwater is 5.0 feet. Under normal conditions, this structure should remain closed to allow stages in the C-29 borrow canal to fluctuate in response to seepage from WCA No. 3B.

Flood Control Regulation. The water level which will bypass the structure is 14.0 feet.

Low Flow Regulation. When discharges are needed for water supply, the S-334 headwater can be raised to as high as 6.5 ft., by increasing discharges at S-333. This will facilitate the southward delivery of water. S-134 may operate with S-333 to support the optimum level of 6.0 ft. in the L-29 borrow canal or to maintain a maximum stage of 7.2 ft. at the L-29-1 culvert. Under design conditions (HW = 5.0 ft., and TW = 4.7 ft.), S-334 can discharge 1,230 cfs with the gate fully opened under low water conditions.

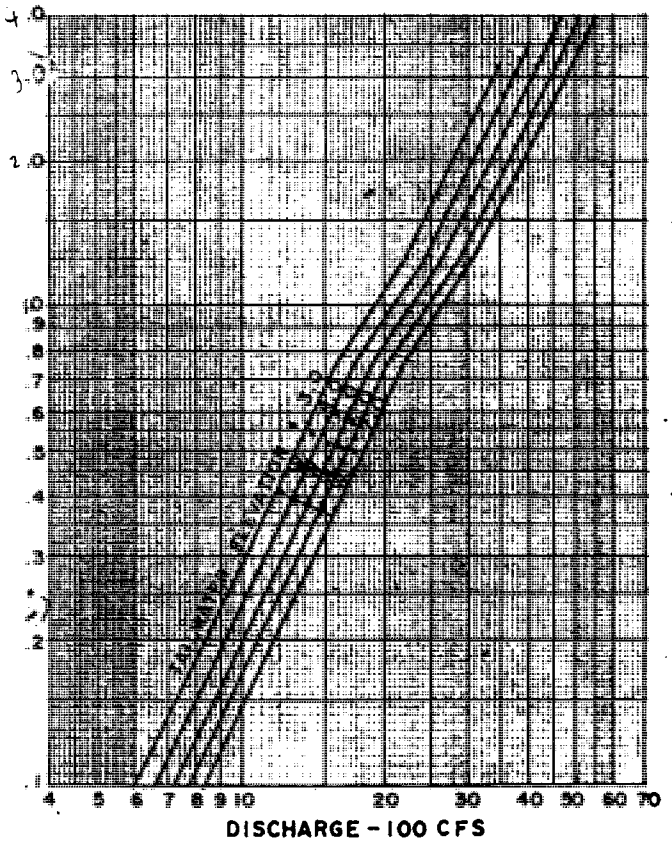
Constraints. S-334 does not have a breastwall. The top of the gate in the closed position is only at elevation 7.7 ft. In addition, the US 41 crossing through L-31N is only at elevation 10.6 ft. The design criteria for S-334 make it necessary for the hydrostatic head not to exceed 3.3 feet.

STRUCTURE 334 (S-334)

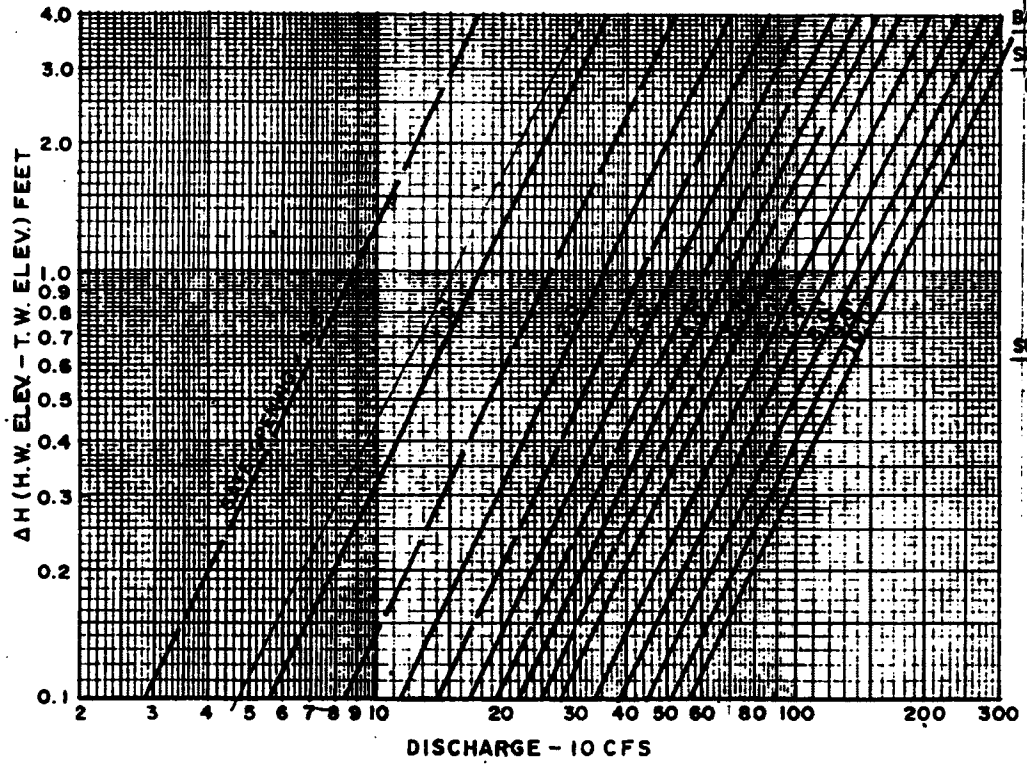
Summary of Hydraulic Design

Location	L-29
Design Conditions	
Discharge (cfs)	1,230
Type	Uncontrolled submerged
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	4.7
Maximum Head (ft.)	3.3
Optimum Conditions	
Headwater Elevation (ft.)	5.0 to 6.0
Tailwater Elevation (ft.)	5.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-6.9
Net Length (ft.)	29
Gates	
Type of Gate	Elect. hydraulic lift
Number	1
Width x Height (ft.)	29 x 14.6
Low Steel Elevation (ft.) (fully open position)	6.2
Top of Gates Elevation (ft.) (fully closed position)	7.7
~~Overflow Slot Elevation (ft.)~~	4.7 to 7.2

New gate does not have slot gates



SUBMERGED UNCONTROLLED FLOW



SUBMERGED CONTROLLED FLOW

BASIS FOR DISCHARGE RATING CURVES

SUBMERGED UNCONTROLLED FLOW

BASED ON DAUBUISSON'S FORMULA

$Q = KA\sqrt{2g\Delta H + V_1^2}$

$K = 0.85$ WHEN $\Delta H \geq 1.0'$

$K = 0.80$ WHEN $\Delta H < 1.0'$

$A = (\text{TW ELEV.} - \text{CREST ELEV.}) \times 29.0'$

V_1 = APPROACH VELOCITY

SUBMERGED CONTROLLED FLOW

BASED ON ORIFICE FORMULA

$Q = CA\sqrt{2g\Delta H}$

$C = 0.75$

A = GATE OPENING X 29.0'

S-334 14.6?

ONE 29.0' WIDE X 12.9' HIGH GATE

CREST ELEVATION = -6.9

A-S334-3

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 334

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1974

STRUCTURE 335 (S-335)

Location. S-335 is located in the south end of the L-30 borrow canal, upstream of U.S. Highway 41 and west of State Highway 27.

Description. S-335 is a single-bay gated spillway. It is a reinforced concrete U-shaped, trapezoidal weir-type structure. The manual vertical-lift gate is equipped with three hand-operated slide gates (6.0 feet wide x 1.5 feet high, each) which minimize the use of the vertical-lift gate. S-335 has a service bridge, operating platform, steel sheet pile wingwalls, and a control house.

Purpose. S-335 functions primarily to make supplemental water deliveries to south and east Dade County. S-335 maintains water control in the L-30 and L-31N borrow canals and regulates discharges from the L-30 borrow canal to the L-31N borrow canal.

S-335 helps maintain desirable stages in the L-30 and L-31N borrow canals and regulates discharges to the L-31N borrow canal
L-30 from the L-29 borrow canal. The spillway functions as a component of the ENP/South Dade conveyance system which supplies water from WCA No. 3A. Under drought conditions, the conveyance system provides supplemental water to satisfy peak month demands for municipal, industrial, and agricultural water supply; for seepage and dilution; and for cyclical discharges to ENP.

Normal Regulation. This structure is operated with S-32A to maintain the optimum level of 6.0 feet in the L-30 borrow canal.

Flood Control Regulation. During high flows, S-335 should be operated to maintain optimum water levels. The gate will be opened when the headwater stage exceeds 6.0 feet and only when releases will not create hazardous conditions downstream. The water level which will bypass the structure is 11.5 feet.

Low Flow Regulation. Releases may be started from S-335, S-334 or both when the canal stage between S-335 and S-331 recedes to 3.5 feet or when the headwater stage at S-25B or S-22 falls below 2.8 feet. Once these releases begin then the headwater at S-335 and S-331 should be held between 5.0 feet and 6.0 feet, and 3.0 feet and 3.5 feet, respectively.

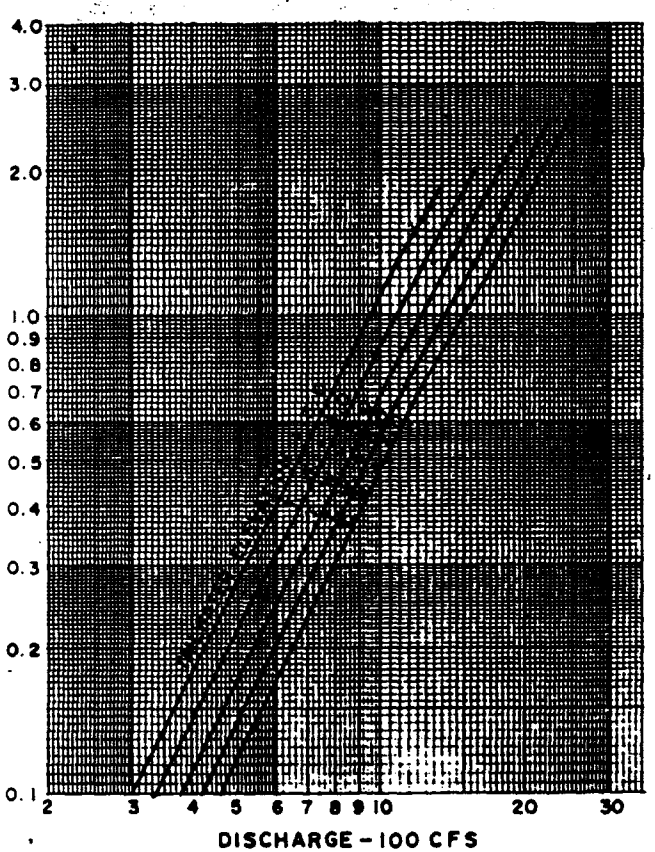
When water is needed in the L-31N borrow canal, S-335 can discharge additional water. The headwater can be raised to 6.0 feet to facilitate the water southward. Under design conditions (HW = 5.0 feet and TW= 4.8 feet for drought conditions), S-335 may discharge 525 cfs with the gate fully open.

Constraints. To protect the stability of the structure, the head across the structure should not exceed 3.2 feet.

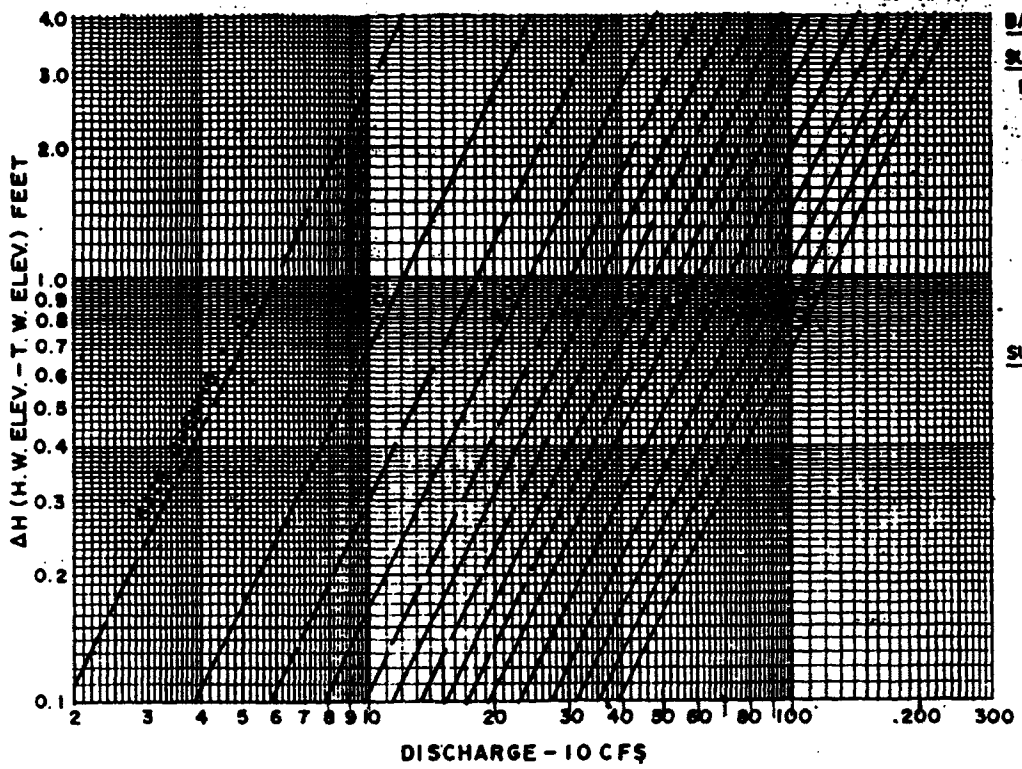
STRUCTURE 335 (S-335)

Summary of Hydraulic Design

Location	L-30
Design Conditions	
Discharge (cfs)	525
Type	Uncontrolled submerged
Headwater Elevation (ft.)	5.0
Tailwater Elevation (ft.)	4.8
Maximum Head (ft.)	3.2
Optimum Conditions	
Headwater Elevation (ft.)	5.0-6.0
Tailwater Elevation (ft.)	5.0
Crest	
Shape	Trapezoidal
Elevation (ft.)	-4.2
Net Length (ft.)	20
Gates	
Type of Gate	Vertical lift
Number	1
Width x Height (ft.)	20 x 11.2
Low Steel Elevation (ft.) (fully open position)	6.0
Top of Gates Elevation (ft.) (fully closed position)	7.0
Overflow Slot Elevation (ft.)	5.0 to 6.5
Service Bridge Elevation (ft.)	11.5
Protection Elevation (ft.)	11.5
Operating Platform Elevation (ft.)	30.5
Dewatering Capabilities	Yes



SUBMERGED UNCONTROLLED FLOW



SUBMERGED CONTROLLED FLOW

BASIS FOR DISCHARGE RATING CURVES

SUBMERGED UNCONTROLLED FLOW

BASED ON DAUBUISSON'S FORMULA

$Q = KA\sqrt{2g\Delta H + V_1^2}$

$K = 0.85$ WHEN $\Delta H \geq 1.0'$

$K = 0.80$ WHEN $\Delta H < 1.0'$

$A = (\text{TW ELEV.} - \text{CREST ELEV.}) \times 20.0'$

V_1 = APPROACH VELOCITY

SUBMERGED CONTROLLED FLOW

BASED ON ORIFICE FORMULA

$Q = CA\sqrt{2g\Delta H}$

$C = 0.75$

A = GATE OPENING X 20.0'

S-335

ONE 20.0' WIDE X 11.2' HIGH GATE

CREST ELEVATION = -4.2

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
STRUCTURE 335

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1974

STRUCTURE 336 (S-336)

Location. Structure 336 is located in the Tamiami Canal (C-4), where the L-30 and L-31N borrow canals intersect.

Description. S-336 is a gated, three barrel, 54-inch, corrugated metal pipe culvert. It has standard manually operated slide gates, reinforced concrete intake headwalls, an operating platform, and a walkway on the upstream side.

Purpose. This structure permits supplemental deliveries from WCA No. 3 to help fulfill water needs in eastern Dade Co. via the L-30 or L-29 canals. It also can be used to discharge excess water from WCA No. 3A when capacity is available in the Tamiami Canal.

S-336 regulates eastward flows in C-4 and southward flows in the L-31N borrow canal. Releases to C-4 help support optimum headwater stages at east coast structures to establish an adequate fresh water head against saltwater intrusion during low flow periods. Flows diverted southward via the L-31(N) borrow canal supply water for the conveyance system which supplements flows in south Dade County and ENP. Under drought conditions, the conveyance system provides supplemental water to satisfy peak monthly demands for municipal, industrial, and agricultural water supply, for seepage and dilution; and for cyclical discharges to ENP.

Normal Regulation. This structure normally remains closed.

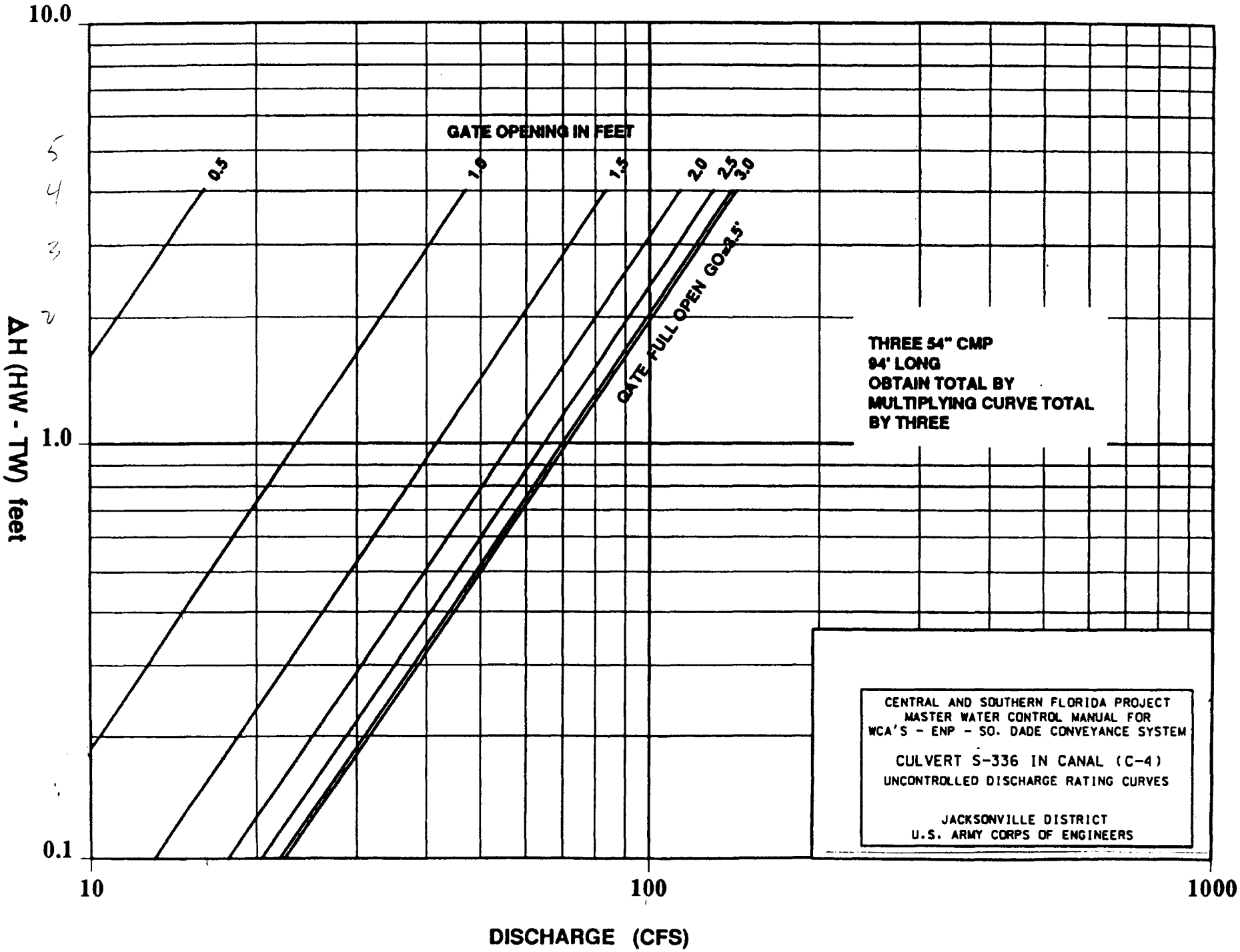
Flood Control Regulation. S-336 is not designed to provide primary flood control but can provide secondary flood releases after flood stages in C-4 and C-2 have peaked and as long as the stage at T-5 is less than 4.0 feet.

Low Flow Regulation. S-336 may supplement water deliveries to East Dade County when the headwater at S-25(B) or S-22 falls below 2.8 feet. Under design conditions (HW =4.7 feet and TW = 4.2 feet) the structure can discharge 145 cfs.

STRUCTURE 336 (S-336)

Summary of Hydraulic Design

Location	C-4
Design Conditions	
Discharge (cfs)	145
Type	Controlled submerged
Headwater Elevation (ft.)	4.7
Tailwater Elevation (ft.)	4.2
Optimum Headwater Elevation (ft.)	5.0
Culvert	
Type	CMP
Number of Barrels	3
Size (dia., inches)	54
Net Length (ft.)	85
Invert Elevation (ft.)	-1.8
Gates	
Type of Control	Manual vertical slide gate
Number	3
Size (Width x height, inches)	54 x 54
Protection Grade Elevation (ft.)	11.0
Operating Platform Elevation (ft.)	10.0
Dewatering Capabilities	No


10.0
1.0
0.1
10
100
1000
ΔH (HW - TW) feet
DISCHARGE (CFS)
GATE OPENING IN FEET
0.5
1.0
1.5
2.0
2.5
3.0
GATE FULL OPEN GO=2.5'
THREE 54" CMP
94' LONG
OBTAIN TOTAL BY
MULTIPLYING CURVE TOTAL
BY THREE
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
CULVERT S-336 IN CANAL (C-4)
UNCONTROLLED DISCHARGE RATING CURVES
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS

A-S336-3

STRUCTURE 337 (S-337)

Location. Structure 337 is located in Levee 30 where L-30 crosses the Miami Canal.

Description. S-337 is a gated, six barrel, 84-inch, corrugated metal pipe culvert with manually operated, standard slide gates. There is a timber operating platform on the upstream side.

Purpose. S-337 regulates discharges from WCA No. 3A into the L-30 borrow canal. Discharges from the structure provide supplemental water to the conveyance system which provides water supply for south Dade County and the Everglades National Park. Under drought conditions, the conveyance system provides water to satisfy peak monthly water demands.

S-337, along with S-31 and S-151, permits water releases from WCA No. 3 to eastern and southern Dade County. S-337 can also be used to discharge excess water from WCA No. 3B when downstream capacity is available.

When insufficient water is available in the WCA's, water is transferred from Lake Okeechobee through the WCA's to meet the needs of the East Coast and ENP. SFWMD can make water supply releases to the East Coast from the WCA's through S-337, and other structures.

Currently, regulatory releases from WCA No. 3B can only be made on a secondary basis through S-31 or S-337 to the East Coast.

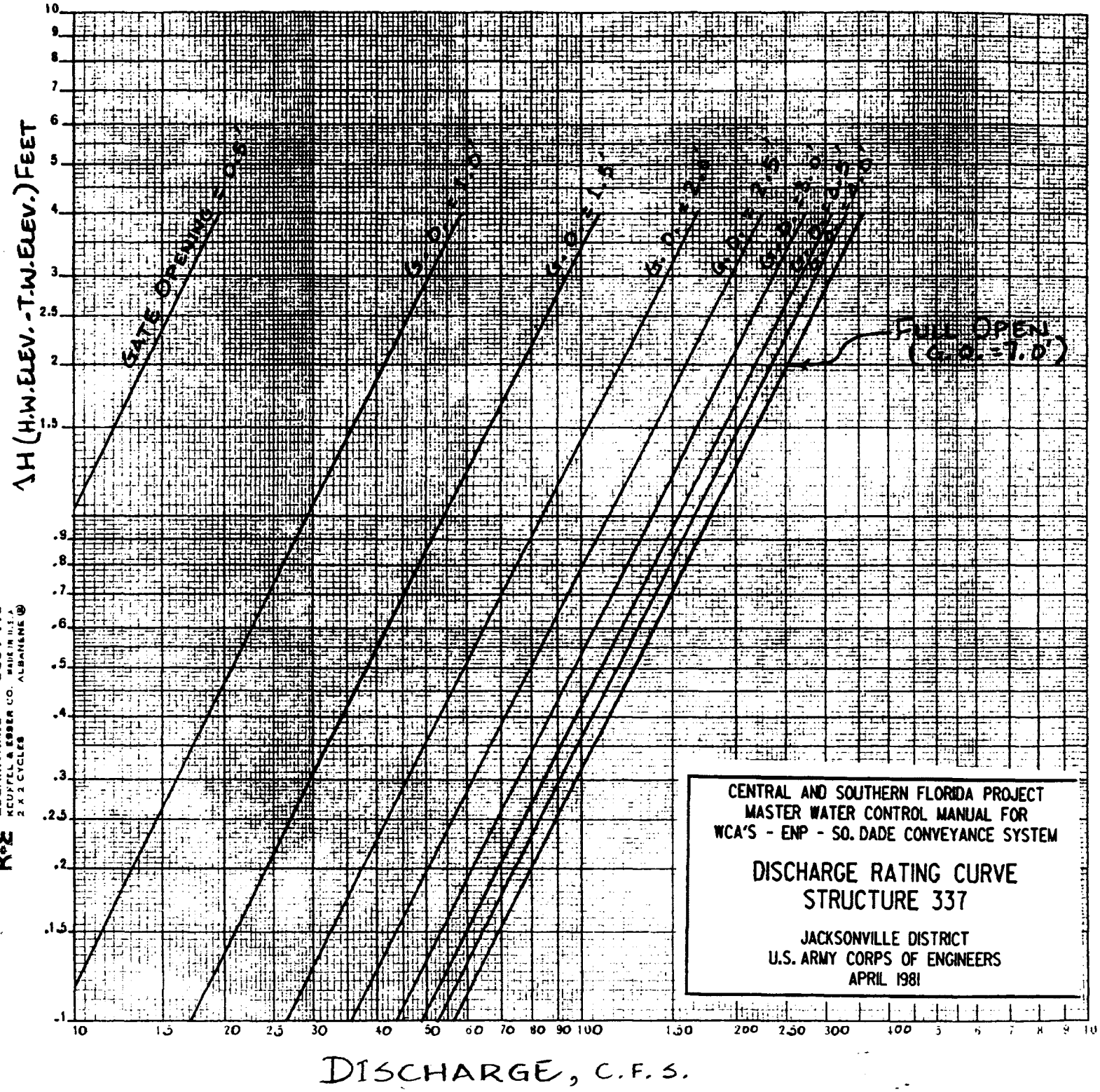
Normal Regulation. S-337 supports an optimum water level in the L-30 borrow canal of 6.0 feet between S-337 and S-335.

Low Flow Regulation. When S-337 makes supplemental releases from WCA No. 3 via the L-30 Canal it should do so together with S-333. The total delivery amount should support the appropriate stages at S-331, S-25B and S-22 while maintaining a headwater between 5.0 feet and 6.0 feet at S-335 and below 6.0 feet at S-32B.

STRUCTURE 337 (S-337)

Summary of Hydraulic Design

Location	L-30
Design Conditions	
Discharge (cfs)	605
Type	Controlled submerged
Headwater Elevation (ft.)	5.5
Tailwater Elevation (ft.)	5.2
Optimum Tailwater Elevation (ft.)	6.0
Culvert	
Type	CMP
Number of Barrels	6
Size (dia., inches)	84
Net Length (ft.)	164
Invert Elevation (ft.)	
Headwater	-3.0
Tailwater	-4.0
Gates	
Type of Control	Manual slide gate
Number	6
Size (width x height, inches)	84 x 84
Protection Grade Elevation (ft.)	X
Operating Platform Elevation (ft.)	15.0
Dewatering Capabilities	No



A-S337-3

RATING CURVE, S-337
6-84" CMP, 152 FT. LONG
TOTAL C.F.S. IS OBTAINED
BY MULTIPLYING CURVE VALUE
BY SIX.

STRUCTURE 338 (S-338)

Location. Structure 338 is located in Canal C-1, just west of State Highway 27.

Description. S-338 is a gated, double-barreled, 84-inch, corrugated metal pipe culvert with a reinforced concrete headwall and operating platform on the upstream side. The structure has manually operated, standard slide gates and stone protection on the embankment side slopes.

Purpose. S-338 supplies water to the C-1 area to maintain adequate canal stages, to prevent saltwater intrusion at east coast structures, to provide water to the root zone of growing plants, and to permit groundwater withdrawals for water supply. S-338 also provides flood control releases from the area between Krome Avenue and L-31N and north of S-331.

Normal Regulation. This structure is normally closed except during flood events when the gates are opened fully.

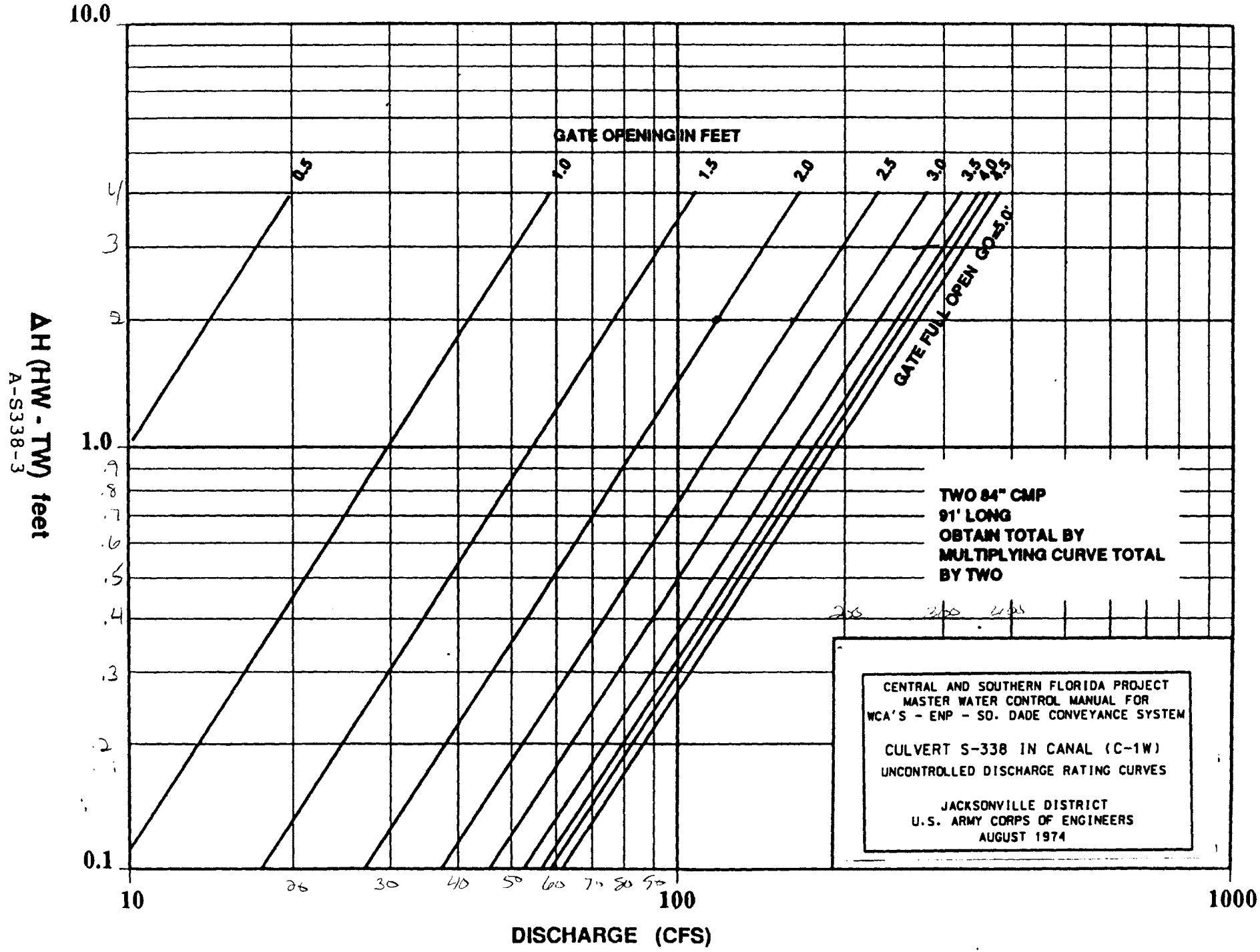
Flood Regulation. During floods, this structure is usually open but the discharge is limited to the design capacity which is 40% of the SPF.

Low Flow Regulation. During drought periods, S-338 should discharge into C-1 to provide for irrigation, ground-water recharge and the maintenance of an adequate head to prevent saltwater intrusion.

STRUCTURE 338 (S-338)

Summary of Hydraulic Design

Location	C-1
Design Conditions	
Discharge (cfs)	170
Type	Uncontrolled submerged
Headwater Elevation (ft.)	6.1
Tailwater Elevation (ft.)	5.91
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	84
Net Length (ft.)	85
Invert Elevation (ft.)	-4.5
Gates	
Type of Control	Manual slide gate
Number	2
Size (width x height, inches)	84 x 84
Protection Grade Elevation (ft.)	8.0
Operating Platform Elevation (ft.)	11.0
Dewatering Capabilities	No


GATE OPENING IN FEET
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
GATE FULL OPEN GO=5.0'
TWO 84" CMP
91' LONG
OBTAIN TOTAL BY
MULTIPLYING CURVE TOTAL
BY TWO
CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM
CULVERT S-338 IN CANAL (C-1W)
UNCONTROLLED DISCHARGE RATING CURVES
JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AUGUST 1974
10.0
1.0
0.1
ΔH (HW - TW) feet
10
100
1000
DISCHARGE (CFS)

A-S338-3

STRUCTURE 339 (S-339)

Location. Structure 339 is located in C-123 of WCA No. 3A, approximately six miles north of Everglades Parkway (Alligator Alley) in Broward County, Florida.

Description. S-339 is a vertical sheet pile barrier wall across C-123 with three 12.0 foot x 12.0 foot cast iron slide gates on the face of the wall. The gate openings will be submerged at all times.

Purpose. This structure prevents overdrainage of the northern portion of WCA No. 3A by forcing flows, from C-123 out into the marsh. It also helps to transfer water to the Everglades National Park, metropolitan Miami, and the South Dade County areas.

Normal Regulation. S-339 remains closed most of the time. When necessary, the gates are opened fully in accordance with the operation schedule. This schedule is governed primarily by the stage at gage 62 (Deer Gage). The operation is also governed by the pumping at S-8, water deliveries to Dade County and Everglades National Park and the gate opening at S-340. The optimum headwater elevation is 11.0 feet. If necessary, the optimum headwater stage can be altered by closing or opening additional gaps in the spoil mounds on either side of C-123.

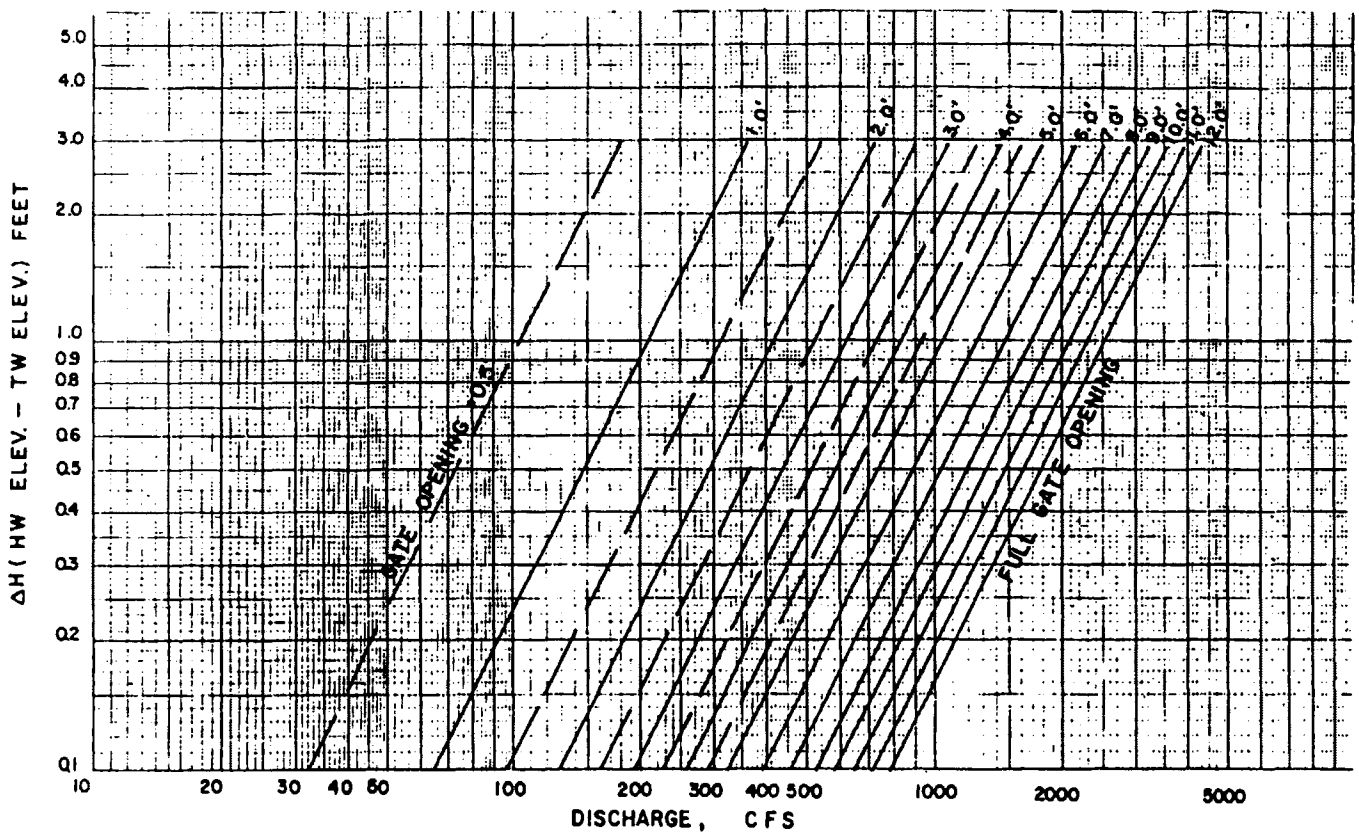
Flood Regulation. Under design conditions, S-339 will pass 1,100 cfs with a headwater stage of 10.4 ft., and a tailwater stage of 10.2 ft. The structure should be opened as shown on the operations schedule to lower excessively high stages in the northern portion of WCA No. 3A and to help with the removal of water pumped into the area at Pumping Station 8. The stage at gage 62 should be used in conjunction with the operations schedule. However, using gage 62 as a basis for operation is not intended to imply stage control in this area. The correct gate setting for a selected discharge can be determined using the discharge rating curve.

Low Flow Regulation. S-339 should be opened when necessary to transfer water from S-8 to Everglades National Park or Dade County.

STRUCTURE 339 (S-339)

Summary of Hydraulic Design

Location	C-123
Design Conditions	
Discharge (cfs)	1,100
Type	Uncontrolled submerged
Headwater Elevation (ft.)	10.4
Tailwater Elevation (ft.)	10.2
Optimum Conditions	
Headwater Elevation (ft.)	11.0
Tailwater Elevation (ft.)	9.3
Minimum Tailwater Elevation (ft.)	7.0
Gates	
Type of Control	Manual slide gate
Number	3
Size (width x height, ft.)	12 x 12
End Sill Elevation (ft.)	-2.8
Protection Grade Elevation (ft.)	15.0
Operating Platform Elevation (ft.)	26.0
Dewatering Capabilities	No



SUBMERGED CONTROLLED FLOW

RATING SHOWN IS FOR THREE 12.
FEET WIDE GATES. DIVIDE BY
THREE TO OBTAIN DISCHARGE
FOR ONE GATE.

0-145b

BASIS FOR DISCHARGE RATING CURVES

SUBMERGED CONTROLLED FLOW

BASED ON THE ORIFICE FOR FORMULA

$Q = CA\sqrt{2g\Delta H}$

C = 0.75

A = GATE OPENING X 36'

S-339 AND S-340

THREE 12.0' WIDE X 12.0' HIGH SLIDE GATES

SILL ELEVATION:

S-339 = -2.8 FEET M.S.L.

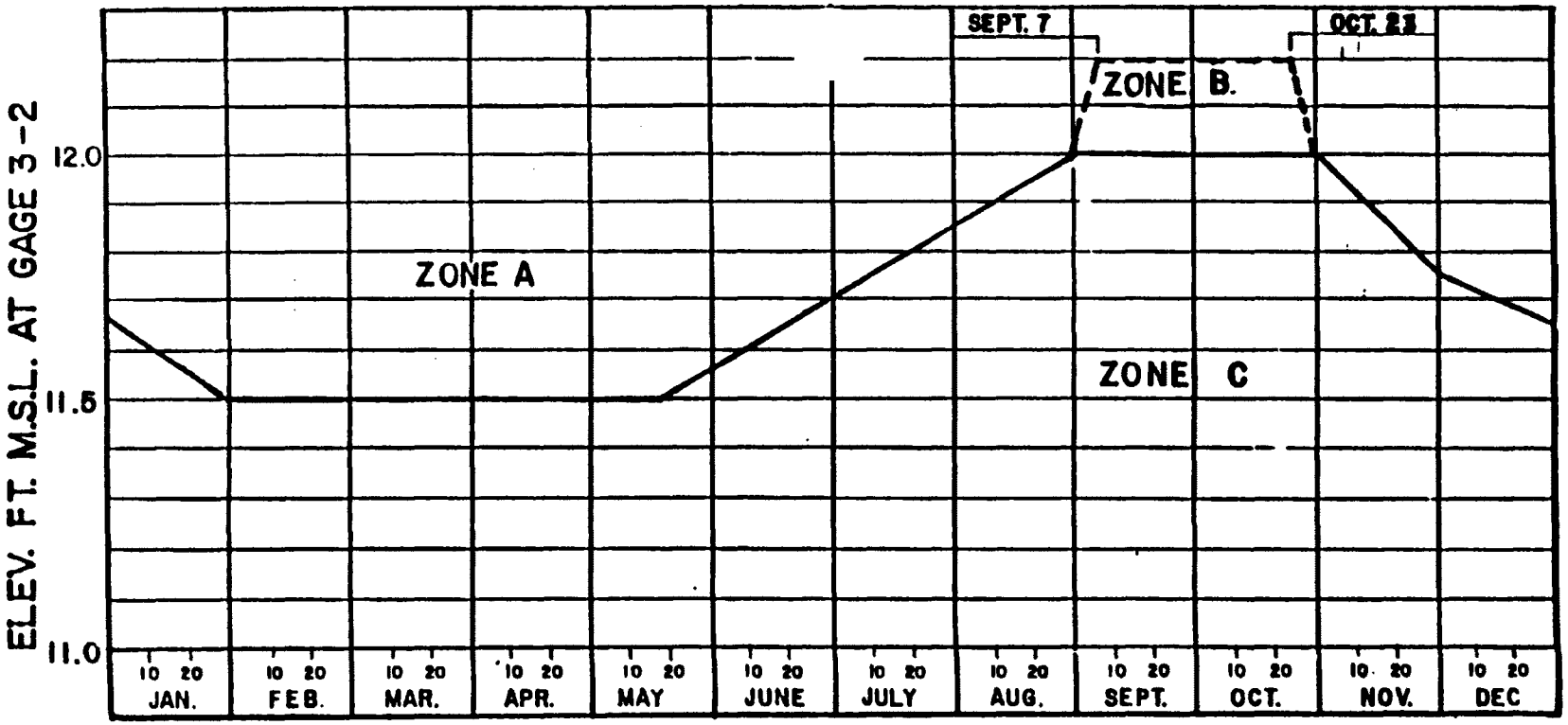
S-340 = -4.3 FEET M.S.L.

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED FLOW
STRUCTURE 339 & 340

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1977

Change
20 Aug



STRUCTURE OPERATION

ZONE	S-340	S-339
A	*OPEN AFTER 7 DAYS IN ZONE	OPEN IF S-8 PUMPING OF 15,000 ACRE FT. OR MORE EXPECTED NEXT 14 DAYS AND S-340 OPEN.
B	OPEN AFTER 30 TO 14 DAYS AS * THE ELEVATION VARIES FROM 12.0 TO 12.2 RESPECTFULLY.	
C	CLOSE AFTER .25 FT BELOW SCHEDULE UNLESS TRANSFERING WATER FROM S-8 TO DADE COUNTY OR E.N.P.	

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATIONS SCHEDULE
CANAL 123 STRUCTURE 339 AND 340

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1977

STRUCTURE 340 (S-340)

Location. Structure 340 is located in C-123 of WCA No. 3A, approximately three miles south of Everglades Parkway (Alligator Alley) in Broward County, Florida.

Description. S-340 is a vertical sheet pile barrier wall across C-123 with three 12.0 foot x 12.0 foot cast iron slide gates on the face of the wall. The gate openings are submerged at all times.

Purpose. This structure prevents overdrainage of the northern portion of WCA No. 3A by forcing flows, from C-123 out into the marsh. It also helps to transfer water to the Everglades National Park, metropolitan Miami, and the South Dade County areas.

Normal Regulation. S-340 remains closed most of the time. When necessary, the gates are fully opened in accordance with the operation schedule. This schedule is governed primarily by the stage at Gage 62 (Deer Gage). The operation is also governed by the pumping at S-8, water deliveries to Dade County and Everglades National Park. The optimum headwater elevation is 9.0 feet. If necessary, the optimum headwater stage can be altered by closing or opening additional gaps in the spoil mounds on either side of C-123.

Flood Regulation. Under design conditions, S-340 will pass 1,100 cfs with a headwater stage of 8.9 ft., and a tailwater stage of 8.7 ft. The structure should be opened as shown on the operations schedule to lower excessively high stages in the northern portion of WCA No. 3A and to help with the removal of water pumped into the area at Pumping Station 8. The stage at Gage 62 should be used in conjunction with the operations schedule. However, using Gage 62 as a basis for operation is not intended to imply stage control in this area. The correct gate setting for a selected discharge can be determined using the discharge rating curve.

Low Flow Regulation. S-340 should be opened when necessary to transfer water from S-8 to Everglades National Park or Dade County.

Constraints. To insure the structure's stability, gates should be opened when the head approaches 2.3 feet.

STRUCTURE 340 (S-340)

Summary of Hydraulic Design

Location	C-123
Design Conditions	
Discharge (cfs)	1,100
Type	Uncontrolled submerged
Headwater Elevation (ft.)	8.9
Tailwater Elevation (ft.)	8.7
Optimum Conditions	
Headwater Elevation (ft.)	9.3
Tailwater Elevation (ft.)	8.5
Minimum Tailwater Elevation (ft.)	7.0
Gates	
Type of Control	Manual Slide gate
Number	3
Size (width x height, ft.)	12 x 12
End Sill Elevation (ft.)	-4.3
Protection Grade Elevation (ft.)	13.5
Operating Platform Elevation (ft.)	24.5
Dewatering Capabilities	No

BASIS FOR DISCHARGE RATING CURVES

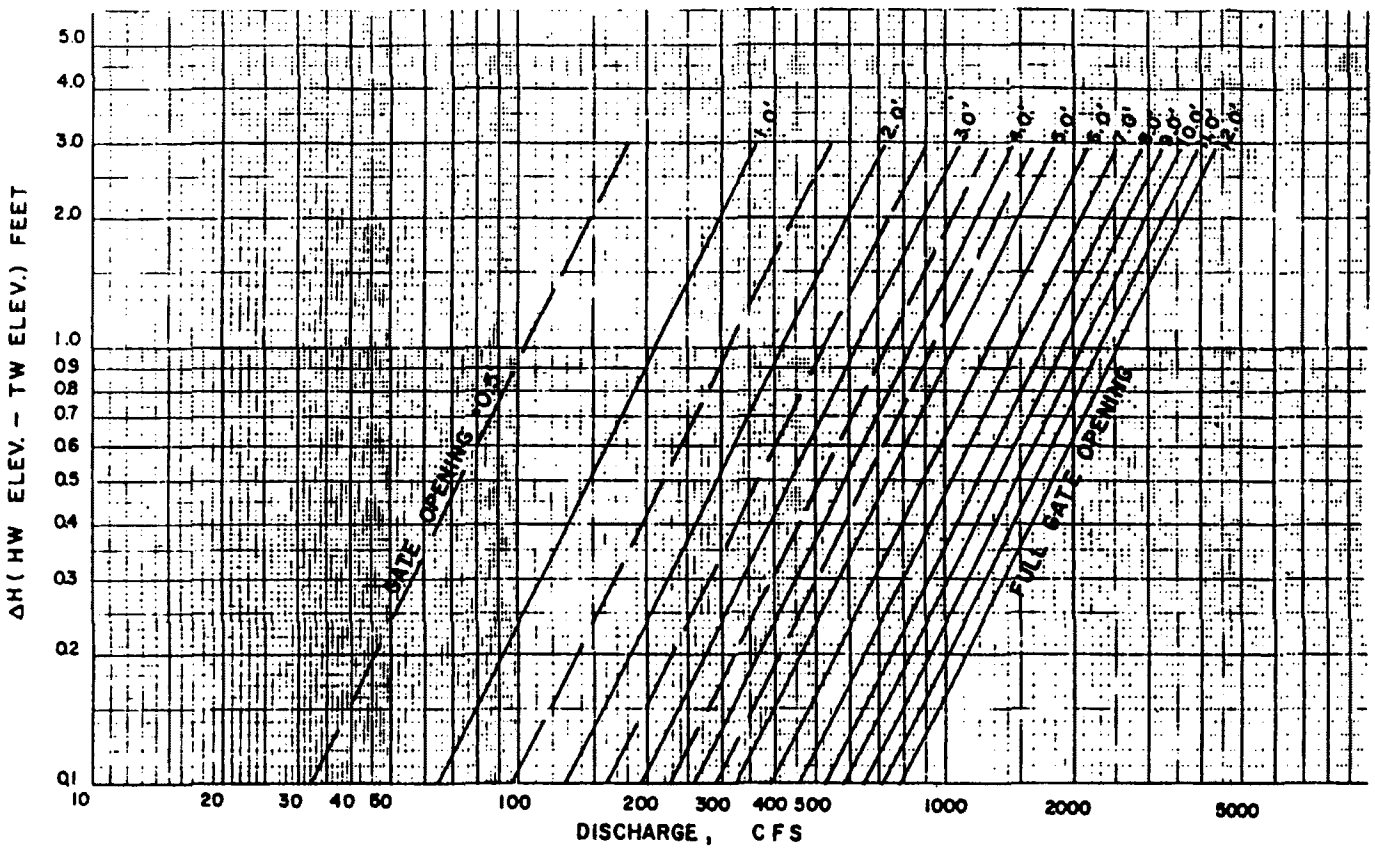
SUBMERGED CONTROLLED FLOW

BASED ON THE ORIFICE FOR FORMULA

$Q = CA\sqrt{2g\Delta H}$

C = 0.75

A = GATE OPENING X 36'



SUBMERGED CONTROLLED FLOW

S-339 AND S-340

THREE 12.0' WIDE X 12.0' HIGH SLIDE GATES

SILL ELEVATION:

S-339 = -2.8 FEET M.S.L.

S-340 = -4.3 FEET M.S.L.

RATING SHOWN IS FOR THREE 12.0 FEET WIDE GATES. DIVIDE BY THREE TO OBTAIN DISCHARGE FOR ONE GATE.

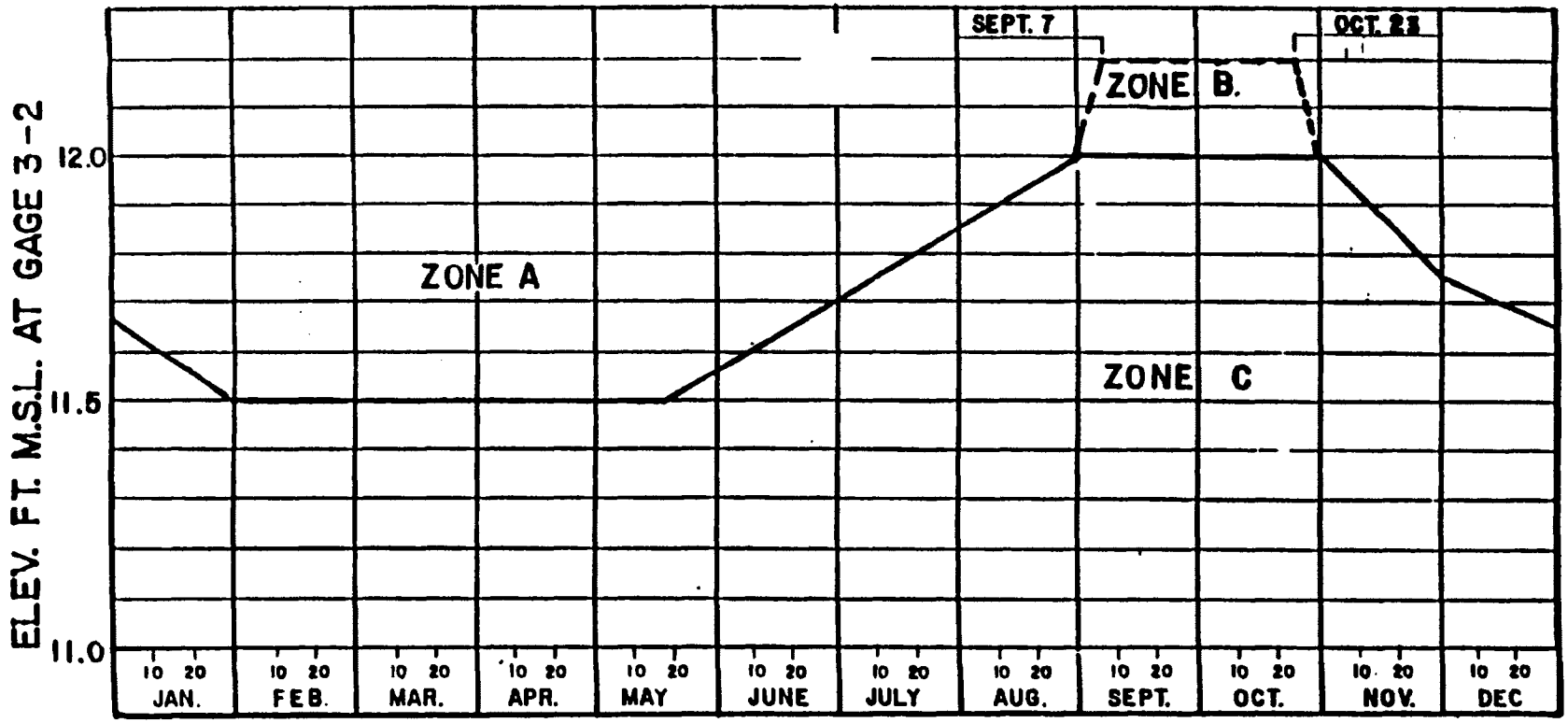
D-145b

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

DISCHARGE RATING CURVE
SUBMERGED CONTROLLED FLOW
STRUCTURE 339 & 340

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1977

Change
20 Aug



STRUCTURE OPERATION

ZONE	S-340	S-339
A	*OPEN AFTER 7 DAYS IN ZONE	OPEN IF S-8 PUMPING OF 15,000 ACRE FT. OR MORE EXPECTED NEXT 14 DAYS AND S-340 OPEN.
B	OPEN AFTER 30 TO 14 DAYS AS * THE ELEVATION VARIES FROM 12.0 TO 12.2 RESPECTFULLY.	
C	CLOSE AFTER .25 FT BELOW SCHEDULE UNLESS TRANSFERING WATER FROM S-8 TO DADE COUNTY OR E.N.P.	

CENTRAL AND SOUTHERN FLORIDA PROJECT
MASTER WATER CONTROL MANUAL FOR
WCA'S - ENP - SO. DADE CONVEYANCE SYSTEM

OPERATIONS SCHEDULE
CANAL 123 STRUCTURE 339 AND 340

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
SEPTEMBER 1977

STRUCTURE 343A (S-343A)

Location. Structure 343A is located near the junction of L-28 and L-29 about 35 miles west of Miami on U.S. 41.

Description. S-343A is a gated, three barrel, 72-inch, corrugated metal pipe culvert with manually operated, standard slide gates. There is a timber operating platform on the upstream side.

Purpose. S-343A permits discharge from WCA No. 3A during periods of excessively high stages.

Regulation. S-343A's gates are normally closed. The gates of the structure are opened when WCA 3A water levels are above schedule.

Constraints. The combined discharge of 343A and 343B shall be limited to the capacity under the bridges on U.S. 41 which is 400 cfs. In addition, the Loop Road 1 gage should not exceed an elevation of 8.5 ft.

STRUCTURE 343A (S-343A)

Summary of Hydraulic Design

Location	
L-29	
Design Conditions	
Discharge (cfs)	195
Type	Controlled
submerged	
Headwater Elevation (ft.)	9.5
Tailwater Elevation (ft.)	9.3
Culvert	
Type	CMP
Number of Barrels	3
Size (dia., inches)	72
Net Length (ft.)	82
Invert Elevation (ft.)	0.0
Gates	
Type of Control	Manual slide gate
Number	3
Size (width x height, inches)	72 x 72
Protection Grade Elevation (ft.)	17.5
Operating Platform Elevation (ft.)	17.5
Dewatering Capabilities	No
Discharge capacity per culvert:	$145(H)^{1/2}$ cfs

STRUCTURE 343B (S-343B)

Location. Structure 343B is located near the junction of L-28 and L-29 about 35 miles west of Miami on U.S. 41.

Description. S-343B is a gated, three barrel, 72-inch, corrugated metal pipe culvert with manually operated, standard slide gates. There is a timber operating platform on the upstream side.

Purpose. S-343B permits discharge from WCA No. 3A during periods of excessively high stages.

Regulation. S-343B's gates are normally closed. The gates of the structure are opened when WCA 3A water levels are above schedule.

Constraints. The combined discharge of 343A and 343B shall be limited to the capacity under the bridges on U.S. 41 which is 400 cfs. In addition, the Loop Road 1 gage should not exceed an elevation of 8.5 ft.

STRUCTURE 343B (S-343B)

Summary of Hydraulic Design

Location	L-29
Design Conditions	
Discharge (cfs)	195
Type	Controlled submerged
Headwater Elevation (ft.)	9.5
Tailwater Elevation (ft.)	9.3
Culvert	
Type	CMP
Number of Barrels	3
Size (dia., inches)	72
Net Length (ft.)	82
Invert Elevation (ft.)	0.0
Gates	
Type of Control	Manual slide gate
Number	3
Size (width x height, inches)	72 x 72
Protection Grade Elevation (ft.)	17.5
Operating Platform Elevation (ft.)	17.5
Dewatering Capabilities	No
Discharge capacity per culvert:	$145(H)^{1/2}$ cfs

STRUCTURE 344 (S-344)

Location. Structure 344 is located in L-28 about 9 miles north of U.S. 41.

Description. S-344 is a gated, two barrel, 72-inch, corrugated metal pipe culvert with manually operated, standard slide gates. There is a timber operating platform on the upstream side.

Purpose. S-344 permits discharge from WCA No. 3A during periods of excessively high stages and extends the hydroperiod in the Big Cypress National Preserve during dry periods.

Regulation. S-344's gates are normally closed. The gates of the structure are opened when WCA 3A water levels are above schedule.

Constraints. The Loop Road 1 gauge should not exceed an elevation of 8.5 ft.

STRUCTURE 344 (S-344)

Summary of Hydraulic Design

Location	L-28
Design Conditions	
Discharge (cfs)	135
Type	Controlled submerged
Headwater Elevation (ft.)	9.9
Tailwater Elevation (ft.)	9.7
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	78
Invert Elevation (ft.)	1.0
Gates	
Type of Control	Manual slide gate
Number	2
Size (width x height, inches)	72 x 72
Protection Grade Elevation (ft.)	17.5
Operating Platform Elevation (ft.)	17.5
Dewatering Capabilities	No
Discharge capacity per culvert:	$150(H)^{1/2}$ cfs

STRUCTURES 345A, B, and C (S-345A, B, and C)

NOTE: These are proposed structures.

Location. Structures 345A, B, and C are located in Levee 67A.

Description. Proposed structures consist of 3 gated culverts having design criterias and size. Each proposed structure S-345A, S-345B, and S-345C, consist of three 72-inch corrugated metal or concrete pipes with manually operated slide gates. A timber walkway and platform will be included to provide for access to the gate hoists.

Purpose. The proposed gated culvert structures will enable discharges from WCA No. 3A into WCA No. 3B. The culvert structures will provide an alternative means of discharging regulatory releases from WCA No. 3A and assist in restoring WCA No. 3B as a hydrologic component of the Everglades.

PROPOSED STRUCTURES 345A,B, and C (S-345A, B, and C)

Summary of Hydraulic Design

Location	L-67A
Design Conditions	
Discharge (cfs)	500
Headwater Elevation (ft.)	9.4
Tailwater Elevation (ft.)	7.9
S.P.F. Condition	
Discharge (cfs)	590
Headwater Elevation (ft.)	14.6
Tailwater Elevation (ft.)	12.6
Culvert	
Type	CMP
Number of Barrels	3
Size (dia., inches)	72
Net Length (ft.)	85
Invert Elevation (ft.)	0.0
Gates	
Type of Control	Slide gate
Number	3
Size (inches)	72

STRUCTURE 346 (S-346)

Location. Structure 346 is located in the borrow canal of the L-67 Extension just south of U.S. Highway 41/Tamiami Trail.

Description. S-346 is a double-barreled, 72 inch, corrugated metal pipe culvert with riser pipes. Control is affected by stop logs in risers in each culvert.

Purpose. S-346 increases the proportion of overland flow with respect to canal flow from the S12D discharge into the Everglades National Park (ENP). S-346 can be open to increase the capacity of S-12D.

Regulation. It is operated in conjunction with the S-12 structures. Normally, this structure can be open when S-12D is open and is closed when all S-12 structures are closed.

Structure 346
Hydraulic Design Data

Location	
L-67 Extension	
Design Conditions	
Discharge (cfs)	165
Type	Controlled Submerged
Headwater Elevation (ft.)	6.2
Tailwater Elevation (ft.)	6.0
Culvert	
Type	Corrugated Metal Pipe
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	
Invert Elevation (ft.)	0.0
Gates	
Type of Control	Stop Logs in Risers
Number	2
Size (dia., inches)	96
Protection Grade Elevation (ft.)	12.0
Operating Platform Elevation (ft.)	12.0
Dewatering Capabilities	No
Discharge capacity per culvert (with all boards removed):	184(H)^(1/2) cfs

Note: All elevations are in feet NGVD 1929 unless otherwise stated. Revised April 2012

STRUCTURE 346 (S-346)

Summary of Hydraulic Design

Location	L-67 Ext.
Design Conditions	
Discharge (cfs)	165
Type	Controlled submerged
Headwater Elevation (ft.)	6.2
Tailwater Elevation (ft.)	6.0
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	
Invert Elevation (ft.)	0.0
Gates	
Type of Control	Stop logs in risers
Number	2
Size (dia., inches)	96
Protection Grade Elevation (ft.)	12.0
Operating Platform Elevation (ft.)	12.0
Dewatering Capabilities	No
Discharge capacity per culvert (with all boards removed):	$184(H)^{1/2}$ cfs

STRUCTURE 347 (S-347)

Location. Structure 347 is located in the borrow canal of the L-67 Extension about 2.5 miles south of U.S. 41.

Description. S-347 is a double-barreled, 72-inch, corrugated metal pipe culvert with riser pipes. Control is effected by stop logs in risers in each culvert.

Purpose. S-347 increases the proportion of overland flow with respect to canal flow from the S-12D discharge into the Everglades National Park (ENP).

Regulation. S-347's gates are normally closed. It is opened only during unusually dry conditions when the minimum deliveries to the ENP cannot otherwise be made. It is operated in conjunction with S-346 and S-12D.

STRUCTURE 347 (S-347)

Summary of Hydraulic Design

Location	L-67 Ext.
Design Conditions	
Discharge (cfs)	165
Type	Controlled submerged
Headwater Elevation (ft.)	6.0
Tailwater Elevation (ft.)	5.8
Culvert	
Type	CMP
Number of Barrels	2
Size (dia., inches)	72
Net Length (ft.)	
Invert Elevation (ft.)	0.5
Gates	
Type of Control	Stop logs in risers
Number	2
Size (dia., inches)	96
Protection Grade Elevation (ft.)	10.5
Operating Platform Elevation (ft.)	10.5
Dewatering Capabilities	No
Discharge capacity per culvert (with all boards removed):	$184(H)^{1/2}$ cfs

STRUCTURE 355A (S-355A)

Location. S-355A is located in levee 29 (L-29), north of both the L-29 borrow canal and US Highway 41 (Tamiami Trail).

Description. S-355A is a single bay, reinforced concrete ogee weir spillway with vertical lift slide gate controls.

Purpose. S-355A was designed to provide control of water levels in WCA-3B by discharging water from WCA-3B to Northeast Shark River Slough via the L-29 borrow canal. Florida Department of Transportation (FDOT) culverts under Tamiami Trail between S-333 and S-334 allow L-29 water to be conveyed from the L-29 borrow canal to Northeast Shark River Slough. Future Tamiami Trail bridge segments are planned (Tamiami Trail Bridge Modification Project) to replace culverts and improve conveyance under Tamiami Trail.

Operation. S-355A will be opened only when southerly flow from WCA-3B to the L-29 Borrow Canal is possible. S-355A will be closed when there is a threat of reverse flow (from the L-29 Borrow Canal to WCA-3B) through the structure. S-355A is operated to maintain water levels in WCA-3B at desirable levels and/or to convey inflows from WCA-3A to the L-29 Borrow Canal. If the FDOT has no roadway subbase concerns, S-355A will be closed when the S-333 tailwater is above 9.0 feet, NGVD. However, when FDOT has roadbase concerns, S-355A will be closed when the S-333 tailwater is above 7.5 feet, NGVD. However, upon completion of the Tamiami Trail Bridge Modification Project these concerns may no longer exist.

Structure 355A

Hydraulic Design Data

Location	Levee 29
Design Conditions	
Gate/Stilling Basin Design	
Discharge (cfs)	1000
Headwater Elevation (ft.)	9.2
Tailwater Elevation (ft.)	8.9
S.P.F. Condition	
Discharge (cfs)	1000
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	9.7
Crest	
Shape	Ogee
Elevation	1.8
Design Head (Hd)(ft.)	7.4
Net Length (ft.)	8.9
Gates	
Number	2
Width x Height (ft.)	20x8.4
Clearance Elevation	10.2
Instrumentation	
Headwater recorder & staff gage	30-feet upstream
Tailwater recorder & staff gage	30-feet downstream
Gate position recorders	at structure
Stilling Basin	
Elevation	0.0
Length	20
Endsill Elevation	0.75
Baffle Block Elevation	1.0
Rows of Baffle Blocks	1
Training Wall Elevation	8.9
Channel Section	
Upstream Bottom Width (ft.)	60
Upstream Bottom Width Elevation	0.0
Upstream Side Slopes	1 on 3
Downstream Bottom Width (ft.)	Existing
Upstream Bottom Width Elevation	Existing
Upstream Side Slopes	Existing
Upstream Riprap	
Length (ft.)	10.0
Protection Elevation	12.0
Downstream Riprap	
Length (ft.)	10.0
Protection Elevation	11.0

Note: All elevations are in feet NGVD 1929 unless otherwise stated. Revised April 2012

STRUCTURE 355B (S-355B)

Location. S-355B is located in levee 29 (L-29), north of both the L-29 borrow canal and US Highway 41 (Tamiami Trail).

Description. S-355B is a single bay, reinforced concrete ogee weir spillway with vertical lift slide gate controls.

Purpose. S-355B was designed to provide control of water levels in WCA-3B by discharging water from WCA-3B to Northeast Shark River Slough via the L-29 borrow canal. Florida Department of Transportation (FDOT) culverts under Tamiami Trail between S-333 and S-334 allow L-29 water to be conveyed from the L-29 borrow canal to Northeast Shark River Slough. Future Tamiami Trail bridge segments are planned (Tamiami Trail Bridge Modification Project) to replace culverts and improve conveyance under Tamiami Trail.

Operation. S-355B will be opened only when southerly flow from WCA-3B to the L-29 Borrow Canal is possible. S-355B will be closed when there is a threat of reverse flow (from the L-29 Borrow Canal to WCA-3B) through the structure. S-355B is operated to maintain water levels in WCA-3B at desirable levels and/or to convey inflows from WCA-3A to the L-29 Borrow Canal. If the FDOT has no roadway subbase concerns, S-355B will be closed when the S-333 tailwater is above 9.0 feet, NGVD. However, when FDOT has roadbase concerns, S-355B will be closed when the S-333 tailwater is above 7.5 feet, NGVD. However, upon completion of the Tamiami Trail Bridge Modification Project these concerns may no longer exist.

Structure 355B

Hydraulic Design Data

Location	Levee 29
Design Conditions	
Gate/Stilling Basin Design	
Discharge (cfs)	1000
Headwater Elevation (ft.)	9.2
Tailwater Elevation (ft.)	8.9
S.P.F. Condition	
Discharge (cfs)	1000
Headwater Elevation (ft.)	10.0
Tailwater Elevation (ft.)	9.7
Crest	
Shape	Ogee
Elevation	1.8
Design Head (Hd)(ft.)	7.4
Net Length (ft.)	8.9
Gates	
Number	2
Width x Height (ft.)	20x8.4
Clearance Elevation	10.2
Instrumentation	
Headwater recorder & staff gage	30-feet upstream
Tailwater recorder & staff gage	30-feet downstream
Gate position recorders	at structure
Stilling Basin	
Elevation	0.0
Length	20
Endsill Elevation	0.75
Baffle Block Elevation	1.0
Rows of Baffle Blocks	1
Training Wall Elevation	8.9
Channel Section	
Upstream Bottom Width (ft.)	60
Upstream Bottom Width Elevation	0.0
Upstream Side Slopes	1 on 3
Downstream Bottom Width (ft.)	Existing
Upstream Bottom Width Elevation	Existing
Upstream Side Slopes	Existing
Upstream Riprap	
Length (ft.)	10.0
Protection Elevation	12.0
Downstream Riprap	
Length (ft.)	10.0
Protection Elevation	11.0

Note: All elevations are in feet NGVD 1929 unless otherwise stated.

Revised April 2012

STRUCTURE 357 (S-357)

Location. The S-357 pump station is located approximately 20 miles southwest of Miami, approximately 3 miles west of Krome Avenue, and approximately 300 feet south of SW 168th Street (Richmond Drive) between SW 205th and SW 206th Avenues.

Description. The S-357 pump station has a capacity of 575 cubic feet per second (cfs), consisting of 4 diesel driven pumps (125 cfs each) and one electric driven pump (75 cfs). The four diesel driven vertical axial flow pumps have a discharge capacity of 56,100 gallons per min (125 cfs) against a total head corresponding to a static head of 15.5 feet, and are capable of constant speed operation from a static head of 15.5 feet down to and including a static head of 6.0 feet with water surface in intake sump ranging from elevation 0.0 feet to elevation 9.5 feet. The electric motor driven pump has a discharge capacity of 33,665 gallons per min (75 cfs) against total head corresponding to a static head of 14.5 feet, and are capable of constant speed operation from a static head of 14.5 feet down to and including a static head of 5 feet with water surface in intake sump ranging from elevation 0.0 feet to elevation 9.5 feet.

The station occupies a footprint approximately 50 feet by 100 feet in plan with an operating finish floor elevation of 18.5 feet and upstream service bridge elevation of 10.0 feet. The seepage canal transitions from a bottom width of 30 feet at elevation of negative 8.5 feet approximately 175 feet upstream of the pump station to a bottom width of 65 feet at elevation negative 12.0 at the beginning of the upstream apron. The S-357 pump station discharges into a settling pond with a concrete apron at elevation 1.0 foot. From the settling pond the flow will transition back to natural grade where the water will flow via an approximately 320 feet wide above ground flow-way to the Detention Cell (DC). Following completion of the C-111 Northern Detention Area (NDA) construction, discharges from the DC into the NDA will be allowed.

Purpose. S-357 will maintain water stages within the interior seepage canal to provide for flood damage reduction (flood mitigation) in the 8.5 SMA and to preserve hydroperiods within the Everglades. The seepage canal and S-357 are designed to work together to maintain water levels within the area interior of the outer perimeter levee. The objective is to control the water level in the seepage collection canal to maintain the groundwater levels within the area interior of the perimeter levee at the same levels as existed prior to the implementation of the MWD project.

Operation. Prior to the completion of the C-111 NDA, the 8.5 SMA pump station and general area will be operated as follows:

The S-357 pump station will turn on when the stilling well water level reaches elevation 6.2 feet. The pump will turn off when the stilling well water level is lower than elevation 5.7 feet. The pump station will pump as required to maintain this upstream canal stage and prevent surface water discharge from the DC. The pumping discharge rate will be reduced or shutdown completely to prevent an overflow event during these interim operations.

DISCHARGE CHARACTERISTICS

Design Discharge Rate (combined):	575 cfs

DESCRIPTION OF STRUCTURE

Number of Pumps:	5
Motor Size:	
1-75-cfs electric pumps:	75 hp
4-125-cfs diesel pumps:	500 hp
Intake Water Surface Elevations	
Maximum Pumping	9.5 ft
Maximum Non-Pumping	7.0 ft
Normal Pumping	5.0 ft to 6.5 ft
Start Pumping	6.2 ft
Normal Drawdown Pumping	5.7 ft
Minimum Pumping	0.0 ft
Minimum Non-Pumping	0.0 ft
Discharge Water Surface Elevations	
Maximum Pumping	11.0 ft
Normal Pumping	6.0 ft to 9.0 ft
Minimum Pumping	5.0 ft
Minimum Non-Pumping	5.0 ft
Channels & Approaches	
Channel Bottom Width	30 ft
Side Slopes	1V:1H 1V:3H above Miami Oolite (Near surface)
Intake Channel Invert	-8.5 ft
Discharge Pond Invert	1.0 ft

POWER SOURCE

Prime Movers	Commercial electricity Commercial Diesel

STATION POWER

Normal	Commercial electricity
Emergency Electrical	generator backup

HYDRAULIC AND HYDROLOGIC MEASUREMENTS

Stilling wells and staff gages located at upstream and downstream of structure.

ACCESS: Access to S-357 pump station is to the south, off of Richmond Drive.

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX B

DROUGHT CONTINGENCY PLAN

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

APPENDIX B

TABLE OF CONTENTS

DROUGHT CONTINGENCY PLAN FOR WATER CONSERVATION AREAS

Paragraph	Title	Page No.
B-01	Purpose	B-1
B-02	References	B-1
B-03	Introduction	B-1
B-04	Background	B-1
B-05	Summary of Existing Water Control Plan	B-1
B-06	Definition of Drought	B-1
B-07	Drought Management Plan	B-2
Selected Federal Emergency Authorities Providing Drought Assistance		B-3
Corps Authority for Drought Assistance		B-3

List of Tables

Table No.	Title	Page No.
B-1.	C&SF Authorized Project Purposes	B-4

List of Exhibits

Exhibit A - Chapter 40E-21 - "Water Shortage Plan" published by SFWMD

B-01. Purpose. This appendix is written to (1) provide a platform from which to make decisions to implement water conservation measures during droughts, (2) review the operational flexibility of the Water Conservation Areas - Everglades National Park and ENP South Dade Conveyance Canals Water Control Plan in a drought, and (3) address the potential problems associated with an extreme drought.

B-02. References.

a. ER 1110-2-1941 - "Drought Contingency Plans"
b. ER 1110-2-240 - "Water Control Management"
c. EM 1110-2-3600 - "Management of Water Control Systems"
d. Water Control Plan for Water Conservation Areas and South Dade Conveyance System - Chapter VII
e. Chapter 40E-21 - "Water Shortage Plan" published by SFWMD (Exhibit A)

B-03. Introduction. A severe drought in the Water Conservation Areas develops over a fairly long period of time and has a typical duration of 6 to 12 months. Adequate time will be available to plan specific details of drought operation. Therefore, this plan is an outline of water management measures and coordination actions to be considered when a severe drought occurs. Details of particular water management measures and the timing of their application will be determined as the drought progresses.

B-04. Background. In 1949, the Central and Southern Florida Flood Control District (C&SFFCD) was established and became the local sponsor for the project works of the Central and Southern Florida Project for flood control and other purposes. In 1972, the C&SFFCD was renamed the South Florida Water Management District (SFWMD). As a government agency, the SFWMD has established rules and regulations that establish priorities and define procedures for restricting water use during conditions of water shortage. The "Water Shortage Plan" published by the South Florida Water Management District is an exhibit to this plan.

B-05. Summary of Existing Water Control Plan. The authorized purposes of the Comprehensive Central and Southern Florida Project for Flood Control are flood control, navigation, environmental enhancement, water supply, groundwater recharge, and prevention of salinity intrusion. A complete listing of project purposes is found in Table B-1. Under normal conditions water is released from Water Conservation Areas to maintain desired water levels in WCA's, Everglades National Park and the South Dade Conveyance System. The volume of water released is limited only by the capacity of the outlet structures. The water control plan for Water Conservation Areas is written to provide for these purposes. Regulation flexibility is very limited under existing authority. When the elevations in the project areas are below their optimum, the project will be operated to meet water supply, environmental enhancement, and prevention of salinity intrusion.

B-06. Definition of Drought. Droughts generally are considered to have three components - duration, magnitude (average water deficiency), and severity (cumulative water deficiency). Dry periods occur randomly during any time period. There is no major indicator to distinguish "normal" dry periods from severe droughts. Conditions may vary slightly depending on the time of year, length of time that water elevations remain below optimum levels, and the water supply and water quality requirements. The SFWMD uses the following definitions:

40E-21.051 Definitions

(1) "Water shortage" means that situation within all or part of the District when insufficient water is available to meet the present and anticipated needs of the users, or when conditions are such as

to require temporary reduction in total use within a particular area to protect water resources from serious harm. A water shortage usually occurs due to drought.

(2) "Water shortage emergency" means that situation when the powers which can be exercised under Part II of Chapter 40E-21 are not sufficient to protect the public health, safety, or welfare, or the health of animals, fish or aquatic life, or a public water supply, or commercial, industrial, agricultural, recreational or other reasonable uses.

B-07. Drought Management Plan.

a. Management Principles. Water conservation is the most efficient and practical option to obtain additional supplies of water using the same sources. It should be the option of primary consideration provided it does not create environmental, health, or other negative effects. If it does, it could be more effective to control or mitigate those effects before going to other options.

b. Actions. If the SFWMD determines there is an increased likelihood that there will be an insufficient amount of water to meet the estimated anticipated user demands within a source class or to protect the water resource from serious harm, the following actions may be initiated by the SFWMD and the Jacksonville District of the Corps of Engineers. The actions include but are not limited to:

1. Initiation of appropriate the SFWMD Water Shortage Plan and "General Water Use Restrictions" as established in Chapter 40E-21.271 by the SFWMD. (These rules are an exhibit to this plan).

SFWMD's Water Shortage Plan provides specific guidelines for water restrictions which are based on the type of use and severity of the drought. Included within the plan are water use reductions which range from 15% to as much as 60% of estimated need.

Note: Water deliveries to Everglades National Park are not reduced except by physical limitations imposed by the drought. Water deliveries to the ENP are computed using a "Rainfall" equation which accounts for floods and droughts.

2. Enforcement of the water use restrictions by the SFWMD.

3. Public press releases shall be made on an "as-need" basis through the Public Affairs Office (PAO) of the Jacksonville District. These statements shall provide the public with a full explanation of drought operations and expected conditions in an effort to reduce inquiries from recreation and concerned interests. Similarly, the SFWMD will make press releases notifying the public of water use restrictions.

EOC

4. Drought situation reports for the Central and Southern Florida Project and other projects within the Jacksonville District shall be prepared by the Water Management and Meteorology Section of the Jacksonville District. This report shall provide detailed information on current and forecast situations for informational purposes of District and South Atlantic Division (SAD) elements. The report will include general descriptions of the drought and climatic conditions, current Palmer Indices, rainfall summaries, stages and storages for the projects, and current water use restrictions.

5. Temporarily relax State standards for water quality requirements in the Lake and the Water Conservation Areas to permit the continued operation of agricultural pumps, and conserve remaining water in storage.

6. Should water quality or all water supply storage become depleted, potential alternatives include but are not limited to:

(a) Emergency reallocation of water from other parts of the Central and Southern Florida project.

(b) Declaration by the State of Florida of a water emergency. After a water emergency has been declared, emergency diversions to meet the needs of human consumption, necessary sanitation, and public safety can be made.

SELECTED FEDERAL EMERGENCY AUTHORITIES PROVIDING DROUGHT ASSISTANCE

The responsibility for providing an adequate supply of water to inhabitants of any area is basically non-Federal. Corps assistance to provide emergency water supplies will only be considered when non-Federal interests have exhausted reasonable means for securing necessary water supplies, including assistance and support from other Federal agencies.

Assistance may be available from the Corps through PL 84-99 as amended by PL 95-51. Before Corps assistance is considered under PL 95-51, the applicability of other Federal authorities should be evaluated. If these programs cannot provide the needed assistance, then maximum coordination should be made with appropriate agencies in implementing Corps assistance. The applicability of programs administered by the following Federal agencies, as a minimum, will be determined prior to consideration of Corps assistance.

1. Small Business Administration (SBA).

2. Farmers Home Administration (FmHA).

3. Economic Development Administration (EDA).

Corps Authority for Drought Assistance.

The Corps authority for Drought Assistance is contained in Chapter 6, "Emergency Water Supplies and Drought Assistance" of Engineering Regulation (ER) 500-1-1 Natural Disaster Procedures (1983). Under this authority, the Chief of Engineers, acting for the Secretary of the Army, can construct wells and transport water to farmers, ranchers, and political subdivisions within areas he determines to be drought-distressed.

Table B-1

C&SF Authorized Project Purposes 1/

Purpose	Authorizing Law
1. Flood Control	PL 71-520, PL 80-858, PL 87-874, and PL 90-843
2. Navigation	PL 71-520 and PL 80-858
3. Agricultural Water Supply 3/	PL 80-858 and PL 90-483
4. Municipal and Industrial Water Supply 3/	PL 80-858, PL 90-483, and PL 87-874
5. Preservation of Fish and Wildlife	PL 80-858, PL 85-624, PL 90-843, and PL 93-205 4/
6. Drainage and Water Control	PL 80-858, PL 87-874, and PL 90-483
7. Preservation of Everglades National Park	PL 90-483 PL 101-229
8. Water Supply to Everglades National Park	PL 80-858, PL 90-483, PL 91-282, PL 98-181, PL 99-190, PL 101-229, and PL 100-676
9. Recreation	PL 90-483, PL 78-534, PL 87-874, and PL 89-72
10. Water Quality Control	PL 90-483, PL 92-500, and PL 95-217
11. Prevention of Saltwater Intrusion	PL 80-858, PL 90-483, and PL 87-874
12. Environmental Protection	PL 101-640, PL 91-190, PL 99-662, 2/ and PL 100-676 2/
13. Groundwater Recharge	PL 80-858 and PL 87-874

Table B-1 (Continued)

C&SF Authorized Project Purposes 1/

Purposes of Operation:

Flood Control
Navigation
Water Supply
Preservation of Fish and Wildlife
Drainage and Water Control
Recreation
Prevention of Saltwater Intrusion
Water Quality Control
Environmental Protection
Water Supply to Everglades National Park
Preservation of Everglades National Park
Groundwater Recharge

Notes:

1/ Agricultural and Conservation Areas, Kissimmee River Basin and Related Areas, Upper St. Johns River Basin and Related Areas, Lake Okeechobee and Outlets, Coastal Areas South of St. Lucie Canal,

2/ Kissimmee River Basin Section 1135 modifications.

3/ This was also called Water Conservation in H.D. 80-643. See discussion of water supply in H.D. 85-186.

4/ As amended by PL 95-632, PL 96-159, and PL 97-304.

PL 71-520 authorized the Project for the Caloosahatchee River and Lake Okeechobee Drainage Areas. PL 80-858 modified and expanded the Project for the Caloosahatchee River and Lake Okeechobee Drainage Areas to include the first phase of the C & SF Project as recommended in H.D. 80-643. PL 83-780 authorized the remainder of the Comprehensive Plan found in H.D. 80-643. Completed work under the Project for Caloosahatchee River and Lake Okeechobee Drainage Areas that did not pertain to navigation have been maintained as a part of the C&SF Project since July 1950 (1950 Annual Report-Chief of Engineers). The navigation project since then has been known as the Okeechobee Waterway.

EXHIBIT A

Chapter 40E-21 - "Water Shortage Plan"

Rules of the South Florida Water Management District

WATER SHORTAGE PLAN
CHAPTER 40E-21, F.A.C.

Effective November 19, 2007

The 2007 SFWMD Water Shortage Plan can be found at:
https://www.sfwmd.gov/sites/default/files/documents/40e-21_0.pdf

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS, EVERGLADES NATIONAL PARK, AND ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX C

AGREEMENTS WITH NON-FEDERAL SPONSORS

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

Central and Southern Florida Flood Control District

RESOLUTION NO. 224

ASSUMPTION OF RESPONSIBILITY FOR COMPLIANCE WITH CONDITIONS OF LOCAL COOPERATION WITH FEDERAL GOVERNMENT UNDER FEDERAL AUTHORIZATION ENACTED BY 83rd CONGRESS, 2nd SESSION

WHEREAS, on the first day of August 1949 the Governing Board of Central and Southern Florida Flood Control District in regular meeting duly assembled at West Palm Beach, Florida, adopted a resolution, dated August 1, 1949 and numbered 12, whereby the said Board on behalf of the Central and Southern Florida Flood Control District agreed to and did assume full responsibility for compliance with the specific requirements of local cooperation set forth in House Document No. 643, Eightieth Congress, Second Session, and in detail in the second paragraph of said resolution; and,

WHEREAS the Flood Control Act of 1954, Public Law No. 780, of the Eighty-third Congress, Second Session, adopted and authorized modification and expansion of the comprehensive plan for Flood Control and other purposes in Central and Southern Florida authorized by the Flood Control Act of June 30, 1948, and amendments thereto, to include the entire comprehensive plan of improvement as recommended by the Report of the Chief of Engineers in House Document No. 643, Eightieth Congress, with such modifications thereof as the Congress may thereafter authorize; Provided that the conditions of local cooperation for the authorized first phase approved by the said Flood Control Act of June 30, 1948, shall apply to that authorized first phase, but for all work over and beyond that previous authorization such conditions shall apply on an interim basis only until they shall be modified as deemed appropriate by the Congress, based on recommendations to be submitted at the earliest practicable date by the Chief of Engineers through the Bureau of the Budget to the Congress: Provided further, That whatever conditions of local cooperation are established by Congress as a result of such recommendations shall be retroactive to any units of the comprehensive plan authorized in the Flood Control Act of September 1, 1954, which may be started prior to establishment of the exact conditions of local cooperation; and,

WHEREAS, the Central and Southern Florida Flood Control District has informally indicated its willingness and intention to assume responsibility for the compliance with conditions of local cooperation for the comprehensive plan for flood control and other purposes in Central and Southern Florida set forth in the Flood Control Act of 1954, Public Law No. 780 of the Eighty-third Congress, Second Session:

NOW, THEREFORE, BE IT RESOLVED by the Governing Board of Central and Southern Florida Flood Control District, in regular meeting duly assembled on the 15th day of September, 1954, at West Palm Beach, Florida, that the Governing Board of Central and Southern Florida Flood Control District by this Resolution agrees to and hereby assumes full responsibility for compliance with the aforementioned requirements of local cooperation which are set forth in detail in the Flood Control Act of 1954, Public Law No. 780, Title Two, Eight-third Congress, Second Session, under the heading CENTRAL AND SOUTHERN FLORIDA in Section 203 thereof, and specifically including compliance with whatever conditions of local cooperation are established by Congress to apply retroactively to any units of the comprehensive plan authorized by the said Flood Control Act of 1954 which may be started prior to establishment of the exact conditions of local cooperation applicable to units of the comprehensive plan authorized by the said Flood Control Act of 1954.

PASSED and ADOPTED, at West Palm Beach, Florida, this the 15th day of September, A. D., 1954.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

(Corporate Seal)

BY /s/F. Elgin Bayless
Chairman

ATTEST:

/s/ W. Turner Wallis
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, W. TURNER WALLIS, Secretary of the Governing Board of Central and Southern Florida Flood Control District, do hereby certify that the foregoing is a true and correct copy of Resolution No. 224 duly adopted by the Governing Board of said District on the 15th day of September A.D. 1954.

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board this 18th day of October, A. D. 1954.

/s/ W. Turner Wallis
W. Turner Wallis, Secretary of
the Governing Board aforesaid

(typed: 3 June 59)

#383

SAKRE

3 - JUN 1959

Mr. D. G. Click
Chairman
Central and Southern Florida
Flood Control District
901 Evernia Street
West Palm Beach, Florida

Re: Local Assurances
(Arch Creek, Florida) (C + S F)

Dear Mr. Click:

Receipt is acknowledged of certified copies of Resolution No. 383, adopted by the Governing Board of Central and Southern Florida Flood Control District on 9 April 1959, providing the assurances of local cooperation in connection with Arch Creek Flood Control Project as required by Congress.

Your assurances are hereby accepted; however, it should be understood that the giving of acceptable assurances does not in itself, alone, satisfy the requirements of local cooperation as such requirements can be met by actual performance only.

Your cooperation with the Government in connection with this project is appreciated.

Sincerely yours,

PAUL D. TROYER
Colonel, Corps of Engineers
District Engineer

Mr.Fryer:pg
SPOONER

Cy furnished:
Chief, Eng. Div. w/cy Assur.
Chief, Operations Div.
w/cy Assur.

4

Central and Southern Florida Flood Control District

RESOLUTION NO. 383

ASSURANCE TO THE CORPS OF ENGINEERS, U. S. ARMY OF LOCAL COOPERATION FOR THE CONSTRUCTION OF ARCH CREEK AND ITS CONTROL STRUCTURE, DADE COUNTY, FLORIDA

WHEREAS, Section 205 of Public Law 858, 80th Congress, as amended, and including the amendment set forth in Public Law 685, 84th Congress, 2d Session, authorizes the Secretary of the Army to construct certain small flood control projects not specifically authorized by Congress, which come within the provisions of Section I of the Flood Control Act of June 22, 1936; and

WHEREAS, Arch Creek and its control structure in Dade County, Florida has been authorized by the Secretary of the Army for improvement and construction; and

WHEREAS, prior to commencement of construction, under the above authorization, it is necessary for local interests to agree to cooperate in connection with this project.

NOW THEREFORE BE IT RESOLVED by the Governing Board of Central and Southern Florida Flood Control District that as the representative of local interests it does agree to the following cooperation with the United States for Arch Creek, Dade County, Florida: (a) to furnish without cost to the United States all necessary lands, easements and rights of way, when and as required; (b) assume the cost of all relocations and alterations incident to construction of the proposed improvements; (c) hold and save the United States free from damages that may result from construction, operation, and maintenance of the improvements; (d) operate and maintain the works after completion in accordance with regulations prescribed by the Secretary of the Army.

PASSED AND ADOPTED, this the 9th day of April, A. D., 1959.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

By /s/ D. G. Click
Chairman

(Corporate Seal)

ATTEST:

/s/ G. E. Dail, Jr.
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, G. E. DAIL, JR., Secretary of the Governing Board of CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, do hereby certify that the foregoing is a true and correct copy of Resolution No. 383 , duly adopted by the Governing Board of said District on the 9th day of April, A. D., 1959

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this Certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board, this the 1st day of June, A. D., 1959

G. E. Dail Jr.
G. E. DAIL, JR., Secretary of
the Governing Board aforesaid

(Corporate Seal)

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

RESOLUTION NO. 511

ASSUMPTION OF RESPONSIBILITY FOR COMPLIANCE WITH CONDITIONS OF LOCAL COOPERATION WITH FEDERAL GOVERNMENT UNDER FEDERAL AUTHORIZATION ENACTED BY 87th CONGRESS, 2d SESSION, RELATING TO SENATE DOCUMENT 146 (WEST PALM BEACH CANAL, FLORIDA)

WHEREAS, on the 1st day of August 1949, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 12 agreeing to and assuming full responsibility for compliance with the specific requirements of local cooperation set forth in House Document No. 643, 80th Congress, 2d Session; and

WHEREAS, on the 15th day of September 1954, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 224 agreeing to and assuming full responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1954, Public Law 780, Title II, 83rd Congress, 2d Session, under the heading, Central and Southern Florida in Section 203 thereof; and

WHEREAS, on the 9th day of October 1959, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 393 agreeing to and assuming responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1958, Public Law 85-500, 85th Congress, 2d Session, as recommended by House Document No. 186, 85th Congress, 2d Session; and

WHEREAS, the Flood Control Act of 1962, Public Law 87-874, 87th Congress, 2d Session, adopted and authorized modifications to be comprehensive plan for flood control in Central and Southern Florida as recommended by Senate Document No. 146, 87th Congress, 2d Session, with respect to the West Palm Beach Canal and which provides for the acceptance by non-Federal interests of certain requirements of local cooperation.

NOW THEREFORE BE IT RESOLVED, by the Governing Board of the Central and Southern Florida Flood Control District that it does agree to and hereby assumes responsibility for compliance with the requirements of local cooperation as set forth in Senate Document No. 146, 87th Congress, 2d Session, West Palm Beach Canal, Florida, in that it will:

1. Contribute in cash 12.5 per cent of the contract price plus supervision and administration thereof for all items of work to be provided by the Corps of Engineers, an amount presently estimated at $444,000, to be paid in a lump sum prior to start of construction, or in installments prior to start of pertinent work items in accordance with construction schedules as required by the Chief of Engineers, the final allocation of cost to be made after the actual costs have been determined;
2. Construct and maintain at no cost to the Federal Government the lateral drainage facilities needed to realize the benefits potential made available by the proposed improvements to the West Palm Beach Canal;
3. Provide without cost to the United States all lands, easements, and rights of way necessary for construction of the project;
4. Assume the cost of construction of all new highway bridges and of all relocations or alterations of existing bridges, roads, utilities, or other improvements, except railroad bridges and approaches;
5. Hold and save the United States free from damages due to the construction works;
6. Prevent encroachment on the flood-carrying capacity of the improved channel; and
7. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army.

PASSED and ADOPTED, this the 5th day of April, A.D. 1963.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

By Riley S. Miles
Chairman

(Corporate Seal)

ATTEST:

/s/ G. E. Dail, Jr.
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, G. E. DAIL, JR., Secretary of the Governing Board of CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, do hereby certify that the foregoing is a true and correct copy of Resolution No. 511 , duly adopted by the Governing Board of said District on the 5th day of April, A. D., 19 63.

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this Certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board, this the 16th day of April, A. D., 19 64.

G. E. DAIL, JR., Secretary of the
Governing Board aforesaid

(Corporate Seal)

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

RESOLUTION NO. 512

ASSUMPTION OF RESPONSIBILITY FOR COMPLIANCE WITH CONDITIONS OF LOCAL COOPERATION WITH FEDERAL GOVERNMENT UNDER FEDERAL AUTHORIZATION ENACTED BY 87th CONGRESS, 2d SESSION, RELATING TO SENATE DOCUMENT 138 (SOUTH DADE COUNTY, FLORIDA)

WHEREAS, on the 1st day of August 1949, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 12 agreeing to and assuming full responsibility for compliance with the specific requirements of local cooperation set forth in House Document No. 643, 80th Congress, 2d Session; and

WHEREAS, on the 15th day of September 1954, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 224 agreeing to and assuming full responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1954, Public Law 780, Title II, 83rd Congress, 2d Session, under the heading, Central and Southern Florida in Section 203 thereof; and

WHEREAS, on the 9th day of October 1959, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 398 agreeing to and assuming responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1958, Public Law 85-500, 85th Congress, 2d Session, as recommended by House Document No. 186, 85th Congress, 2d Session; and

WHEREAS, the Flood Control Act of 1962, Public Law 87-874, 87th Congress, 2d Session, adopted and authorized modifications to the comprehensive plan for flood control in Central and Southern Florida as recommended by Senate Document No. 138, 87th Congress, 2d Session, with respect to South Dade County and which provides for the acceptance by non-Federal interests of certain requirements of local cooperation.

NOW THEREFORE BE IT RESOLVED, by the Governing Board of the Central and Southern Florida Flood Control District that it does agree to and hereby assumes responsibility for compliance with the requirements of local cooperation as set forth in Senate Document No. 138, 87th Congress, 2d Session, South Dade County, in that it will:

1. Contribute in cash 19.2 per cent of the sum of the contract price and the costs of supervision and administration thereof for all items of

work to be provided by the Corps of Engineers; this amount is presently estimated at $2,953,000, to be paid either in a lump sum prior to start of construction, or in installments prior to start of pertinent work items in accordance with construction schedules as required by the Chief of Engineers, the final contribution to be determined after actual costs are known;

2. Construct and maintain at no cost to the Federal Government the lateral drainage facilities needed to realize the benefits potential made available by the proposed improvements;

3. Provide without cost to the United States all lands, easements, and rights of way necessary for construction of the project;

4. Assume the cost of construction of all new highway bridges and of all relocations and alterations of existing bridges, roads, utilities, and other improvements, except railroad bridges and approaches;

5. Hold and save the United States free from damages due to construction works;

6. Prevent encroachment on the flood-carrying capacity of the improved channels;

7. Operate and maintain all the works after completion in accordance with regulations prescribed by the Secretary of the Army;

8. At least annually, inform interests affected that the Project will provide no protection from ocean surges.

PASSED and ADOPTED, this the 5th day of April, A. D. 1963.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

(Corporate Seal)

By Riley S. Miles
Chairman

ATTEST:

/s/ G. E. Dail, Jr.
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, G. E. DAIL, JR., Secretary of the Governing Board of CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, do hereby certify that the foregoing is a true and correct copy of Resolution No. 512 , duly adopted by the Governing Board of said District on the 5th day of April, A. D., 19 63.

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this Certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board, this the 16th day of April, A. D., 19 64.

G. E. DAIL, JR., Secretary of the
Governing Board aforesaid

(Corporate Seal)

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

RESOLUTION NO. 514

ASSUMPTION OF RESPONSIBILITY FOR COMPLIANCE WITH CONDITIONS OF LOCAL COOPERATION WITH FEDERAL GOVERNMENT UNDER FEDERAL AUTHORIZATION ENACTED BY 87th CONGRESS, 2d SESSION, RELATING TO SENATE DOCUMENT 123 (CUTLER DRAIN AREA, FLORIDA)

WHEREAS, on the 1st day of August 1949, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 12 agreeing to and assuming full responsibility for compliance with the specific requirements of local cooperation set forth in House Document No. 643, 80th Congress, 2d Session; and

WHEREAS, on the 15th day of September 1954, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 224 agreeing to and assuming full responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1954, Public Law 780, Title II, 83rd Congress, 2d Session, under the heading, Central and Southern Florida in Section 203 thereof; and

WHEREAS, on the 9th day of October 1959, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 398 agreeing to and assuming responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1958, Public Law 85-500, 85th Congress, 2d Session, as recommended by House Document No. 186, 85th Congress, 2d Session; and

WHEREAS, the Flood Control Act of 1962, Public Law 87-874, 87th Congress, 2d Session, adopted and authorized modifications to the comprehensive plan for flood control in Central and Southern Florida as recommended by Senate Document No. 123, 87th Congress, 2d Session, with respect to the Cutler Drain Area and which provides for the acceptance by non-Federal interests of certain requirements of local cooperation.

NOW THEREFORE BE IT RESOLVED, by the Governing Board of the Central and Southern Florida Flood Control District that it does agree to and hereby assumes responsibility for compliance with the requirements of local cooperation as set forth in Senate Document No. 123, 87th Congress, 2d Session, Cutler Drain Area, Florida, in that it will:

1. Construct and maintain at no cost to the Federal Government the lateral drainage facilities needed to realize the benefits potential made available by the proposed improvements in the Cutler Drain area;
2. Provide without cost to the United States all lands, easements, and rights of way necessary for construction of the project;
3. Assume the cost of construction of all new highway bridges and of all relocations and alterations of existing bridges, roads, utilities, and other improvements, except railroad bridges and approaches;
4. Hold and save the United States free from damages due to the construction works;
5. Prevent encroachments on the flood-carrying capacity of the improved channels; and
6. Maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army.

PASSED and ADOPTED, this the 5th day of April, A.D. 1963.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

(Corporate Seal)

By Riley S. Miles
Chairman

ATTEST:

/s/ G. E. Dail, Jr.
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, G. E. DAIL, JR., Secretary of the Governing Board of CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, do hereby certify that the foregoing is a true and correct copy of Resolution No. 514 , duly adopted by the Governing Board of said District on the 5th day of April, A. D., 19 63.

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this Certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board, this the 16th day of April, A. D., 19 64.

G. E. DAIL, JR., Secretary of the
Governing Board aforesaid

(Corporate Seal)

Central and Southern Florida Flood Control District

RESOLUTION NO. 744

ASSUMPTION OF RESPONSIBILITY FOR COMPLIANCE WITH CONDITIONS OF LOCAL COOPERATION WITH FEDERAL GOVERNMENT UNDER FEDERAL AUTHORIZATION ENACTED BY 89th CONGRESS, 1st SESSION, RELATING TO SENATE DOCUMENT NO. 20, SOUTHWEST DADE COUNTY

WHEREAS, on the 1st day of August 1949, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 12 agreeing to and assuming full responsibility for compliance with the specific requirements of local cooperation set forth in House Document No. 643, 80th Congress, 2nd Session; and

WHEREAS, on the 15th day of September 1954, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 224 agreeing to and assuming full responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1954, Public Law 780, Title II, 83rd Congress, 2nd Session, under the heading, Central and Southern Florida in Section 203 thereof; and

WHEREAS, on the 9th day of October 1959, the Governing Board of the Central and Southern Florida Flood Control District adopted its Resolution No. 398 agreeing to and assuming responsibility for compliance with the requirements of local cooperation set forth in the Flood Control Act of 1958, Public Law 85-500, 85th Congress, 2nd Session, as recommended by House Document No. 186, 85th Congress, 2nd Session; and

WHEREAS, the Flood Control Act of 1965, Public Law 89-298, 89th Congress, 1st Session, adopted and authorized modifications to the comprehensive plan for flood control in Central and Southern Florida as recommended by Senate Document No. 20, 89th Congress, 1st Session, with respect to Southwest Dade County, Dade County, Florida, and which provides for the acceptance by non-Federal interests of certain requirements of local cooperation.

NOW THEREFORE BE IT RESOLVED, by the Governing Board of the Central and Southern Florida Flood Control District that it does agree to and hereby assumes responsibility for compliance with the requirements of local cooperation as set forth in Senate Document No. 20, 89th Congress, 1st Session, Southwest Dade County, in that it will:

1. Contribute in cash 46 percent of the sum of the contract price and the costs of supervision and administration thereof for each part of the primary work to be provided by the Corps of Engineers, an amount presently estimated at $3,663,000 to be paid either in a lump sum prior to start of construction, or in installments prior to start of pertinent work items in accordance with construction schedules as required by the Chief of Engineers, the final contribution to be determined after actual costs are known;

2. Construct and maintain the associated works needed to realize the benefits made available by the work to be provided by the United States;

3. Provide without cost to the United States all lands, easements, and rights of way necessary for construction of the project;

4. Provide without cost to the United States all necessary alterations or replacements of bridges, roads, miscellaneous utilities, and other existing improvements;

5. Hold and save the United States free from damages due to the construction works;

6 Prevent encroachment on the flood-removal capacity of the improvements; and

7 Operate and maintain the works after completion in accordance with regulations prescribed by the Secretary of the Army

PASSED and ADOPTED, this the 9th day of June, A.D., 1967.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, BY ITS GOVERNING BOARD

By /s/ Riley S. Miles
Chairman

(Corporate Seal)

ATTEST:

/s/ G. E. Dail, Jr.
Secretary

STATE OF FLORIDA)
)
COUNTY OF PALM BEACH)

C E R T I F I C A T E

I, G. E. DAIL, JR., Secretary of the Governing Board of CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, do hereby certify that the foregoing is a true and correct copy of Resolution No. 744 , duly adopted by the Governing Board of said District on the 9th day of June A. D., 1967 .

I FURTHER CERTIFY that said Resolution has not been revoked, modified or changed in any way and is at the date of this Certificate in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Governing Board, this the 12th day of June A. D., 1967.

G. E. DAIL, JR., Secretary of the
Governing Board Aforesaid

(Corporate Seal)

PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE SEMINOLE TRIBE OF FLORIDA
FOR CONSTRUCTION OF THE
BIG CYPRESS SEMINOLE INDIAN RESERVATION WATER CONSERVATION PLAN
CRITICAL RESTORATION PROJECT

THIS AGREEMENT is entered into this 7th day of January, 2000, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the Assistant Secretary of the Army (Civil Works), and the SEMINOLE TRIBE OF FLORIDA (hereinafter the "Non-Federal Sponsor"), represented by the Chairman of its Tribal Council.

WITNESSETH, THAT:

WHEREAS, construction of the Big Cypress Seminole Indian Reservation Water Conservation Plan Project (hereinafter the "Project", as defined in Article I.A. of this Agreement) at Hendry County, Florida is authorized by Section 528(b)(3) of the Water Resources Development Act of 1996, Public Law 104-303, as amended;

WHEREAS, the Government and the Non-Federal Sponsor desire to enter into a Project Cooperation Agreement for construction of the Project;

WHEREAS, Section 528(e) of the Water Resources Development Act of 1996, Public Law 104-303, as amended, specifies the cost-sharing requirements applicable to the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provides that the Secretary of the Army shall not commence construction of any water resources project, or separable element thereof, until each Non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 208(b) of the Water Resources Development Act of 1999, Public Law 106-53, provides that the Secretary of the Army (Civil Works) may afford credit or provide reimbursement to the Non-Federal Sponsor for certain costs that have been incurred or may be incurred in connection with the Project;

WHEREAS, the Non-Federal Sponsor has performed certain work and proposes to perform certain work (hereinafter referred to as the "Section 208 Work") which is a part of the Project;

WHEREAS, Section 102 of the Energy and Water Development Appropriations Act, 2000, Public Law 106-60, provides that credits and reimbursements afforded under certain general authorities and under project specific authority, such as Section 528 of the Water Resources Development Act of 1996, as amended, shall not exceed $10,000,000 per project in each fiscal year, nor shall they exceed $50,000,000 for all applicable projects in each fiscal year; and

WHEREAS, the Government and Non-Federal Sponsor have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the construction of the Project in accordance with the terms of this Agreement.

NOW, THEREFORE, the Government and the Non-Federal Sponsor agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Project" shall mean infrastructure improvements for the construction of water control, management and treatment facilities in Basins 1, 2, 3 and 4, which compose the western portion of the Big Cypress Seminole Indian Reservation (hereinafter referred to as the "Reservation") and planning, design and construction of conveyance canals on the eastern portion of the Reservation, as well as required planning and design activities, land acquisition, operational and best management practice plans for the basins and reservoirs as generally described in the Seminole Tribe Big Cypress Reservation Water Conservation Plan Letter Report, dated March, 1998 and approved by the Chief, Planning Division, Directorate of Civil Works on June 24, 1998 (hereinafter referred to as the "Letter Report").

B. The term "total project costs" shall mean all costs incurred by the Non-Federal Sponsor and the Government in accordance with the terms of this Agreement directly related to construction of the Project. Subject to the provisions of this Agreement, the term shall include only those costs incurred by the Non-Federal Sponsor and the Government after approval of the Letter Report. Total project costs shall include, but are not necessarily limited to: continuing planning and engineering costs; advanced engineering and design costs; preconstruction engineering and design costs; engineering and design costs during construction; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation activities in accordance with Articles XVII.A. and XVII.C. of this Agreement; actual construction costs, including costs incurred for the Section 208 Work as defined in paragraph K. of this Article for which the Government affords credit in accordance with Article II.D.2. of this Agreement to the extent that they do not

duplicate costs otherwise included in this paragraph; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; and costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

C. The term "financial obligation for construction" shall mean a financial obligation of the Government, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project costs.

D. The term "Non-Federal Sponsor's proportionate share" shall mean the ratio of the Non-Federal Sponsor's total cash contribution required in accordance with Article II.D. of this Agreement to total financial obligations for construction, as projected by the Government.

E. The term "period of construction" shall mean the time from the date the Government first notifies the Non-Federal Sponsor in writing, in accordance with Article VI.B. of this Agreement, of the scheduled date for issuance of the solicitation for the first construction contract to the date that the U.S. Army Engineer for the Jacksonville District (hereinafter the "District Engineer") notifies the Non-Federal Sponsor in writing of the Government's determination that construction of the Project is complete in accordance with Article II.C. of this Agreement.

F. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

G. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

H. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

I. The term "functional portion of the Project" shall mean a portion of the Project that is suitable for tender to the Non-Federal Sponsor to operate and maintain in advance

of completion of the entire Project. For a portion of the Project to be suitable for tender, the District Engineer must notify the Non-Federal Sponsor in writing of the Government's determination that the portion of the Project is complete and can function independently and for a useful purpose, although the balance of the Project is not complete.

J. The term "betterment" shall mean a change in the design and construction of an element of the Project resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

K. The term "Section 208 Work" means Project work commencing after approval of the Letter Report and for which the Government will give credit pursuant to Section 208 of Public Law 106-53 and includes but is not limited to the design and construction of distribution canals in the eastern basin of the Reservation to transport internal and external surface water to the proposed storage cells in that basin and ultimately to the Feeder Canal system. Both east and west channels will be sized to carry a combined flow of 190 cfs. Widths and depths of 75 feet and 6 feet, respectively, are proposed for these channels. These channels will both be approximately 21,000 feet long distributing surface water from east to west traversing both the existing E-1 and E-2 ditches. An eastern distribution canal is approximately 23,000 feet long, connecting future water resources from the L-4 Canal (via a 190 cfs pump station that will be constructed by the South Florida Water Management District) and intersecting the E-1 and E-2 ditches and certain work as described in Attachment "A". Attachment "A" may be amended by mutual agreement between the Non-Federal Sponsor and the District Engineer, as required.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSOR

A. The Government and the Non-Federal Sponsor acknowledge that the Project is being pursued as a Critical Restoration Project. The Department of the Army agrees that, consistent with the authority provided in Section 528(b)(3) of Public Law 104-303, as amended, and the rules that govern Executive Branch budget requests, it will exert its best efforts to obtain the appropriations to pay for the Federal share of the cost of constructing the Project. The Government, subject to receiving funds appropriated by the Congress and using those funds and funds provided by the Non-Federal Sponsor, shall expeditiously construct the Project applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations and policies. The Government and the Non-Federal Sponsor acknowledge at the time of signing this Agreement, the Congress has not provided sufficient funding necessary to complete the Project, and that, therefore, it is necessary to closely consult on all Project expenditures to ensure that amounts to be expended for Project work including project design, land acquisition and construction do not exceed the amount of Federal appropriations that are available for Project costs. The Government and the Non-Federal Sponsor agree that no Project work will ensue unless both parties agree in writing that such work can be initiated within available Federal

appropriations. As Federal appropriations are made available for the Project, the Government shall proceed with implementation of the Project on an incremental basis after consulting with the Non-Federal Sponsor pursuant to Article V.C. of this Agreement. The Government shall then, consistent with the amount of appropriations so provided, initiate engineering and design of the Project, afford credit to the Non-Federal Sponsor in accordance with this Agreement, and construct the Project. Where the Non-Federal Sponsor proposes to perform Section 208 Work under this Agreement, the Government shall authorize the initiation of such Section 208 Work consistent with the amount of available appropriations and other limitations set forth in this Agreement, after consultation with the Non-Federal Sponsor pursuant to Article V.C. of this Agreement.

1. The Government shall afford the Non-Federal Sponsor the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. The Government shall not issue the solicitation for the first construction contract until the Non-Federal Sponsor has confirmed in writing its willingness to proceed with the Project. To the extent possible, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsor with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsor, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project, with the exception of the Section 208 Work, whether the work is performed under contract or by Government personnel, shall be exclusively within the control of the Government.

2. Throughout the period of construction, the District Engineer shall furnish the Non-Federal Sponsor with a copy of the Government's Written Notice of Acceptance of Completed Work for each contract for the Project.

3. For future Section 208 Work , the Government shall be afforded an opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Non-Federal Sponsor's issuance of such solicitations. No construction shall commence under this Agreement until the designs, detailed plans and specifications, and arrangements for prosecution of the Section 208 Work have been approved in writing by the District Engineer, or his representative. All bids received and proposed provisions of any contract shall be subject to review by the Government prior to contract award. In addition, all proposed changes in approved designs, plans, and specifications also must be reviewed and approved by the District Engineer or his representative in writing in advance of the related construction where practicable. To the extent possible, the Non-Federal Sponsor also shall afford the

Government the opportunity to review and comment on all contract claims prior to resolution thereof. The Non-Federal Sponsor shall consider in good faith the comments of the Government made as a result of its review, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all Section 208 Work shall be exclusively within the control of the Non-Federal Sponsor. However, the failure of the Non-Federal Sponsor to comply with direction received from the District Engineer, with respect to the Section 208 Work, may result in the costs associated with such work being determined ineligible for credit towards the Non-Federal Sponsor's share of total project costs.

4. Notwithstanding paragraph A.1. of this Article, if, upon the award of any contract for construction of the Project, cumulative financial obligations for the Project would exceed $50,000,000.00, the Government and the Non-Federal Sponsor agree to defer award of that contract and all subsequent contracts for construction of the Project until such time as the Government and the Non-Federal Sponsor agree to proceed with further contract awards for the Project, but in no event shall the award of contracts be deferred for more than three years. Notwithstanding this general provision for deferral of contract awards, the Government, after consultation with the Non-Federal Sponsor, may award a contract or contracts after the Assistant Secretary of the Army (Civil Works) makes a written determination that the award of such contract or contracts must proceed in order to comply with law or to protect life or property from imminent and substantial harm.

5. To the extent provided in applicable Federal laws and regulations, including procurement regulations, preferences and opportunities for training and employment in connection with the administration of this Agreement shall be given to tribal members of the Non-Federal Sponsor and preferences in the award of sub-contracts shall be given to Seminole Indian organizations and Seminole Indian owned economic enterprises.

B. The Non-Federal Sponsor may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

C. When the District Engineer determines that the entire Project is complete or that a portion of the Project has become a functional portion of the Project, the District Engineer shall so notify the Non-Federal Sponsor in writing and furnish the Non-Federal Sponsor with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") and with copies of all of the Government's

Written Notices of Acceptance of Completed Work for all contracts for the Project or the functional portion of the Project that have not been provided previously. Upon such notification, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project in accordance with Article VIII of this Agreement.

D. The Non-Federal Sponsor shall contribute 50 percent of total project costs in accordance with the provisions of this paragraph.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsor shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsor must provide for the construction, operation, and maintenance of the Project, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the Project.

2. As authorized by Section 208 of Public Law 106-53, the Government may afford credit for the Section 208 Work. The affording of such credit shall be subject to a technical review by the Government to verify that the credited work was accomplished in a satisfactory manner and in accordance with the limitations contained in this Agreement. To afford any such credit, the Government, as further specified in Article VI.B. of this Agreement, shall apply the actual amount of credit toward the cash contribution required by paragraph D.3. of this Article. The actual amount of credit shall not exceed the Non-Federal Sponsor's actual costs attributable to the Section 208 Work. The actual amount of credit shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. If the actual amount of credit exceeds the cash contribution required by paragraph D.3. of this Article, the Government, subject to the availability of funds, shall, on behalf of the Non-Federal Sponsor, provide Project lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, or perform Project relocations, equal in value to such excess credit amount. As an alternative, and in its sole discretion, the Government may, subject to the availability of funds, reimburse the Non-Federal Sponsor in an amount equal to such excess credit amount.

3. If the Government projects that the value of the Non-Federal Sponsor's contributions under paragraphs D.1. and D.2. of this Article and Articles IV, V, X, XV.A., and XVII of this Agreement will be less than 50 percent of total project costs, the Non-Federal Sponsor shall provide an additional cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsor's total contribution equal to 50 percent of total project costs.

4. If the Government determines that the value of the Non-Federal Sponsor's contributions provided under paragraphs D.1. and D.2. of this Article and Articles IV, V, X, XV.A., and XVII of this Agreement has exceeded 50 percent of total

project costs, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsor for any such value in excess of 50 percent of total project costs. After such a determination, the Government, in its sole discretion, may provide any remaining Project lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining Project relocations on behalf of the Non-Federal Sponsor.

E. The Non-Federal Sponsor may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the Non-Federal Sponsor. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

F. The Government shall perform a final accounting in accordance with Article VI.D. of this Agreement to determine the contributions provided by the Non-Federal Sponsor in accordance with paragraphs B., D., and E. of this Article and Articles IV, V, X, XV.A., and XVII of this Agreement and to determine whether the Non-Federal Sponsor has met its obligations under paragraphs B., D., and E. of this Article.

G. In addition to any other limitations contained in this Agreement, the affording of credit and the amount of credit is subject to the following additional limitations.

1. Any reimbursement for the Section 208 Work performed by the Non-Federal Sponsor shall be dependent upon the appropriation of funds applicable thereto or funds available therefor.

2. No credit shall be given or reimbursement made unless and until the District Engineer has certified that the Section 208 Work subject to credit or reimbursement pursuant to this Agreement has been performed in accordance with this Agreement.

3. The amount of credit or reimbursement for which the Non-Federal Sponsor may be eligible pursuant to this Agreement is not subject to interest charges, nor is it subject to adjustment to reflect changes in price levels between the time the Section 208 Work is completed and the time that the credit or reimbursement is afforded.

4. The Non-Federal Sponsor shall obtain all applicable Federal, State and Tribal permits required for the performance of the Section 208 Work and for operation, maintenance, repair, rehabilitation and replacement of the Section 208 Work.

5. Any contract awarded by the Non-Federal Sponsor for the Section 208 Work under this Agreement shall include provisions consistent with all applicable Federal laws and regulations including preferences and opportunities for training and employment in connection with the administration of this Agreement for tribal members of the Non-Federal Sponsor and preferences in the award of sub-contracts shall be given to Seminole Indian organizations and Seminole Indian owned economic enterprises.

6. Subject to the limitations above and an audit in accordance with Article X of this Agreement, the Government may afford credit for Section 208 Work performed by or to be performed on behalf of the Non-Federal Sponsor by the firms of AMS Engineering & Environmental, Inc.; Ardaman & Associates, Inc.; Gerald T. Benock; Lewis, Longman & Walker, P.A.; Lodge Environmental Consulting, Inc.; The Phoenix Environmental Group, Inc.; and Wilkison & Associates, Inc.. This provision does not preclude the Non-Federal Sponsor from selecting other contractors in accordance with applicable procurement procedures.

7. The Non-Federal Sponsor shall not perform any construction work until all National Environmental Policy Act of 1969 (NEPA) requirements are satisfied and the Non-Federal Sponsor obtains all required Federal and Tribal permits and South Florida Water Management District (SFWMD) work plan approval in accordance with the Water Rights Compact among the Seminole Tribe of Florida, the State of Florida and the South Florida Water Management District pursuant to the Seminole Indian Land Claims Settlement Act of 1987, Public Law 100-228.

8. The amount of credit or reimbursement that may be afforded the Non-Federal Sponsor for the Section 208 Work shall be subject to the applicable limitations contained in Section 102 of the Energy and Water Appropriations Act, 2000, Public Law 106-60.

H. The Non-Federal Sponsor shall not use Federal funds to meet the Non-Federal Sponsor's share of total project costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

ARTICLE III - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, after consultation with the Non-Federal Sponsor, shall determine the lands, easements, and rights-of-way required for the construction,

operation, and maintenance of the Project, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsor must provide, in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. Prior to the end of the period of construction, the Non-Federal Sponsor shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the Non-Federal Sponsor shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsor must provide for that contract. For so long as the Project remains authorized, the Non-Federal Sponsor shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project and that were provided by the Non-Federal Sponsor are retained in public ownership for uses compatible with the authorized purposes of the Project.

B. The Government, after consultation with the Non-Federal Sponsor, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the Project. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with construction of such improvements. Prior to the end of the period of construction, the Non-Federal Sponsor shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsor, shall determine the relocations necessary for the construction, operation, and maintenance of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with such relocations. Prior to the end of the period of construction, the Non-Federal Sponsor shall perform or ensure the performance of all

relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsor in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs, and afford credit for such value toward the Non-Federal Sponsor's share of total project costs.

E. The Non-Federal Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR VALUE OF LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsor shall receive credit toward its share of total project costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article III of this Agreement, and for the value of the relocations that the Non-Federal Sponsor must perform or for which it must ensure performance pursuant to Article III of this Agreement. However, the Non-Federal Sponsor shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project. The Non-Federal Sponsor also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market

value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned or controlled by the Non-Federal Sponsor on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsor provides the Government with authorization for entry thereto. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsor shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsor and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsor's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's appraisal, the Non-Federal Sponsor may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsor's second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's second appraisal, or the Non-Federal Sponsor chooses not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsor. In the event the Non-Federal Sponsor does not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsor, shall consider the Government's and the Non-Federal Sponsor's appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsor for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsor, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsor, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsor, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsor shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsor shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsor shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsor agree as to an appropriate amount, then the Non-Federal Sponsor shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsor cannot agree as to an appropriate amount, then the Non-Federal Sponsor may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the construction, operation, and maintenance of the Project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the approval of the Letter Report, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, Non-Federal Sponsor's attorney's fees and costs, plat maps, and mapping costs, landowner's attorney fees and costs required to be paid under Florida Law, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. After consultation with the Non-Federal Sponsor, the Government shall determine the value of relocations in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard that the State of Florida would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsor and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of construction. The Government's Project Manager and a counterpart named by the Non-Federal Sponsor shall co-chair the Project Coordination Team.

B. The Government's Project Manager and the Non-Federal Sponsor's counterpart shall keep the Project Coordination Team informed of the progress of construction and of significant pending issues and actions, and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project, including consulting on issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; the Section 208 Work; contract costs; the Government's cost projections; final inspection of the entire Project or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters. The goal of this consultation, among other things, shall be to ensure, to the maximum extent practicable, that the Government and the Non-Federal Sponsor agree on the precise work that is to be performed under this Agreement and the scheduling of that work. This oversight shall be consistent with a project management plan developed by the Government after consultation with the Non-Federal Sponsor.

D. The Project Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Coordination Team. The Government, having the legal authority and responsibility for construction of the Project, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations.

E. The costs of participation in the Project Coordination Team shall be included in total project costs and shall be cost shared in accordance with the provisions of this Agreement.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs, current projections of each party's share of total project costs and costs due to betterments. By March 31 of each year and at least quarterly thereafter, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project costs, of total costs due to betterments, of the components of total project costs, of each party's share of total project costs, of the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, of the Non-Federal Sponsor's proportionate share, and of the funds the Government projects to be required from the Non-Federal Sponsor for the upcoming fiscal year. On the effective date of this Agreement, total project costs are projected to be $49,332,000, and the Non-Federal Sponsor's cash contribution required under Article II.D. of this Agreement is projected to be $17,149,000. The amount of credit for the Section 208 Work to be afforded against the Non-Federal Sponsor's required contribution towards total project costs in accordance with Article II.D.2. of this

Agreement is projected to be $3,774,000. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor.

B. The Non-Federal Sponsor shall provide the cash contribution required under Article II.D.3. of this Agreement in accordance with the provisions of this paragraph. For the purposes of budget planning, the Government shall notify the Non-Federal Sponsor by March 15 of each year of the estimated funds that will be required from the Non-Federal Sponsor to meet the Non-Federal Sponsor's share of total Project costs for the upcoming fiscal year.

1. Not less than 60 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and the funds the Government, after consideration of any credit afforded pursuant to Article II.D. of this Agreement, determines to be required from the Non-Federal Sponsor to meet the Non-Federal Sponsor's proportionate share of projected financial obligations for construction through the first fiscal year of construction, including the Non-Federal Sponsor's proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, Jacksonville District" to the District Engineer or verify to the satisfaction of the Government that the Non-Federal Sponsor has deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsor, or present the Government with an irrevocable letter of credit acceptable to the Government for the required funds, or provide an Electronic Funds Transfer in accordance with procedures established by the Government.

2. For the second and subsequent fiscal years of construction, the Government shall notify the Non-Federal Sponsor in writing, no later than 120 calendar days prior to the beginning of that fiscal year, of the funds the Government, after consideration of any credit afforded pursuant to Article II.D. of this Agreement, determines to be required from the Non-Federal Sponsor to meet the Non-Federal Sponsor's proportionate share of projected financial obligations for construction for that fiscal year. No later than 30 calendar days following the beginning of the fiscal year, the Non-Federal Sponsor shall make the full amount of the required funds for that fiscal year available to the Government through any of the funding mechanisms specified in paragraph B.1. of this Article.

3. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government deems necessary to cover: (a) the Non-Federal Sponsor's proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction; and (b) the Non-Federal Sponsor's proportionate share of financial obligations for construction as they are incurred during the period of construction.

4. If at any time during the period of construction the Government, after consideration of any credit afforded pursuant to Article II.D. of this Agreement, determines that additional funds will be needed from the Non-Federal Sponsor to cover the Non-Federal Sponsor's proportionate share of projected financial obligations for construction for the current fiscal year, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required, and the Non-Federal Sponsor, no later than 60 calendar days from receipt of such notice, shall make the additional required funds available through any of the payment mechanisms specified in paragraph B.1. of this Article.

C. In advance of the Government incurring any financial obligation associated with additional work under Articles II.B. or II.E. of this Agreement, the Non-Federal Sponsor shall provide the Government with the full amount of the funds required to pay for such additional work through any of the payment mechanisms specified in paragraph B.1. of this Article. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet its cash contribution, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required. Within 45 calendar days thereafter, the Non-Federal Sponsor shall provide the Government with the full amount of the additional required funds through any of the payment mechanisms specified in paragraph B.1. of this Article.

D. Upon completion of the Project or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the Non-Federal Sponsor with the results of the final accounting. The final accounting shall determine total project costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to betterments and the Non-Federal Sponsor's cash contribution provided pursuant to Article II.D.3. of this Agreement. The Non-Federal Sponsor may request that the Government perform an interim accounting upon completion of each functional portion of the Project.

1. In the event the interim or final accounting shows that the total contribution provided by the Non-Federal Sponsor is less than its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. as well as credits associated with the Section 208 Work provided in accordance with Article II.D. of this Agreement, the Non-Federal Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsor's required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement by delivering a check payable to "FAO, USAED, Jacksonville District" to the

District Engineer or provide an Electronic Funds Transfer in accordance with procedures established by the Government.

2. In the event the interim or final accounting shows that the total contribution provided by the Non-Federal Sponsor exceeds its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. as well as credits associated with the Section 208 Work provided in accordance with Article II.D. of this Agreement, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsor no later than 90 calendar days after the final accounting is complete. In the event existing funds are not available to refund the excess to the Non-Federal Sponsor, the Government shall seek such appropriations as are necessary to make the refund.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

A. Upon notification in accordance with Article II.C. of this Agreement and for so long as the Project remains authorized, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal, Tribal and State laws as provided in Article XI of this Agreement and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto.

B. The Non-Federal Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner subject to reasonable written notice, upon property that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of inspection and, if necessary in the event of Non-Federal Sponsor's failure to perform as described below, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Non-Federal Sponsor for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-

Federal Sponsor. If, after 30 calendar days from receipt of notice, the Non-Federal Sponsor continues to fail to perform, then the Government shall have the right to enter, at reasonable times and in a reasonable manner subject to reasonable written notice, upon property that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsor of responsibility to meet the Non-Federal Sponsor's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX - INDEMNIFICATION

The Non-Federal Sponsor shall hold and save the Government free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, including the Section 208 Work, and any Project-related betterments, except for damages due to the fault or negligence of the Government or its contractors. The Non-Federal Sponsor does not waive any defense it may have against third parties by providing the indemnification contemplated in this Article.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 60 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of construction and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. For purposes of this Project, pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsor agrees to comply with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-133 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsor and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsor and independent auditors any information necessary to enable an audit of the Non-Federal Sponsor's activities under this Agreement. The costs of any Non-Federal Sponsor audits performed in accordance

with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-133, and such costs as are allocated to the Project shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsor agrees to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI – FEDERAL, TRIBAL, AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal, Tribal, and State laws and regulations.

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement, the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsor fails to fulfill its obligations under Articles II.B., II.D., II.E., VI, or XVII.C. of this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under

this Agreement unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If the Government fails to receive annual appropriations in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsor in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsor elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of liability for any obligation previously incurred. Any delinquent payment owed by the Non-Federal Sponsor shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsor shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsor determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsor for such investigations for hazardous substances shall be included in total project costs and

cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project, the Non-Federal Sponsor and the Government shall provide prompt written notice to each other, and the Non-Federal Sponsor shall not proceed with the acquisition of the real property interests until both parties agree that the Non-Federal Sponsor should proceed.

C. The Government and the Non-Federal Sponsor shall determine whether to initiate construction of the Project, or, if already in construction, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. Should the Government and the Non-Federal Sponsor determine to initiate or continue with construction after considering any liability that may arise under CERCLA, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of total project costs. In the event the Non-Federal Sponsor fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsor's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project.

D. The Non-Federal Sponsor and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsor:

Director of Water Resources Management Dept.
Seminole Tribe of Florida
Hollywood, Florida 33024
(954) 967-3402
Fax No. (954) 967-3489

If to the Government:

Deputy District Engineer for Programs and Project Management
U.S. Army Engineer District
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019
(904) 232-2586
Fax No. (904) 232- 1213

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

B. As specified in Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project costs, up to the statutory limit of one percent of the total amount authorized to be appropriated for the Project.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs.

ARTICLE XVIII - PROGRAM EXPENDITURE LIMITATION

The Government's cost sharing participation in the Project is subject to a current Critical Project Restoration Program Federal expenditure limitation of 75 million dollars and a maximum Federal contribution of 25 million dollars for any single project under Section 528(b)(3)(C)(i) of the Water Resources Development Act of 1996 (Public Law 104-303), as amended. Expenditures under this Agreement and other agreements executed for Critical Restoration Projects will be cumulatively limited to this expenditure limitation or as it may be amended. Notwithstanding any other provision of this Agreement, the Non-Federal Sponsor shall be responsible for all costs on this Project that exceed 25 million dollars or that exceed the program expenditure limitation of 75 million dollars.

ARTICLE XIX – CREDIT OR REIMBURSEMENT UNDER SECTION 208 OF PUBLIC LAW 106-53

Pursuant to Section 208(b) of the Water Resources Development Act of 1999, Public Law 106-53, the Government may provide credit or reimburse the Non-Federal Sponsor for the reasonable costs for any Project work that has been performed or will be performed in connection with the Project based upon the following criteria: 1) the Government determines that the work performed by the Non-Federal Sponsor will substantially expedite completion of the Project, and 2) further determines that the work is necessary for the Project. The amount of such credit or reimbursement shall be determined by the Government based upon an audit in accordance with Article X.C. of this Agreement to determine that such costs are allowable, reasonable, and allocable to the Project.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

DEPARTMENT OF THE ARMY

BY: _____
JOSEPH W. WESTPHAL
Assistant Secretary of the Army
(Civil Works)

DATE: January 7, 2000

SEMINOLE TRIBE OF FLORIDA

BY: _____
JAMES E. BILLIE
Chairman of its
Tribal Council, Seminole Tribe

DATE: January 7, 2000

CERTIFICATE OF AUTHORITY

I, Jim Shore, do hereby certify that I am the principal legal officer of the Seminole Tribe of Florida, that the Seminole Tribe of Florida is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Seminole Tribe of Florida in connection with the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project, and that, pursuant to its Constitution the Seminole Tribe of Florida has the authority and legal capability to pay damages, if necessary, in the event of the failure to perform, as required by Section 221 of Public Law 91-611 (42 U.S.C. Section 1962d-5b), and that the person who has executed this Agreement on behalf of the Seminole Tribe of Florida has acted within his authority pursuant to the Constitution and By-Laws of the Seminole Tribe of Florida.

IN WITNESS WHEREOF, I have made and executed this certification this 7th day of January, 2000.

Jim Shore
General Counsel
Seminole Tribe of Florida

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file any required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

DATE: 1/4/2000

James E. Billie
Chairman of its
Tribal Council
Seminole Tribe of Florida

ATTACHMENT A

Scope of Work for Feasibility Effort
Big Cypress Reservation Critical Project
Seminole Tribe of Florida

Item Description				Tribe Est.	COE Est.	Total $	C/T
A.	Verify that engineering and water quality assumptions used in the original master plan are valid.						
	1.	Review new information that may be available through on-going research projects related to the Everglades project.					
		a.	Revisit STA design concepts for relevance to this project. Incorporate COE Restudy Team comments.	$4,000	$6,300	$10,300	T/C
		b.	Consider any newer data that may have been developed related to water quality treatment in a natural wetland system.	$3,000	$0	$3,000	T
		c.	Review ENR data related to treatment capacity of wetland systems.	$3,000	$0	$3,000	T
	2.	Recalculate WRA sizes if warranted from above review. If newer information shows a ___ percent change (same as COE contingency % for project--25 ?) through a reduction in land needed, then newer information will be used to resize the WRAs. If this threshold percentage is not reached, then existing WRA assumptions will be maintained.		$3,000	$0	$3,000	T
	3.	Obtain concurrence on any proposed changes. **(Project Management Team-PMT review meeting)**		$5,000	$5,800	$10,800	T/C

B.	Using new digital aerials and FLUCCS GIS coverage, transfer and adjust plan feature boundaries (i.e. reservoirs dikes, ditches, structure locations, etc.). Based on new field knowledge and 404 Permit requirements.					
	1.	Produce a working layout of the system as transferred from the original plan to the new rectified photographic maps.	$4,000	$500	$4,500	T
	2.	Incorporate existing soils information through a digital database and determine if layout adjustments are necessary based on this preliminary data.	$3,000	$3,000	$6,000	T/C
	3.	Make major decisions on sizes and locations of storage cells.	$3,000	$13,800	$16,800	T/C
	4.	Revise the layout through coordinated team review session(s) to consider new environmental and regulatory issues.	$5,000	$1,920	$6,920	T/C
	5.	Produce revised layout. Provide limited documentation of assumptions.	$3,000	$3,200	$6,200	T/C
C.	Obtain concurrence on revised layout.					
	1.	Provide sign-off on layout revisions from COE & Tribe.	$2,000	$4,270	$6,270	T/C
	2.	Provide Real Estate O.K. from Tribe with documentation provided to COE. **This excludes formal boundary survey of the planned facilities.**	$3,000	$0	$3,000	T
D.	Run preliminary engineering calculations to confirm size and configuration of proposed WRAs, storage areas, ditches and canals.					
	1.	Obtain concurrence from Tribe and COE on basic hydrologic and hydraulic parameters to be evaluated and the types of models to use.				
		a. Site or office visit needed to confirm selections. (PMT review meeting)	$8,000	$6,250	$14,250	T/C
	2.	Run storm event model				
		a. SE Model preparation	$11,000	$0	$11,000	T
		b. run 1-in-10 year storm event plus 25-year and 100-year events	$4,000	$0	$4,000	T
		c. verify capacity of WRA borrow canal for drainage flows	$4,000	$0	$4,000	T
	3.	Check conveyance capacity under maximum irrigation flows.	$2,000	$0	$2,000	T

E.	Review data and identify critical deficiencies and collect limited data for completing feasibility analysis.					
	1.	Core boring(s) are needed at most proposed structure locations.	$0	$51,480	$51,480	C
	2.	Topographic data is needed at all proposed structure locations.	$0	$60,000	$60,000	C
	3.	Soil borings are needed along proposed main canal alignment to determine depth to rock and permeability capacity. Permeability data collection envisioned.	$0	$50,000	$50,000	C
	4.	Referencing digitized soils information and proposed dike locations, soil borings will be needed along dike alignments.				
		a. Soil borings will be needed along Irrigation Cell dike alignment. Limited soil borings may be needed from interior of proposed cell locations.	$0	$300,000	$300,000	C
		b. Limited soil borings will be needed along WRA dike alignment.	$0	$100,000	$100,000	C
	5.	Identify borrow and spoil staging areas.	$2,000	$8,240	$10,240	T/C
	6.	Collect limited topographic data in strategically selected wetlands within proposed WRA sites.	$15,000	$3,000	$18,000	T/C
	7.	Obtain field survey data				
		a. Obtain topographic data from within contributing watersheds (fields outside WRA and Irrigation Cell boundaries)	$38,000	$0	$38,000	T
		b. Obtain cross-section and elevation data along major dike/canal alignments. Locate wells and other important physical features that could impede future construction efforts.	$0	$280,480	$280,480	C
F.	Modify design and recalculate engineering parameters using new data.					
	1.	Run storm event model to predict performance under the following scenarios:				
		a. Adjust model inputs	$4,000	$0	$4,000	T
		b. 25-year, 100-year events and the SPF event ???	$4,000	$0	$4,000	T
	2.	Check conveyance capacity under maximum irrigation flows.	$2,000	$0	$2,000	T
	3.	Compare post-development system against original 1994 system with regard to storm event behavior/capability.	$10,000	$0	$10,000	T
G.	Identify design and performance parameters and develop					

	tables and plates for report.					
	1.	Set control elevations, channel sizes, culverts sizes, etc.	$4,000	$13,000	$17,000	T/C
	2.	Develop drawings (tables & plates) depicting final plan elements and critical design parameters.	$7,000	$0	$7,000	T
H.	Tribe sends preliminary findings to COE (90% review)					
	1.	COE provides comments to Tribe on reviewed **drawings**	$0	$17,240	$17,240	C
	2.	Meeting to agree on proposed changes. (PMT review meeting)	$5,000	$5,400	$10,400	T/C
I.	Prepare final feasibility documents and submit for review.					
	1.	Re-estimate cost of project.	$2,500	$2,000	$4,500	C/T
	2.	Develop estimated project O&MRRR costs. (Operation & Maintenance, Replacement, Repair and Rehabilitation). - use 50 year life cycle - include replacement cost - include annual/bi-annual inspections with the COE.	$5,000	$1,000	$6,000	T/C
	3.	Prepare feasibility document.	$15,000	$0	$15,000	T/C
	4.	Tribal review and revisions before submitting to COE	$5,000	$0	$5,000	T
J.	Review and comment from Tribe and COE (100%--PMT review meeting) **and final revisions.**		$8,000	$6,240	$14,240	T/C
			$196,500	$943,120	$1,139,620	

AMENDMENT NO. 1
TO
PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE SEMINOLE TRIBE OF FLORIDA
FOR CONSTRUCTION OF THE
BIG CYPRESS SEMINOLE INDIAN RESERVATION WATER CONSERVATION PLAN
CRITICAL RESTORATION PROJECT

The Amendment No. 1 is entered into this the 11th day of May, 2007 by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), represented by the District Engineer, U.S. Army Corps of Engineers, Jacksonville District, and the SEMINOLE TRIBE OF FLORIDA (hereinafter the "Non-Federal Sponsor"), represented by the Chairman of its Tribal Council.

WHEREAS, the parties entered into a Project Cooperation Agreement (hereinafter referred to as "PCA") on January 7, 2000 providing for the construction of the Big Cypress Seminole Indian Reservation Water Conservation Plan Project. (hereinafter referred to as "Project");

WHEREAS, the Water Resources Development Act of 2000 provided for a change in the cost sharing for the operation, maintenance, repair, replacement and rehabilitation responsibility of the Non-Federal Sponsor for the Project from 100 percent Non-Federal and 0 percent Federal to 50 percent Non-Federal and 50 percent Federal;

WHEREAS, the parties desire to implement the new operation, maintenance, repair, replacement and rehabilitation authority for the Project as provided by Congress, and it is necessary to amend the existing PCA to so provide;

WHEREAS, the parties also need to address the application of federal labor standards for work to be performed by contractors or subcontractors of the Non-Federal Sponsor;

WHEREAS, Section 6012 of the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005, (Public Law 109-13) was passed by Congress and provided as follows:

> Section 6012. Section 528(b)(3) of the Water Resources Development Act of 1996 (110 Stat. 3769; 113 Stat. 286) is amended by adding the following:

The Seminole Tribe of Florida shall receive a mitigation credit for 50 percent of the net wetland benefits derived within the footprint of the Big Cypress Seminole Reservation

Water Conservation Plan Project. Such credit may be used to meet the mitigation requirements of Section 404 of the Clean Water Act as they may apply to future projects proposed by the Seminole Tribe of Florida.

And it is necessary to document and implement the authority provided by Section 6012 of Public Law 109-13);

NOW, THEREFORE, the parties do hereby agree as follows:

1. Article I- Definitions, there is added the following definition:

"L. The term "operation, maintenance, repair, replacement, and rehabilitation costs" (hereinafter referred to as "OMRR&R") shall mean those costs incurred by the Non-Federal Sponsor and the Government directly related to performing the OMRR&R on the Project as described and required in the Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual ("OMRR&R Manual").

2. Article 1V.C. is amended by adding a new paragraph 4 as follows:

Crediting for relocations performed by the Non-Federal Sponsor's contractors or subcontractors within the Project boundaries is subject to satisfactory compliance with applicable federal labor laws covering non-Federal construction, including, but not limited to applicable Federal labor standards in U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 USC 276a et seq.) the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c). Crediting may be withheld, in whole or in part, as a result of the failure of the Non-Federal Sponsor's contractors or subcontractors to comply with its obligations under these laws. However, in recognition of Tribal Sovereignty, if relocation is performed by employees of the Non-Federal Sponsor, without contractors or subcontractors, compliance with applicable federal labor laws governing non-Federal construction will not be required as a condition of relocation credit.

3. Article V.C. of the PCA is amended to read as follows:

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project, including consulting on issues related to design; plans and specifications; scheduling; real property and relocations requirements; real property acquisition; contract awards and modifications; the Section 208 Work; contract costs; the application of and compliance with the Davis-Bacon Act, Contract Work Hours and Safety Standards Act and the Copeland Anti-Kickback Act for relocations, the Section 208 Work and OMRR&R work by the Non-Federal Sponsor; the Government's cost projections, final inspection of the entire Project or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters. The goal of this consultation,

among other things, shall be to ensure, to the maximum extent practicable, that the Government and the Non-Federal Sponsor agree on the precise work that is to be performed under this Agreement and the scheduling of that work. This oversight shall be consistent with a project management plan developed by the Government after consultation with the Non-Federal Sponsor.

4. Article VIII of the PCA is amended to read as follows:

A. Upon notification in accordance with Article 1I.C of this Agreement, and for so long as the Project remains authorized, the Non-Federal sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project, or the functional portions of the Project, in a manner compatible with the Project's authorized purposes, and in accordance with applicable Federal, Tribal, and State laws as provided in Article XI of this Agreement, and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto. The Government shall provide the Non-Federal Sponsor with payment for 50% of the operation, maintenance, repair, replacement and rehabilitation costs for so long as the Project remains authorized in accordance with Article XX.

5. Article XI- Federal, Tribal, and State Laws is amended to read as follows:

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal, Tribal, and State laws and regulations. To the extent that relocations, Section 208 work or OMRR&R is performed by contractors or subcontractors of the Non-Federal Sponsor and not by employees of the Non-Federal Sponsor, such contractors or subcontractors are required to comply with all applicable Federal labor requirements including, but not limited to 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis Bacon Act (formerly 40 U.S.C. 276a et seq.) the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c).

6. Article XX - COST SHARING FOR OPERATION, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION is added as follows:

a. In accordance with Title VI, Section 601 (c)(4) of the Water Resources Development Act of 2000, the Government shall provide the Non-Federal Sponsor with payment for 50 percent of the OMRR&R activities subject to the procedures and requirements outlined below for so long as the project remains authorized.

b. The Government and the Non-Federal Sponsor shall consult with each other in accordance with Article V of this Agreement in an effort to ensure timely accomplishment of the cost-shared OMRR&R activities.

c. The Government, in consultation with the Non-Federal Sponsor, shall develop a five-year plan to identify proposed future fiscal year funding requirements for cost-shared

OMRR&R activities. The five-year plan will be updated every year based on actual cost-shared OMRR&R activities accomplished. The Government shall use the five-year plan for development of future fiscal year budget requests.

d. To aid in the development of annual scopes of work relating to the five year plan, the Government shall notify the Non-Federal Sponsor in writing, no later than 90 calendar days prior to the end of the then current fiscal year, of the amount of anticipated funding for accomplishment of the cost-shared OMRR&R activities for the next fiscal year. The Government, working jointly with the Non-Federal Sponsor, shall develop a preliminary scope of work, including an estimate of costs, for accomplishment of scheduled cost-shared OMRR&R activities based on the anticipated appropriations for the upcoming fiscal year. The Government and the Non-Federal sponsor shall confer on the preliminary scope of work and estimate of costs.

e. No later than 30 calendar days following receipt of appropriations for that fiscal year, the Government shall notify the Non-Federal Sponsor of the actual funds available for accomplishment of cost-shared OMRR&R activities. The Government, working jointly with the Non-Federal Sponsor, shall develop a final scope of work, including an estimate of costs, for accomplishment of cost-shared OMRR&R activities. The Government and the Non-Federal sponsor shall confer on the final scope of work and estimate of costs for such cost-shared OMRR&R activities to be accomplished for that fiscal year.

f. The Non-Federal Sponsor, in contracting for the performance of any cost-shared OMRR&R activity under this Agreement, shall include provisions consistent with all applicable Federal laws and regulations.

g. The Non-Federal Sponsor shall not issue a solicitation for any contract for cost-shared OMRR&R activities until the Government has approved the relevant plans and specifications for such OMRR&R activities. Such written approval shall be provided no later than 45 days after the Government receives such plans and specifications.

h. The Non-Federal Sponsor shall not award a contract, execute a contract modification, issue a change order, or resolve a contract claim without the prior written approval of the Government. Such written approval shall be provided no later than 45 days after the Government receives notice from the Non-Federal Sponsor that it intends to award a contract, execute a contract modification, issue a change order, or resolve a contract claim.

i. The Government shall inspect all cost-shared OMRR&R activities accomplished by the Non-Federal Sponsor under this Agreement to ensure that such work is accomplished in accordance with the approved final scopes of work, designs, and plans and specifications. If in the Government's judgment, the cost-shared OMRR&R activities do not conform to the final scopes of the Non-Federal Sponsor's designs or plans and specifications, the Government shall notify the Non-Federal sponsor in writing, setting

forth with specifity the nonconformity. The Non-Federal sponsor will then have a reasonable time to cure the nonconformity to the satisfaction of the Government.

j. Subject to the availability of funds, the Government shall make quarterly payments to the Non-Federal Sponsor for its share of cost-shared OMRR&R activity costs. Not later than 90 days after the completion of the cost-shared OMRR&R activities performed within each quarter, the Non-Federal Sponsor shall provide the Government with such documents as are sufficient to enable the Government to conduct an accounting of the cost-shared OMRR&R activities performed that quarter to determine the estimated amount of payment. The Government shall conduct an annual audit for the cost-shared OMRR&R activities performed during each fiscal year, to determine final costs eligible for payment, subject to an audit in accordance with Article X of this Agreement to determine reasonableness, allocability, and allowability of costs. After the annual audit, and review and comment by the Non-Federal Sponsor, any adjustments in quarterly payments to reflect the results of the audit will be made in the next quarterly payment by the Government, subject to the availability of funds.

k. No portion of the quarterly payment shall be made for any cost-shared OMRR&R activities which do not in the judgment of the Government, conform to approved plans and specifications, contract modifications, or change orders approved pursuant to Sections (g) and (h) above, and the OMRR&R manual.

1. The amount of payment is not subject to interest charges, nor is it subject to adjustment to reflect changes in price levels between the time the cost-shared OMRR&R activities are completed and the time that payments are made.

m. Payment for OMRR&R activities performed by the Non-Federal Sponsor's contractors or subcontractors is subject to satisfactory compliance with applicable federal labor laws covering non-Federal construction, including, but not limited to the Davis-Bacon Act (40 USC 276a et seq), the Contract Work Hours and Safety Standards Act (40 USC 327 et seq) and the Copeland Anti-Kickback Act (40 USC 276c). Payment for OMRR&R activities may be withheld, in whole or in part, as a result of the failure of the Non-Federal Sponsor's contractors or subcontractors to comply with their obligations under these laws. However, in recognition of Tribal sovereignty, if OMRR&R activities are performed by employees of the Non-Federal Sponsor, and not by contractors or subcontractors, compliance with federal labor laws covering non-Federal construction will not be required as a condition for payment for OMRR&R activities.

7. The following Article is added to the Agreement:

ARTICLE XXI - PREPARTION OF MITIGATION CREDIT REPORT

The Government in cooperation with the Non-Federal Sponsor shall prepare a report identifying the net wetland benefits derived within the footprint of the Big Cypress Seminole Reservation Water Conservation Plan Project. This report, once approved by

the Government, shall be the basis of the mitigation credit provided for by Section 6012 of Public Law 109-13.

8. All other provisions of the Agreement remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment No. 1, which shall become effective upon the date it is signed by the District Engineer.

DEPARTMENT OF THE ARMY

By: _____
Paul L. Grosskruger
Colonel, U.S. Army
District Engineer

Date: 3/11/07

SEMINOLE TRIBE OF FLORIDA

By: _____
Mitchell Cypress
Chairman of its Tribal Council
Seminole Tribe of Florida

Date: 3/30/2007

CERTIFICATE OF AUTHORITY

I, Jim Shore, do hereby certify that I am the principal legal officer of the Seminole Tribe of Florida, that the Seminole Tribe of Florida is a legally constituted public body with full authority and legal capability to perform the terms of this Amendment to the Project Cooperation Agreement between the Department of the Army and the Seminole Tribe of Florida for the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project and to pay damages, if necessary, in the event of the failure to perform, in accordance with Section 221 of Public Law 91-611, and that the person who has executed this Amendment on behalf of the Seminole Tribe of Florida has acted within his statutory capacity.

IN WITNESS WHEREOF, I have made and executed this certification this 30th day of March 2007.

Jim Shore
General Counsel
Seminole Tribe of Florida

CERTIFICATION OF LEGAL REVIEW

This is to certify that the draft Amendment to the Project Cooperation Agreement for construction of the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project has been reviewed by Office of Counsel, USAED, Jacksonville, and is legally sufficient.

Assistant District Counsel

CERTIFICATION REGARDING LOBBYING

While the Seminole Tribe of Florida does not agree that it is required by law to execute this certification pursuant to 31 USC 1352, nevertheless the Seminole Tribe of Florida voluntarily and without qualification does agree to and be bound by the execution of this certification.

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress , an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction. Any person who fails to file the required certification shall be subject to a penalty of not less than $10,000 and not more than $100,000 for each such failure.

Mitchell Cypress
As Its Chairman of Tribal Council

Date: 5/4/2007

Exhibit A

AMENDMENT NO. 2
TO
PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE SEMINOLE TRIBE OF FLORIDA
FOR CONSTRUCTION OF THE
BIG CYPRESS SEMINOLE INDIAN RESERVATION WATER CONSERVATION PLAN
CRITICAL RESTORATION PROJECT

This Amendment No. 2 is entered into this the ~~22~~ 7th day of ~~February~~ March 2011, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), represented by the U.S. Army Engineer, Jacksonville District, and the SEMINOLE TRIBE OF FLORIDA (hereinafter the "Non-Federal Sponsor"), represented by the Chairman of its Tribal Council.

WHEREAS, the parties entered into a Project Cooperation Agreement on January 7, 2000 and Amendment No. 1 on May 11, 2007 (hereinafter collectively referred to as "Amended PCA") providing for the construction of the Big Cypress Seminole Indian Reservation Water Conservation Plan Project, (hereinafter referred to as "Project");

WHEREAS, Section 6006 of the Water Resources Development Act of 2007 increased the amount authorized to be appropriated to the Department of the Army to pay the Federal share of costs of carrying out Critical Restoration Projects pursuant to Section 528 of the Water Resources Development Act of 1996, as amended from $75,000,000 to $95,000,000 and increased the Federal share of costs of carrying out the Project from $25,000,000 to $30,000,000;

WHEREAS, the parties desire to further amend the Amended PCA to implement the increased limits.

NOW, THEREFORE, the parties do hereby agree as follows:

1. Article II.A.4 is deleted in its entirety and replaced as follows:

"4. Notwithstanding paragraph A.1. of this Article, if, upon the award of any contract for construction of the Project, cumulative financial obligations for the Project would exceed $60,000,000, the Government and the Non-Federal Sponsor agree to defer award of that contract and all subsequent contracts for construction of the Project until such time as the Government and the Non-Federal Sponsor agree to proceed with further contract awards for the Project, but in no event shall the award of contracts be deferred for more than three years. Notwithstanding this general provision for deferral of contract awards, the Government, after consultation with the Non-Federal Sponsor, may

award a contract or contracts after the Assistant Secretary of the Army (Civil Works) makes a written determination that the award of such contract or contracts must proceed in order to comply with law or to protect life or property from imminent and substantial harm."

2. Article VI.A is deleted in its entirety and replaced as follows:

"A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs, current projections of each party's share of total project costs and costs due to betterments. By March 31 of each year and at least quarterly thereafter, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project costs, of total costs due to betterments, of the components of total project costs, of each party's share of total project costs, of the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, of the Non-Federal Sponsor's proportionate share, and of the funds the Government projects to be required from the Non-Federal Sponsor for the upcoming fiscal year. On the effective date of Amendment No. 2 of this Agreement, the total project costs are projected to be $60,000,000, and the Non-Federal Sponsor's cash contribution required under Article II.D. of this Agreement is projected to be $12,380,000. The amount of credit for the Section 208 Work to be afforded against the Non-Federal Sponsor's required contribution towards total project costs in accordance with Article II.D.2. of this Agreement is projected to be $10,120,000. Such amounts are estimates subject to adjustment by the Government, after consultation with the Non-Federal Sponsor, and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor."

3. Article XVIII, Program Expenditure Limitation, is deleted in its entirety and replaced as follows:

"The Government's cost sharing participation in the Project is subject to a Critical Project Restoration Program Federal expenditure limitation of 95 million dollars and a maximum Federal contribution of 30 million dollars for this Project under Section 528(b)(3)(C) of the Water Resources Development Act of 1996 (Public Law 104-303), as amended. Expenditures under this Agreement and other agreements executed for Critical Restoration Projects will be cumulatively limited to this expenditure limitation or as it may be amended. Notwithstanding any other provision of this Agreement, the Non-Federal Sponsor shall be responsible for all costs on this Project that exceed the Federal expenditure limit of 30 million dollars or that exceed the Federal program expenditure limitation of 95 million dollars."

4. All other provisions of the Amended PCA remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment No. 2, which shall become effective upon the date it is signed by the U.S. Army Engineer, Jacksonville District.

DEPARTMENT OF THE ARMY

Alfred A. Pantano, Jr.
Colonel, U.S. Army
District Commander

Date: 07 March 2011

SEMINOLE TRIBE OF FLORIDA

Mitchell Cypress
Chairman of its Tribal Council
Seminole Tribe of Florida

Date: 2/24/11

CERTIFICATE OF AUTHORITY

I, Jim Shore, do hereby certify that I am the principal legal officer of the Seminole Tribe of Florida, that the Seminole Tribe of Florida is a legally constituted public body with full authority and legal capability to perform the terms of this Amendment No. 2 to the Project Cooperation Agreement between the Department of the Army and the Seminole Tribe of Florida for the Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project and to pay damages, if necessary, in the event of the failure to perform, in accordance with Section 221 of Public Law 91-611, and that the person who has executed this Amendment on behalf of the Seminole Tribe of Florida has acted within his statutory capacity.

IN WITNESS WHEREOF, I have made and executed this certification this 2nd day of March 2011.

Jim Shore
General Counsel
Seminole Tribe of Florida

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

DATE: 2/24/11

Mitchell Cypress
Chairman of its Tribal Council
Seminole Tribe of Florida

AMENDMENT NO. 3
TO
PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE SEMINOLE TRIBE OF FLORIDA
FOR CONSTRUCTION OF THE
BIG CYPRESS SEMINOLE INDIAN RESERVATION WATER CONSERVATION PLAN
CRITICAL RESTORATION PROJECT

This AMENDMENT NO. 3 is entered into this 20th day of August, 2018, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the U.S. Army Commander, Jacksonville District (hereinafter the "District Commander"), and the SEMINOLE TRIBE OF FLORIDA (hereinafter the "Non-Federal Sponsor"), represented by the Chairman of its Tribal Council.

WITNESSETH, THAT:

WHEREAS, the Government and the Non-Federal Sponsor entered into a Project Cooperation Agreement on January 7, 2000 (hereinafter the "Agreement") for the construction of the Big Cypress Seminole Indian Reservation Water Conservation Plan Project (hereinafter the "Project");

WHEREAS, on May 11, 2007, the Government and the Non-Federal Sponsor entered into Amendment No. 1 to the Agreement to implement the new operation, maintenance, repair, replacement and rehabilitation authority for the Project; address the application of Federal labor standards for work to be performed by contractors or subcontractors of the Non-Federal Sponsor; and implement the authority allowing the Seminole Tribe of Florida to apply a certain mitigation credit to mitigation requirements of Section 404 of the Clean Water Act;

WHEREAS, on March 7, 2011, the Government and the Non-Federal Sponsor entered into Amendment No. 2 to the Agreement to implement the increased Federal share of costs of carrying out the Project;

WHEREAS, on July 8, 2015, the Jacksonville District Commander approved an Engineering Documentation Report which removed the Basin 3 lands and associated construction features from the Project; and

WHEREAS, the Government and the Non-Federal Sponsor desire to further amend the Agreement to remove the Basin 3 lands and affiliated features from the Project.

NOW, THEREFORE, the Government and the Non-Federal Sponsor agree to further amend the Agreement as follows:

1. Article I.A. of the Agreement is amended by striking the current paragraph and replacing with the following:

"A. The term "Project" shall mean infrastructure improvements for the construction of water control, management and treatment facilities in Basins 1, 2 and 4, which are located within the western portion of the Big Cypress Seminole Indian Reservation (hereinafter the "Reservation") and planning, design, and construction of conveyance canals on the eastern portion of the Reservation, as well as planning and design activities, land acquisition, and operational and best management practice plans for the basins and reservoirs as generally described in the Seminole Tribe Big Cypress Reservation Water Conservation Plan Letter Report, dated March 1998 and approved by the Chief, Planning Division, Directorate of Civil Works on June 24, 1998 (hereinafter the "Letter Report"), as amended by the Engineering Documentation Report, dated June 2015 and approved by the Jacksonville District Commander on July 8, 2015.

2. Article VI.A. of the Agreement is amended by striking it in its entirety and replacing with the following:

"A. The Government shall maintain current records of contributions provided by the Government and the Non-Federal Sponsor and current projections of total project costs, current projections of each party's share of total project costs and costs due to betterments. By March 31 of each year and at least quarterly thereafter, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project costs, total costs due to betterments, the components of total project costs, each party's share of total project costs, the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, the Non-Federal Sponsor's proportionate share, and the funds the Government projects to be required from the Non-Federal Sponsor for the upcoming fiscal year. On the effective date of Amendment No. 3 to this Agreement, total project costs are projected to be $62,886,000, and the Non-Federal Sponsor's cash contribution required under Article II.D. of this Agreement is projected to be $ 16,491,000. The amount of credit for the Section 208 Work to be afforded against the Non-Federal Sponsor's required contribution towards total project costs in accordance with Article II.D.2. of this Agreement is projected to be $10,119,000. Such amounts are estimates subject to adjustment by the Government, after consultation with the Non-Federal Sponsor, and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor."

3. The title of Article XXI is amended by replacing "PREPARTION" with "PREPARATION".

4. All other terms and conditions of the Agreement, as amended, remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment No. 3, which shall become effective upon the date it is signed by the District Commander.

DEPARTMENT OF THE ARMY

Jason A. Kirk, P.E.
Colonel, U.S. Army
District Commander

Date: 20 AUG 2018

SEMINOLE TRIBE OF FLORIDA

Marcellus W. Osceola, Jr.
Chairman of its Tribal Council
Seminole Tribe of Florida

Date: 7/31/18

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Marcellus W. Osceola, Jr.
Chairman of its Tribal Council
Seminole Tribe of Florida

DATE: 7/31/18

CERTIFICATE OF AUTHORITY

I, Jim Shore, do hereby certify that I am the principal legal officer of the Seminole Tribe of Florida, that the Seminole Tribe of Florida is a legally constituted public body with full authority and legal capability to perform the terms of this Amendment No. 3 to the Agreement between the Department of the Army and the Seminole Tribe of Florida in connection with the Big Cypress Seminole Indian Reservation Water Conservation Plan Project, and to pay damages, if necessary, in the event of the failure to perform in accordance with the terms of this Amendment No. 3 to the Agreement, as required by Section 221 of the Flood Control Act of 1970, as amended (42 U.S.C. Section 1962d-5b), and that the person who executed the Amendment No. 3 on behalf of the Seminole Tribe of Florida acted within his statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 13th day of August 2018.

Jim Shore
General Counsel
Seminole Tribe of Florida

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX D

CODE OF FEDERAL REGULATIONS

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX D1

CODE OF FEDERAL REGULATIONS
TITLE 33, SECTION 208.10

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

§ 208.10 - Local flood protection works; maintenance and operation of structures and facilities.

(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(b) *Levees* - (1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of leave exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls* - (1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures* - (1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent

closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures* - (1) *Maintenance.* Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants* - (1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment,

repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the “Operating Instructions” for each station. The equipment shall be operated in accordance with the above-mentioned “Operating Instructions” and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* - (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities* - (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.

(Sec. 3, 49 Stat. 1571, as amended; 33 U.S.C. 701c) [9 FR 9999, Aug. 17, 1944; 9 FR 10203, Aug. 22, 1944]

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX D2

CODE OF FEDERAL REGULATIONS
TITLE 33, SECTION 208.11

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

This page intentionally left blank

§ 208.11 - Regulations for use of storage allocated for flood control or navigation and/or project operation at reservoirs subject to prescription of rules and regulations by the Secretary of the Army in the interest of flood control and navigation.

(a) Purpose. This regulation prescribes the responsibilities and general procedures for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States, and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding between project owners, operating agencies, and the Corps of Engineers.

(b) Responsibilities. The basic responsibilities of the Corps of Engineers regarding project operation are set out in the cited authority and described in the following paragraphs:

(1) Section 7 of the Flood Control Act of 1944 (58 Stat. 890, 33 U.S.C. 709) directs the Secretary of the Army to prescribe regulations for flood control and navigation in the following manner:

Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: Provided, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department.

(2) Section 9 of Public Law 436-83d Congress (68 Stat. 303) provides for the development of the Coosa River, Alabama and Georgia, and directs the Secretary of the Army to prescribe rules and regulations for project operation in the interest of flood control and navigation as follows:

The operation and maintenance of the dams shall be subject to reasonable rules and regulations of the Secretary of the Army in the interest of flood control and navigation.

Note:

This Regulation will also be applicable to dam and reservoir projects operated under provisions of future legislative acts wherein the Secretary of the Army is directed to prescribe rules and regulations in the interest of flood control and navigation. The Chief of Engineers, U.S. Army Corps of Engineers, is designated the duly authorized representative of the Secretary of the Army to exercise the authority set out in the Congressional Acts. This Regulation will normally be

implemented by letters of understanding between the Corps of Engineers and project owner and will incorporate the provisions of such letters of understanding prior to the time construction renders the project capable of significant impoundment of water. A water control agreement signed by both parties will follow when deliberate impoundment first begins or at such time as the responsibilities of any Corps-owned projects may be transferred to another entity. Promulgation of this Regulation for a given project will occur at such time as the name of the project appears in the Federal Register in accordance with the requirements of paragraph 6k. When agreement on a water control plan cannot be reached between the Corps and the project owner after coordination with all interested parties, the project name will be entered in the Federal Register and the Corps of Engineers plan will be the official water control plan until such time as differences can be resolved.

(3) Federal Energy Regulatory Commission (FERC), formerly Federal Power Commission (FPC), Licenses.

(i) Responsibilities of the Secretary of the Army and/or the Chief of Engineers in FERC licensing actions are set forth in reference 3c above and pertinent sections are cited herein. The Commission may further stipulate as a licensing condition, that a licensee enter into an agreement with the Department of the Army providing for operation of the project during flood times, in accordance with rules and regulations prescribed by the Secretary of the Army.

(A) Section 4(e) of the Federal Power Act requires approval by the Chief of Engineers and the Secretary of the Army of plans of dams or other structures affecting the navigable capacity of any navigable waters of the United States, prior to issuance of a license by the Commission as follows:

The Commission is hereby authorized and empowered to issue licenses to citizens * * * for the purpose of constructing, operating and maintaining dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction * * * Provided further, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of the Army.

(B) Sections 10(a) and 10(c) of the Federal Power Act specify conditions of project licenses including the following:

(1) Section 10(a). “That the project adopted * * * shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of waterpower development, and for other beneficial public uses * * *.”

(2) Section 10(c). “That the licensee shall * * * so maintain and operate said works as not to impair navigation, and shall conform to such rules and regulations as the Commission may from time to time prescribe for the protection of life, health, and property * * *.”

(C) Section 18 of the Federal Power Act directs the operation of any navigation facilities built under the provision of that Act, be controlled by rules and regulations prescribed by the Secretary of the Army as follows:

The operation of any navigation facilities which may be constructed as part of or in connection with any dam or diversion structure built under the provisions of this Act, whether at the expense of a licensee hereunder or of the United States, shall at all times be controlled by such reasonable rules and regulations in the interest of navigation; including the control of the pool caused by such dam or diversion structure as may be made from time to time by the Secretary of the Army, * * *.

(ii) Federal Power Commission Order No. 540 issued October 31, 1975, and published November 7, 1975 (40 FR 51998), amending § 2.9 of the Commission's General Policy and Interpretations prescribed Standardized Conditions (Forms) for Inclusion in Preliminary Permits and Licenses Issued Under part I of the Federal Power Act. As an example, Article 12 of Standard Form L-3, titled: “Terms and Conditions of License for Constructed Major Projects Affecting Navigable Waters of the United States,” sets forth the Commission's interpretation of appropriate sections of the Act, which deal with navigation aspects, and attendant responsibilities of the Secretary of the Army in licensing actions as follows:

The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, * * * and the Licensee shall release water from the project reservoir at such rate * * * as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

(c) Scope and terminology. This regulation applies to Federal authorized flood control and/or navigation storage projects, and to non-Federal projects which require the Secretary of the Army to prescribe regulations as a condition of the license, permit or legislation, during the planning, design and construction phases, and throughout the life of the project. In compliance with the authority cited above, this regulation defines certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. In carrying out the conditions of this regulation, the owner and/or operating agency will comply with applicable provisions of Pub. L. 85-624, the Fish and Wildlife Coordination Act of 1958, and Pub. L. 92-500, the Federal Water Pollution Control Act Amendments of 1972. This regulation does not apply to local flood protection works governed by § 208.10, or to navigation facilities and associated structures which are otherwise covered by part 207 (Navigation

Regulations) of title 33 of the code. Small reservoirs, containing less than 12,500 acre-feet of flood control or navigation storage, may be excluded from this regulation and covered under § 208.10, unless specifically required by law or conditions of the license or permit.

(1) The terms reservoir and project as used herein include all water resource impoundment projects constructed or modified, including natural lakes, that are subject to this regulation.

(2) The term project owner refers to the entity responsible for maintenance, physical operation, and safety of the project, and for carrying out the water control plan in the interest of flood control and/or navigation as prescribed by the Corps of Engineers. Special arrangements may be made by the project owner for "operating agencies" to perform these tasks.

(3) The term letter of understanding as used herein includes statements which consummate this regulation for any given project and define the general provisions or conditions of the local sponsor, or owner, cooperation agreed to in the authorizing legislative document, and the requirements for compliance with section 7 of the 1944 Flood Control Act, the Federal Power Act or other special congressional act. This information will be specified in the water control plan and manual. The letter of understanding will be signed by a duly authorized representative of the Chief of Engineers and the project owner. A "field working agreement" may be substituted for a letter of understanding, provided that the specified minimum requirements of the latter, as stated above, are met.

(4) The term water control agreement refers to a compliation of water control criteria, guidelines, diagrams, release schedules, rule curves and specifications that basically govern the use of reservoir storage space allocated for flood control or navigation and/or release functions of a water control project for these purposes. In general, they indicate controlling or limiting rates of discharge and storage space required for flood control and/or navigation, based on the runoff potential during various seasons of the year.

(5) For the purpose of this regulation, the term water control plan is limited to the plan of regulation for a water resources project in the interest of flood control and/or navigation. The water control plan must conform with proposed allocations of storage capacity and downstream conditions or other requirements to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system.

(6) The term real-time denotes the processing of current information or data in a sufficiently timely manner to influence a physicial response in the system being monitored and controlled. As used herein the term connotes * * * the analyses for and execution of water control decisions for both minor and major flood events and for navigation, based on prevailing hydrometeorological and other conditions and constraints, to achieve efficient management of water resource systems.

(d) Procedures - (1) Conditions during project formulation. During the planning and design phases, the project owner should consult with the Corps of Engineers regarding the quantity and value of space to reserve in the reservoir for flood control and/or navigation purposes, and for utilization of the space, and other requirements of the license, permit or conditions of the law.

Relevant matters that bear upon flood control and navigation accomplishment include: Runoff potential, reservoir discharge capability, downstream channel characteristics, hydrometeorological data collection, flood hazard, flood damage characteristics, real estate acquisition for flowage requirements (fee and easement), and resources required to carry out the water control plan. Advice may also be sought on determination of and regulation for the probable maximum or other design flood under consideration by the project owner to establish the quantity of surcharge storage space, and freeboard elevation of top of dam or embankment for safety of the project.

(2) Corps of Engineers involvement. If the project owner is responsible for real-time implemenetation of the water control plan, consultation and assistance will be provided by the Corps of Engineers when appropriate and to the extent possible. During any emergency that affects flood control and/or navigation, the Corps of Engineers may temporarily prescribe regulation of flood control or navigation storage space on a day-to-day (real-time) basis without request of the project owner. Appropriate consideration will be given for other authorized project functions. Upon refusal of the project owner to comply with regulations prescribed by the Corps of Engineers, a letter will be sent to the project owner by the Chief of Engineers or his duly authorized representative describing the reason for the regulations prescribed, events that have transpired, and notification that the project owner is in violation of the Code of Federal Regulations. Should an impasse arise, in that the project owner or the designated operating entity persists in noncompliance with regulations prescribed by the Corps of Engineers, measures may be taken to assure compliance.

(3) Corps of Engineers implementation of real-time water control decisions. The Corps of Engineers may prescribe the continuing regulation of flood control storage space for any project subject to this regulation on a day-to-day (real-time) basis. When this is the case, consultation and assistance from the project owner to the extent possible will be expected. Special requests by the project owner, or appropriate operating entity, are preferred before the Corps of Engineers offers advice on real-time regulation during surcharge storage utilization.

(4) Water control plan and manual. Prior to project completion, water control managers from the Corps of Engineers will visit the project and the area served by the project to become familiar with the water control facilities, and to insure sound formulation of the water control plan. The formal plan of regulation for flood control and/or navigation, referred to herein as the water control plan, will be developed and documented in a water control manual prepared by the Corps of Engineers. Development of the manual will be coordinated with the project owner to obtain the necessary pertinent information, and to insure compatibility with other project purposes and with surcharge regulation. Major topics in the manual will include: Authorization and description of the project, hydrometeorology, data collection and communication networks, hydrologic forecasting, the water control plan, and water resource management functions, including responsibilities and coordination for water control decisionmaking. Special instructions to the dam tender or reservoir manager on data collection, reporting to higher Federal authority, and on procedures to be followed in the event of a communication outage under emergency conditions, will be prepared as an exhibit in the manual. Other exhibits will include copies of this regulation,

letters of understanding consummating this regulation, and the water control agreements. After approval by the Chief of Engineers or his duly authorized representative, the manual will be furnished the project owner.

(5) Water control agreement. (i) A water control diagram (graphical) will be prepared by the Corps of Engineers for each project having variable space reservation for flood control and/or navigation during the year; e.g., variable seasonal storage, joint-use space, or other rule curve designation. Reservoir inflow parameters will be included on the diagrams when appropriate. Concise notes will be included on the diagrams prescribing the use of storage space in terms of release schedules, runoff, nondamaging or other controlling flow rates downstream of the damsite, and other major factors as appropriate. A water control release schedule will be prepared in tabular form for projects that do not have variable space reservation for flood control and/or navigation. The water control diagram or release schedule will be signed by a duly authorized representative of the Chief of Engineers, the project owner, and the designated operating agency, and will be used as the basis for carrying out this regulation. Each diagram or schedule will contain a reference to this regulation.

(ii) When deemed necessary by the Corps of Engineers, information given on the water control diagram or release schedule will be supplemented by appropriate text to assure mutual understanding on certain details or other important aspects of the water control plan not covered in this regulation, on the water control diagram or in the release schedule. This material will include clarification of any aspects that might otherwise result in unsatisfactory project performance in the interest of flood contol and/or navigation. Supplementation of the agreement will be necessary for each project where the Corps of Engineers exercises the discretionary authority to prescribe the flood control regulation on a day-to-day (real-time) basis. The agreement will include delegation of the responsibility. The document should also cite, as appropriate, section 7 of the 1944 Flood Control Act, the Federal Power Act and/or other congressional legislation authorizing construction an/or directing operation of the project.

(iii) All flood control regulations published in the Federal Register under this section (part 208) of the code prior to the date of this publication which are listed in § 208.11(e) are hereby superseded.

(iv) Nothing in this regulation prohibits the promulgation of specific regulations for a project in compliance with the authorizing acts, when agreement on acceptable regulations cannot be reached between the Corps of Engineers and the owner.

(6) Hydrometeorological instrumentation. The project owner will provide instrumentation in the vicinity of the damsite and will provide communication equipment necessary to record and transmit hydrometeorological and reservoir data to all appropriate Federal authorities on a real-time basis unless there are extenuating circumstances or are otherwise provided for as a condition of the license or permit. For those projects where the owner retains responsibility for real-time implementation of the water control plan, the owner will also provide or arrange for the measurement and reporting of hydrometeorological parameters required within and adjacent to the watershed and downstream of the damsite, sufficient to regulate the project for flood control

and/or navigation in an efficient manner. When data collection stations outside the immediate vicinity of the damsite are required, and funds for installation, observation, and maintenance are not available from other sources, the Corps of Engineers may agree to share the costs for such stations with the project owner. Availability of funds and urgency of data needs are factors which will be considered in reaching decisions on cost sharing.

(7) Project safety. The project owner is responsible for the safety of the dam and appurtenant facilities and for regulation of the project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the project owner, and does not relieve the owner of the responsibility for safety of the project.

(8) Notification of the general public. The Corps of Engineers and other interested Federal and State agencies, and the project owner will jointly sponsor public involvement activities, as appropriate, to fully apprise the general public of the water control plan. Public meetings or other effective means of notification and involvement will be held, with the initial meeting being conducted as early as practicable but not later than the time the project first becomes operational. Notice of the initial public meeting shall be published once a week for 3 consecutive weeks in one or more newspapers of general circulation published in each county covered by the water control plan. Such notice shall also be used when appropriate to inform the public of modifications in the water control plan. If no newspaper is published in a county, the notice shall be published in one or more newspapers of general circulation within that county. For the purposes of this section a newspaper is one qualified to publish public notices under applicable State law. Notice shall be given in the event significant problems are anticipated or experienced that will prevent carrying out the approved water control plan or in the event that an extreme water condition is expected that could produce severe damage to property or loss of life. The means for conveying this information shall be commensurate with the urgency of the situation. The water control manual will be made available for examination by the general public upon request at the appropriate office of the Corps of Engineers, project owner or designated operating agency.

(9) Other generalized requirements for flood control and navigation. (i) Storage space in the reservoirs allocated for flood control and navigation purposes shall be kept available for those purposes in accordance with the water control agreement, and the plan of regulation in the water control manual.

(ii) Any water impounded in the flood control space defined by the water control agreement shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from reservoirs shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dam, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan or regulation may require releases to be completely curtailed in the interest of flood control or safety of the project.

(iii) Nothing in the plan of regulation for flood control shall be construed to require or allow dangerously rapid changes in magnitudes of releases. Releases will be made in a manner consistent with requirements for protecting the dam and reservoir from major damage during passage of the maximum design flood for the project.

(iv) The project owner shall monitor current reservoir and hydro- meteorological conditions in and adjacent to the watershed and downstream of the damsite, as necessary. This and any other pertinent information shall be reported to the Corps of Engineers on a timely basis, in accordance with standing instructions to the damtender or other means requested by the Corps of Engineers.

(v) In all cases where the project owner retains responsibility for real-time implementation of the water control plan, he shall make current determinations of: Reservoir inflow, flood control storage utilized, and scheduled releases. He shall also determine storage space and releases required to comply with the water control plan prescribed by the Corps of Engineers. The owner shall report this information on a timely basis as requested by the Corps of Engineers.

(vi) The water control plan is subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the project owner and shall include justification for the action.

(vii) The project owner may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Chief of Engineers, or his duly authorized representative.

(viii) Advance approval of the Chief of Engineers, or his duly authorized representative, is required prior to any deviation from the plan of regulation prescribed or approved by the Corps of Engineers in the interest of flood control and/or navigation, except in emergency situations provided for in paragraph (d)(9)(vii) of this section. When conditions appear to warrant a prolonged deviation from the approved plan, the project owner and the Corps of Engineers will jointly investigate and evaluate the proposed deviation to insure that the overall integrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigations and evaluations have been conducted to the extent deemed necessary by the Chief of Engineers, or his designated representatives, to fully substantiate the deviation.

(10) Revisions. The water control plan and all associated documents will be revised by the Corps of Engineers as necessary, to reflect changed conditions that come to bear upon flood control and navigation, e.g., reallocation of reservoir storage space due to sedimentation or transfer of storage space to a neighboring project. Revision of the water control plan, water control agreement, water control diagram, or release schedule requires approval of the Chief of Engineers or his duly authorized representative. Each such revision shall be effective upon the date specified in the approval. The original (signed document) water control agreement shall be

kept on file in the respective Office the Division Engineer, Corps of Engineers, Department of the Army, located at division offices throughout the continental USA. Copies of these agreements may be obtained from the office of the project owner, or from the office of the appropriate Division Engineer, Corps of Engineers.

(11) Federal Register. The following information for each project subject to section 7 of the 1944 Flood Control Act and other applicable congressional acts shall be published in the Federal Register prior to the time the projects becomes operational and prior to any significant impoundment before project completion or * * * at such time as the responsibility for physical operation and maintenance of the Corps of Engineers owned projects is transferred to another entity:

(i) Reservoir, dam, and lake names,

(ii) Stream, county, and State corresponding to the damsite location,

(iii) The maximum current storage space in acre-feet to be reserved exclusively for flood control and/or navigation purposes, or any multiple-use space (intermingled) when flood control or navigation is one of the purposes, with corresponding elevations in feet above mean sea level, and area in acres, at the upper and lower limits of said space,

(iv) The name of the project owner, and

(v) Congressional legislation authorizing the project for Federal participation.

(e) List of projects. The following tables, “Pertinent Project Data - Section 208.11 Regulation,” show the pertinent data for projects which are subject to this regulation.

List of Projects

[Non-Corps projects with Corps Regulation Requirements]

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Agency Valley Dam & Res	OR	Malheur	N Fork Malheur R	FICR	60.0	3340.0	3263.0	1900	0	PL 68-292	USBR.
Alpine Dam	IL	Winnebago	Keith Cr	F	0.6	796.0	760.0	52	0	PWA Proj	Rkfd, IL.
Altus Dam & Res	OK	Jackson	N Fork Red R	F IMR	19.6 132.6	1562.0 1559.0	1559.0 1517.5P	6800 6260	6260 735	PL 761	USBR.
Anderson Ranch Dam & Res	ID	Elmore	S Fk Boise R	FEI	423.2	4196.0	4039.6	4740	1150	Act of 1939 53 Stat 1187	USBR.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Arbuckle Dam & Res	OK	Murray	Rock Cr	F MRC	36.4 62.5	885.3 872.0	872.0 827.0	3130 2350	2350 606	PL 594	USBR.
Arrowrock Dam & Res	ID	Elmore	Boise R	FI	286.6	3216.0	2974.0	3100	200	Act of 1902 32 Stat 388	USBR.
Bear Cr Dam	MO	Marion Ralls	Bear Cr	F	8.7	546.5	520.0	540	0	PL 83-780	Hnbl, MO.
Bear Swamp Fife Brook (Lo)	MA	Franklin	Deerfield R	E	6.9	870.0	830.0	152	115	FERC 2669	NEPC.
Bear Swamp PS (Upper)	MA	Franklin	Deerfield R Trib	E	8.9	1600.0	1550.0	118	102	Fed Pwr Act	NEPC.
Bellows Falls Dam & Lk	VT	Cheshire	Connecticut R	E	7.5	291.6	273.6	2804	836	FERC 1885	NEPC.
Big Dry Creek and Div	CA	Fresno	Big Dry Cr & Dog Cr	F	16.2	425.0	393.0	1530	0	PL 77-228	Rclm, B CA.
Blue Mesa Dam & Res	CO	Gunnison	Gunnison R	FER	748.5	7519.4	7393.0	9180	2790	PL 84-485	USBR
Boca Dam & Res	CA	Nevada	Little Truckee R	I FI	32.8 8.0	5596.5 5605.0	5521.0 5596.0	873 980	52 873	PL 61-289 PL 68-292	USBR.
Bonny Dam & Res	CO	Yuma	S Fork Republic R	F ICR	128.2 39.2	3710.0 3672.0	3672.0 3638.0	5036 2042	2042 331	PL 78-534 PL 79-732	USBR.
Boysen Dam & Res	WY	Fremont	Wild R	F FEIQ EIQ	150.4 146.1 403.8	4732.2 4725.0 4717.0	4725.0 4717.0 4685.0	22170 19560 16960	19560 16960 9280	PL 78-534	USBR.
Brantley Dam & Res	NM	Eddy	Pecos R	FIRQ	348.5	3283.0	3210.7	21294	38	PL 92-515	USBR.
Brownlee Dam & Res	OR ID	Baker Washington	Snake R	FE	975.3	2077.0	1976.0	13840	6650	FERC No 1971-C	ID Pwr.
Bully Cr Dam & Res	OR	Malheur	Bully Cr	FI	31.6	2516.0	2456.8	1082	140	PL 86-248	USBR.
Camanche Dam & Res	CA	San Joaquin	Mokelumne R	FRIE RIE	200.0 230.9	235.5 205.1	205.1 92.0	7600 5507	5507 0	PL 86-645	EB-MUD.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Canyon Ferry Dam & Lk	MT	Lewis Clark	Missouri R	F FEI EI	99.5 795.1 711.5	3800.0 3797.0 3770.0	3797.0 3770.0 3728.0	33535 32800 24125	32800 24125 11480	PL 78-534	USBR.
Cedar Bluff Dam & Res	KS	Trego	Smoky Hill R	F IMCR	191.9 149.8	2166.0 2144.0	2144.0 2107.8	10790 6869	6869 2086	PL 78-534	USBR.
Cheney Dam & Res	KS	Sedgwick	N Fork Ninnescah R	F MC	80.9 151.8 0.0	1429.9 1421.6 0.0	1421.6 1392.9 0.0	12420 9540 0	9540 1970 0	PL 86-787	USBR.
Clark Canyon Dam & Res	MT	Beaverhead	Beaverhead R	F FI I	79.1 50.4 126.1	5560.4 5546.1 5535.7	5546.1 5535.7 5470.6	5900 5160 4495	5160 4495 220	PL 78-534	USBR.
Del Valle Dam & Res	CA	Alameda	Alameda Cr	F FIM IMR	37.0 1.0 29.0	745.0 703.1 702.2	703.1 702.2 635.0	1060 710 700	710 700 275	PL 87-874	DWR. CA.
Don Pedro Dam & Lk	CA	Tuolumne	Tuolumne R	FIER EIR	340.0 1381.0 308.0	830.0 802.0 600.0	802.0 600.0 342.0	12900 11260 3520	11260 3520 29	PL 78-534	M&T. Irr.
East Canyon Dam & Res	UT	Morgan	East Canyon Cr	FEIM	48.0	5705.5	5578.0	684	130	PL 81-273	USBR.
Echo Dam & Res	UT	Summit	Weber R	FEIM	74.0	5560.0	5450.0	1455	0	PL 81-83	USBR.
Emigrant Dam & Res	OR	Jackson	Emigrant Cr	FIR	39.0	2241.0	2131.5	801	80	PL 83-606	USBR.
Enders Dam & Res	NE	Chase	Frenchman Cr	F ICR	30.0 34.5	3127.0 3112.3	3112.3 3082.4	2405 1707	1707 658	PL 78-534 PL 84-505	USBR.
Folsom Dam & Lk	CA	Sacramento	American R	FEIM EIM	400.0 610.0	466.0 427.0	427.0 210.0	11450 9040	9040 0		USBR.
Fort Cobb Dam & Res	OK	Caddo	Pond (Cobb) Cr	F IMCR	63.7 78.3	1354.8 1342.0	1342.0 1300.0	5980 4100	4100 337	PL 419	USBR.
Foss Dam & Res	OK	Custer	Washita R	F IMRC	180.6 243.8	1668.6 1652.0	1652.0 1597.2	13140 8800	8800 1360	PL 419	USBR.
Friant Dam & Millerton Lk	CA	Fresno	San Joaquin R	FEIM	390.5	578.0	466.3	4850	2101	PL 75-392 PL 76-868	USBR.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Galesville Dam	OR	Douglas	Cow Cr	FEMCR	42.2	1881.5	1780.0	760	150	FERC No. 71 61001	Dgls, CO.
Gaston Dam & Res	NC	Halifax Northampton	Roanoke R	FE	63.0	203.0	200.0	22500	20300	Fed Pwr Act	VA Pwr.
Glen Elder Dam & Waconda Lk	KS	Mitchel	Solomon R	F IM	722.3 204.8	1488.3 1455.6	1455.6 1428.0	33682 12602	12602 3341	PL 78-534 PL 79-526	USBR.
Glendo Dam & Res	WY	Platte	N Platte R	F EIM	271.9 454.3	4653.0 4635.0	4635.0 4570.0	17990 12370	12370 3130	PL 78-534	USBR.
Grand Coulee Dam & FDR Lk	WA	Okanogan Grant	Columbia R	FEI	5185.5	1290.0	1208.0	82280	45592	PL 89-561	USBR.
H Neely Henry Dam & Res	AL	Calhoun St. Clair	Coosa R	FE	49.7	508.0	502.5	11235	7632	PL 83-436	AL Pwr.
Harris Dam & Res	AL	Randolph	Tallapoosa R	FE	215.0	793.0	785.0	10661	9012	PL 89-789	AL Pwr.
Heart Butte Dm & Lk Tschida	ND	Grant	Heart R	F IQ	147.9 69.0	2094.5 2064.5	2064.5 2030.0	6580 3400	3400 810	PL 78-534	USBR.
Hells Canyon Dam & Res	OR ID	Wallowa Adams	Snake R	EN	11.7	1688.0	1683.0	2380	2280	FERC No 1971-A	ID Pwr.
Hoover Dam & Lk Mead	NV AZ	Clark Mohave	Colorado R	F FEIMCAR	1500.0 15.8	1229.0 1219.6	1219.6 1083.0	162700 156500	156500 83500	PL 70-642	USBR.
Hungry Horse Dam & Res	MT	Flathead	S Fork Flathead R	FEI	2982.0	3560.0	3336.0	23800	5400	PL 78-329	USBR.
Indian Valley Dam & Res	CA	Lake	N Fork Cache Cr	FIMR IMR	40.0 260.0	1485.0 1474.0	1474.0 1334.0	3975 3734	3734 308	PL 84-984	Yolo FC&W.
Jamestown Dam & Res	ND	Stutsman	James R	F IQ	185.4 28.1	1454.0 1429.8	1429.8 1400.0	13210 2090	2090 160	PL 78-534	USBR.
Jocassee Dam & Res	SC	Pickens	Keowee R	PRFC	1160.0	1110.0	1080.0	7565	6815	FERC 2503	USBR Pwr.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Keowee Dam & Lk	SC	Pickens	Keowee R	FPMCAR	392.0	800.0	775.0	18372	13072	FERC 2503	Duke Pwr.
Kerr Dam Flathead Lk	MT	Lake	Flathead R	FER	1219.0	2893.0	2883.0	125560	120000	FERC No 5	MT Pwr.
Kerr Dam & Lk Hudson (Markham Ferry Project)	OK	Mayes	Grand Neosho R	F E	244.2 48.6	636.0 619.0	619.0 599.0	18800 10900	10900 4500	PL 76-476	GRD Auth.
Keyhole Dam & Res	WY	Crook	Belle Fourche R	F IQ	140.5 185.8	4111.5 4099.3	4099.3 4051.0	13730 9410	9410 820	PL 78-534	USBR.
Kirwin Dam & Res	KS	Phillips	N Fork Solomon R	F ICR	215.1 89.6	1757.3 1729.2	1729.3 1697.0	10640 5080	5080 1010	PL 78-534 PL 79-732; PL 79-526	USBR.
Lake Kemp Dam & Res	TX	Wichita	Wichita R	F MI	234.9 268.0	1156.0 1144.0	1144.0 1114.0	23830 15590	15590 3350	SD 144	WF&C. WID2.
Leesville Dam & Res	VA	Campbell Pttsylvnia	Roanoke R	EQ	37.8	613.0	600.0	3235	2400	Fed Pwr Act	Appl Pwr.
Lemon Dam & Res	CO	La Plata	Florida R	FIM	39.0	8148.0	8023.0	622	62	PL 84-485	USBR.
Lewis M Smith Dam & Res	AL	Walker Culman	Sipsey Fork; Black Warrior R	F E	280.6 394.3	522.0 510.0	510.0 488.0	25700 21200	21200 15097	Fed Pwr Act	AL Pwr.
Little Wood	ID	Blain	Little Wood R	FI	30.0	5237.3	5127.4	572	0	PL 84-993	USBR.
Logan Martin Dam & Res	AL	Talladega	Cossa R	F E	245.3 67.0	477.0 465.0	465.0 460.0	26310 15263	15260 11887	PL 83-436	AL Pwr.
Los Banos Dam & Detention	CA	Merced	Los Banos Cr	R	20.6	327.8	231.2	467	0		USBR.
Los Banos Dam & Detention Res	CA	Merced	Los Banos Cr	F	14.0	353.5	327.8	619	467	PL 86-488	USBR.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Lost Creek Dam & Res	UT	Morgan	Lost Cr	FEIM	20.0	6005.0	5912.0	365	93	PL 81-273	USBR.
Lovewell Dam & Res	KS	Jewell	White Rock Cr	F ICR	50.5 24.9	1595.3 1582.6	1582.6 1571.7	5025 2986	2986 1704	PL 78-534 PL 79-732	USBR.
Marshall Ford Dam & Res	TX	Travis	Colorado R	F NEIM	779.8 810.5	714.0 681.0	681.0 618.0	29060 18955	18955 8050	PL 73-392 PL 78-534	LCRA
Mayfield Dam & Res	WA	Lewis	Cowlitz R	FER	21.4	425.0	415.0	2250	2030	FPC No 2016-A	Tac WN.
McGee Creek Dam & Res	OK	Atoka	McGee Cr	F MCR	85.3 108.0	595.5 577.7	577.1 515.1	5540 3810	3810 370	PL 94-423	USBR.
Medicine Cr Dam Harry Strunk Lk	NE	Frontier	Medicine Cr	F ICR	52.7 26.8	2386.2 2366.1	2366.1 2343.0	3483 1840	1840 701	PL 78-534 PL 84-505	USBR.
Mossyrock Dam Davisson Lk	WA	Lewis	Cowlitz R	FER	1397.0	778.5	600.0	11830	4250	FERC No 2016-B	Tac, WN
Mt Park Dam Tom Steed Res	OK	Kiowa	W Otter Cr	F MRC	20.3 89.0	1414.0 1411.0	1411.0 1386.3	7130 6400	6400 1270	PL 90-503	USBR.
Navajo Dam & Res	NM	San Juan Rio Arriba	San Juan R	FEIRQ	1036.1	6085.0	5990.0	15610	7400	PL 84-485	USBR.
New Bullards Bar Dam & Res	CA	Yuba	Yuba R	FEIMR EIMR	170.0 790.9	1956.0 1918.3	1918.3 1447.5	4809 4225	4225 129	PL 89-298	YCWA.
New Exchequer Dam & Lk	CA	Tuolumne	Merced R	FEIR EIR IR	400.0 451.6 171.0	867.0 799.7 660.0	799.7 660.0 467.0	7110 4849 1900	4849 1900 150	PL 86-645	Mrcd, Irr.
New Melones Dam & Lk	CA	Tuolumne Calaveras	Stanislaus R	FEIMR EIMR IMR	450.0 1670.0 300.0	1088.0 1049.5 808.0	1049.5 808.0 540.0	12500 10900 3500	10900 3500 0	PL 87-874	USBR.
Northfield Mt (Up) PS	MA	Franklin	Connecticut	E	14.0	965.0	938.0	196	134	FERC 1889	WMEC.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Norton Dam & Kieth Sebelius Lk	KS	Norton	Prairie Dog Cr	F IMRC	98.8 30.7	2331.4 2304.3	2304.3 2280.4	5316 2181	2181 587	PL 78-534 PL 79-526 PL 79-732	USBR.
Ochoco Dam & Res	OR	Crook	Ochoco Cr	FICR	52.5	3136.2	0.0	1130	130	PL 84-992	USBR.
Oroville Dam & Lk	CA	Butte	Feather R	FEIMAR EIMAR	750.0 2788.0	900.0 848.5	848.5 210.0	15800 13346	13346 0	PL 85-500	CA.
Pactola Dam & Res	SD	Pennington	Rapid Cr	F IM	43.1 55.0	4621.5 4580.2	4580.2 4456.1	1230 860	860 100	PL 78-534	USBR.
Palisades Dam & Res	ID	Bonneville	Snake R	FIE	1202.0	5620.0	5452.0	16100	2170	PL 81-864	USBR.
Paonia Dam & Res	CO	Gunnision	Muddy Cr	FIR	17.0	6447.5	6373.0	334	120	PL 80-177 PL 84-485	USBR.
Pensacola Dam Grand Lake O' the Cherokees	OK	Mayes	Grand (Neosho) R	F E	525.0 1192.0	755.0 745.0	745.0 705.0	59200 46500	46500 17000	PL 77-228	Grd, Auth.
Pineview Dam & Res	UT	Weber	Odgen R	FEIM	110.0	4900.0	4818.0	2874	0	PL 81-273	USBR.
Platoro Dam & Res	CO	Conejos	Conejos R	F IR	6.0 54.0	10034.0 10027.5	10027.5 9911.0	947 920	920 0	PL 76-640	USBR.
Priest Rapids Dam & Res	WA	Grant	Columbia R	FER	44.0	488.0	481.5	7600	6500	FERC No 2114-A	Grnt, PUD.
Prineville Dam & Res	OR	Crook	Crooked R	FIRC	233.0	3257.9	3114.0	3997	140	PL-84-992	USBR.
Prosser Cr Dam & Res	CA	Nevada	Prosser Cr	C FC	8.6 20.0	5703.7 5761.0	5661.0 5703.7	334 745	86 334	PL 84-858 PL 85-706	USBR.
Pueblo Dam & Res	CO	Pueblo	Arkansas R	F IR	93.0 261.4	4898.7 4880.5	4880.5 4764.0	5671 4640	4640 421	PL 87-590	USBR.
Red Willow Dam Hugh Butler Lk	NE	Frontier	Red Willow Cr	F IRC	48.9 27.3	2604.9 2581.8	2581.8 2558.0	2682 1629	1629 787	PL 78-534 PL 85-783 PL 84-505	USBR.
Ririe Dam & Res	ID	Bonneville	Willow Cr	FIRC	99.0	5119.0	5023.0	150	360	PL 87-874	USBR.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Roanoke Rapids Dam & Res	NC	Halifax	Roanoke R	EC	16.8	132.0	128.0	4600	4100	FPC 2009	VA, Pwr.
Rocky Reach Dam Lk Entiat	WA	Chelan	Columbia R	FER	36.0	707.0	703.0	9920	9490	FERC No 2145	Chln PUD.
Rocky River PS Lk Candlewood	CT	Litchfield	Housatonic R	E	142.5	430.0	418.0	5608	4692	FERC 2576	CLPC.
Ross Dam & Res	WA	Whatcom	Skagit R	E	1052.0	1602.5	1475.0	11700	4450	FERC 553	Sttl.
Sanford Dam & Lk Meredith	TX	Hutchison	Canadian R	F IMCRQ	462.1 761.3	2965.0 2941.3	2941.3 2860.0	21640 17320	17320 4500	PL 81-898	USBR.
Savage River Dam & Res	MD	Garrett	Savage R	FMA	20.0	1468.5	1317.0	366	0	PL 78-534	Ptmc Comm.
Scoggins Dam Henry Hagg Lk			Scoggins Cr	FIR	56.3	305.8	235.3	116	4	PL 89-596	USBR.
Shadehill Dam & Res	SD	Perkins	Grand R	F IQ	218.3 80.9	2302.0 2271.9	2271.9 2250.8	9900 4800	4800 2800	PL 78-534	USBR.
Shasta Dam Lk	CA	Shasta	Sacramento R	FEIA EIA	1300.0 3241.0	1067.0 1018.6	1018.6 735.8	29570 23894	23894 2200	PL 75-392	USBR.
Shepaug Dam & Lk	CT	Litchfield	Housatonic R	E	5.0	200.0	172.0	1882	1125	FERC 2576	CLPC.
Smith Mtn Dam & Res	VA	Bedford Franklin Roanoke Pttsylvnia	Roanoke R	E	40.8	795.0	793.0	20600	20200	Fed Pwr Act	Appl Pwr.
Stampede Dam & Res	CA	Sierra	Little Truckee R	FEM EM	22.0 199.4	5949.0 5942.0	5942.1 5798.0	3430 3230	3230 210	PL 84-858	USBR.
Starvation Dam and Res	UT	Duchesne	Strawberry R	FIM	165.3	5712.0	5595.0	3310	689	PL 84-485	USBR.

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Stevens Creek Dam & Res	GA	Columbia	Savannah River	P	10.5	187.5	183.0	4300	0	FERC 2535	SC E&G.
Stevenson Dam Lk Zoar	CT	Litchfield	Housatonic R	E	5.0	108.0	80.0	1148	516	FERC 2576	CLPC.
Summer Dam & Lk	NM	De Baca	Pecos R	FI	51.4	4261.0	4200.0	2835	0	PL 83-780	USBR.
Tat Momolikot Dam & Lake	AZ	Pinal	Santa Rosa Wash	FIC	198.5	1539.0	1480.0	11790	0	PL 89-298	BIA.
Tiber Dam & Res	MT	Libert Toole	Marias R	F FIQ IQ	400.9 268.0 121.7	3012.5 2993.0 2976.0	2993.0 2976.0 2966.4	23150 17890 13790	17890 13790 11710	PL 78-534	USBR.
Trenton Dam & Res	NB	Hitchcock	Republican R	F IRC	134.1 99.8	2773.0 2752.0	2752.0 2720.0	7940 4922	4922 1572	PL 78-534 PL 84-505	USBR.
Turners Falls (Low) Dam & Lk	MA	Franklin	Connecticut R	E	8.7	185.0	176.0	2110	1880	FERC 1889	WMEC
Twin Buttes Dam & Lake	TX	Tom Green	Concho R	F IM	454.4 150.0	1969.1 1940.2	1940.2 1885.0	23510 9080	23510 670	PL 85-152 PL 78-534	USBR
Twitchell Dam & Res	CA	Santa Barbara	Cuyama R	F IM	89.8 135.6	651.5 623.0	623.0 504.0	3671 2556	2556 0	PL 83-774	USBR
Upper Baker Dam Baker Lk	WA	Whatcom	Baker R	FE	184.6	724.0	674.0	4985	2375	PL 89-298 FERC 2150B	Pgt P&L
Vallecito Dam & Res	CO	La Plata	Los Pinos R	FEI	125.4	7665.0	7582.5	2720	350	PL 61-288 PL 68-292	USBR
Vernon Dam & Lk	VT	Windham	Connecticut R	E	18.3	220.1	212.1	2550	1980	FERC 1904	NEPC
Wanapum Dam & Res	WA	Grant	Columbia R	FER	151.6	571.5	560.0	14300	13350	FERC No 2114-B	Grnt PUD
Wanship Dam & Rockport	UT	Summit	Weber R	FEIM	61.0	6037.0	5930.0	1077	121	PL 81-273	USBR

Project name 1 (1)	State (2)	County (3)	Stream 1 (4)	Project purpose 2 (5)	Storage 1000 AF (6)	Elev limits feet M.S.L.		Area in acres		Authorizing legis. 3 (11)	Proj. owner 4 (12)
						Upper (7)	Lower (8)	Upper (9)	Lower (10)		
Warm Springs Dam & Res	OR	Malheur	Middle Fork Malheur R	FICR	191.0	3406.0	3327.0	460	90	PL 78-534	Vale USBR
Waterbury Dam & Res	VT	Washington	Little R	FP	27.7	617.5	592.0	1330	890	PL 78-534	VT
Webster Dam & Res	KS	Rocks	S Fork Solomon R	F IRC	183.4 72.1	1923.7 1892.5	1892.5 1860.0	8480 3772	3772 906	PL 78-534 PL 79-526 PL 79-732	USBR
Weiss Dam & Res	AL	Cherokee	Coosa R	F E	397.0 148.4	574.0 564.0	564.0 558.0	50000 30200	30200 19545	PL 83-436	AL Pwr
Wells Dam L Pateros	WA	Douglas	Columbia R	FER	74.0	781.0	771.0	10000	8000	FERC No 2149	Dgls PUD
Wilder Dam & Lk	VT	Windsor	Connecticut R	E	13.3	385.0	380.0	3100	2240	FERC 1893	NEPC
Yellowtail Dam & Bighorn Lk	MT	Big Horn	Bighorn R	F FEIQ EIQ	258.3 240.3 336.1	3657.0 3640.0 3614.0	3640.0 3614.0 3547.0	17280 12600 6915	12600 6915 4150	PL 78-534	USBR PUD

1: Cr - Creek; CS - Control Structure; Div - Diversion; DS - Drainage Structure; FG - Floodgate; Fk - Fork; GIWW - Gulf Intercoastal Waterway; Lk - Lake; L&D - Lock & Dam; PS - Pump Station; R - River; Res - Reservoir

2: F - Flood Control; N - Navigation; P - Corps Hydropower; E - Non Corps Hydropower; I - Irrigation; M - Municipal and/or Industrial Water Supply; C - Fish and Wildlife Conservation; A - Low Flow Augmentation or Pollution Abatement; R - Recreation; Q - Water Quality or Silt Control

3: FCA - Flood Control Act; FERC - Federal Energy Regulatory Comm; HD - House Document; PL - Public Law; PW - Public Works; RHA - River & Harbor Act; SD - Senate Document; WSA - Water Supply Act

4: Appl Pwr - Appalachian Power; Chln PUD - Chelan Cnty PUD 1; CLPC - CT Light & Power Co; Dgls PUD - Douglas Cnty PUD 1; DWR - Department of Water Resources; EB-MUD - East Bay Municipal Utility Dist; GRD - Grand River Dam Auth; Grnt PUD - Grant Cnty PUD 2; Hnbl - city of Hannibal; LCRA - Lower Colorado River Authority; M&T Irr - Modesto & Turlock Irr; Mrcd Irr - Merced Irr; NEPC - New England Power Co; Pgnt P&L - Pugent Sound Power & Light; Ptmc Comm - Upper Potomac R Comm; Rclm B - Reclamation Board; Rkfd - city of Rockford; Sttl - city of Seattle; Tac - City of Tacoma; Vale USBR - 50% Vale Irr 50% USBR; WF&CWID - City of Wichita Falls and Wichita Cnty Water Improvement District No. 2; WMEC - Western MA Electric Co; YCWA - Yuba City Water Auth; Yolo FC&W - Yolo Flood Control & Water Conserv Dist.

(Sec. 7, Pub. L. 78-534, 58 Stat. 890 (33 U.S.C. 709); the Federal Power Act, 41 Stat. 1063 (16 U.S.C. 791(A)); and sec. 9, Pub. L. 83-436, 68 Stat. 303) [43 FR 47184, Oct. 13, 1978, as amended at 46 FR 58075, Nov. 30, 1981; 55 FR 21508, May 24, 1990; 79 FR 13564, Mar. 11, 2014]

This page intentionally left blank

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX E

STANDING INSTRUCTIONS TO STRUCTURE OPERATOR

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

APPENDIX E

TABLE OF CONTENTS

STANDING INSTRUCTIONS TO STRUCTURE OPERATOR (DAMTENDER)

Paragraph No.	Title	Page No.
E-01	References	E-1
E-02	General	E-1
E-03	Possible Flow Conditions	E-1
E-04	Maximum Allowable Gate Opening Curves	E-2
E-05	Normal Operating Conditions	E-3
E-06	Storms Procedures	E-3
E-07	Communications Outages	E-3
E-08	Deviation from Normal Regulation	E-3

E-01. References. The following Operation and Maintenance Manuals should be consulted for specific guidance on structure operations and maintenance. This list will be updated upon the completion of the O&M Manuals as construction of project features is completed.

Central and Southern Florida Project O&M Manual

Volume I: Levees, Canals, and Bridges
Volume II: Spillways and Culverts
Volume III: Pumping Stations

E-02. General. The Water Conservation Area-Everglades National Park-South Dade Conveyance System is an integrated system of storage capabilities and structure outlet capacities. The spillway structures are operated to maintain optimum stages in Water Conservation Areas and the canals. The optimum stage essentially represents the limits of storage which guides the regulation of the project for the planned purposes. The minimum levels are set to provide sufficient flood control storage. The optimum level was derived by determining the effect of various water levels on the flood control, low water regulation, groundwater, fish and wildlife, and recreation. The maximum levels are governed by the level of minimum allowable flood damages and maximum level desirable for fish and wildlife.

E-03. Possible Flow Conditions. The project features in the Water Conservation Area-Everglades National Park-South Dade Conveyance System are designed to provide flood protection ranging from 30-percent to 100-percent of the Standard Project Flood (SPF) level without exceeding damaging levels. Spillways in the project area can have four possible flow regimes resulting from the effects of the spillway gates and tailwater effects. The flow regimes are:

a. Free Uncontrolled Flow. The spillway gates are fully opened and the discharge is unaffected by the tailwater stage.

b. Submerged Uncontrolled Flow. The spillway gates are fully opened and the discharge is reduced by tailwater conditions.

c. Free Controlled Flow. The spillway gates are partially opened and discharge is unaffected by the tailwater stage.

d. Submerged Controlled Flow. The spillway gates are partially open and the discharge is reduced by the tailwater conditions.

The spillway discharge rating curves that are being used must be applicable to the particular flow regime encountered. The spillway gates should be opened and closed gradually to provide

an even transition to the new flow regime and to minimize the hydraulic effects downstream. The tailwater stage should be allowed to build up before the next gate opening operation takes place. Some of the spillways in the Water Conservation Area-Everglades National Park-South Dade Conveyance System always have a high tailwater, therefore, no Maximum Allowable Gate Opening (MAGO) Curves are provided for these structures. Spillway gate openings should be checked to insure that the gate opening operations are non-damaging to the spillway. The gate openings should retain the hydraulic jump within the stilling basin and provide safe velocities over the riprap. These MAGO curves must not be exceeded in the "Apron Control" range to insure the safety of the structure. For large floods the MAGO curves may be exceeded in the "Riprap Control" range, however some riprap damage will likely occur.

For spillway structures with multiple gates, the spillway gates should be operated at the same gate opening. As a practical consideration the main spillway gates should not be adjusted such that the gate opening differs by more than one foot. Violation of this precaution could result in erosive action due to excessive velocities, turbulence, and return flow. The stilling basin reduces the kinetic energy of the flow entering the downstream channel. The stilling basin and downstream riprap are intended to prevent scour downstream of the spillway from undermining or otherwise threatening the integrity of the structure.

E-04. Maximum Allowable Gate Opening Curves. Some of the spillways in the Water Conservation Area-Everglades National Park-South Dade Conveyance System always have a high tailwater, therefore, no Maximum Allowable Gate Opening Curves (MAGO) are provided for these structures. The purpose of these MAGO curves are to prevent excessive discharges with low tailwater conditions. They show the allowable gate openings for specific headwater and tailwater elevations to alert the operator that there may be damage downstream of the structure if the gate openings shown on the curve are exceeded. The gate openings limits are based on either hydraulic jump conditions, excessive velocities at the end of the riprap, or excessive velocities over the end sill. If the tailwater is lower than the conjugate depth of the hydraulic jump, the jump will sweep out of the stilling basin and dissipate its energy over the riprap with the possibility of undermining the end sill and causing scour and erosion downstream. A low tailwater with high discharges could create high velocities over the end sill, and can create erosion along the canal banks and channel bottom and may disturb the riprap. The most critical condition for a particular concurrent headwater, tailwater, and discharge is selected for the control at the structure. The controlling condition varies with each structure depending on the required functions at the structure,

the capability of the structure, or the characteristic of the downstream channel.

These maximum allowable gate openings should not be exceeded during normal operations of the structure. During extreme flood conditions it might become necessary to exceed the values on the curve to avoid overtopping or washing out the tieback levees or exceeding the maximum allowable head differential for the structure. In these dangerous situations, the gates should be opened as required to lower the headwater regardless of the limits established on the maximum gate opening curves.

E-05. Normal Operating Conditions. During normal conditions the project structures shall be operated in accordance with the approved Water Control Plan (contained herein as Chapter VII), and in accordance with the structure design criteria as described in Appendix A. Optimum elevations in the manual shall be followed. Deviation from the normal regulation schedule will be permitted only under emergency conditions. Notification shall be as outlined in the Water Control Plan (Chapter VII).

E-06. Storms Procedures.

a. Corps of Engineers. The Jacksonville District, U.S. Army Corps of Engineers (CESAJ) will operate the main outlets to WCA Nos. 1, 2, and 3, during hurricane alerts as specified in the Central and Southern Florida Flood Control Project as Maintained by the Corps of Engineers, Operation & Maintenance Manual.

1. Hurricane Alert - Structures S-10A, B, C, and Structures 11A, B, and C. The Area Engineer will arrange for a two-man inspection team to make an examination of these structures when the U.S. Weather Bureau reports the existence of a hurricane that might strike the South Florida area. This examination ordinarily will be made 12 to 48 hours in advance of the time a hurricane emergency is expected to occur. Prior to making this inspection, the Area Office should contact the Water Management Section of the District Office for instructions relating to desired gate positions condition, including recording gages, with gates set in the position as directed by the District Office. The inspecting team will report to the Area Engineers' office by telephone or radio any instance of a structure not being in proper operating condition, and will be required from the Clewiston Base Station to correct the inoperative condition. The Water Management Section of the Jacksonville District Office should be notified by the Area Engineer or one of his assistants of any inability to comply with requested gate settings.

2. Hurricane Alert - Structures S-12A, B, C, and D. S-12 operations will become the responsibility of the Clewiston Area Engineer in the event of a hurricane alert. Immediately after declaration of a Hurricane Alert by the District Engineer,

the Area Engineer will contact the West Palm Beach office of the C&SFFCD and coordinate operations affecting the two agencies at this spillway. The Area Engineer will arrange for a two-man inspection team to make an examination of these structures when the U.S. Weather Bureau reports the existence of a hurricane that might strike the South Florida area. This examination ordinarily will be made 12 to 48 hours in advance of the time a hurricane emergency is expected to occur. Prior to making this inspection, the Area Office should contact the Water Management Section of the District Office for instructions relating to desired gate positions condition, including recording gages, with gates set in the position as directed by the District Office. The inspecting team will report to the Area Engineers' office by telephone or radio any instance of a structure not being in proper operating condition, and will be required from the Clewiston Base Station to correct the inoperative condition. The Water Management Section of the Jacksonville District Office should be notified by the Area Engineer or one of his assistants of any inability to comply with requested gate settings.

b. South Florida Water Management District. SFWMD is responsible for operations of the remaining project works covered in this volume for storm procedures. In addition to the referenced manuals in paragraph E-01, the South Florida Water Management District's Major Storm Procedure Manual should be consulted for specific guidance on structure operations in preparation for and duration of major storms.

E-07. Communication Outages. Upon emergency situations where communication with the Damtender is interrupted, the Damtender shall take any action deemed necessary to prevent the loss of life or property. Such actions shall be documented in writing and shall be forwarded to the Jacksonville District as soon as practicable. Upon the resumption of normal communications, the Damtender shall report the sequence of events which lead to unplanned releases and receive additional instructions from higher authority.

E-08. Deviation from Normal Regulation.

a. Emergencies. Some emergencies can be expected. The Damtender shall take the necessary action under emergency conditions immediately unless such action would create equal or worse conditions. The Jacksonville District (SAJ) will be informed as soon as practicable. A written confirmation showing the deviations and conditions shall be furnished to the Jacksonville District after the incident. SAJ will report these deviations to the South Atlantic Division Office (SAD).

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from

the normal regulation, although they are not considered emergencies. Requests for changes of release rates are generally for a few hours to a few days. Each request will be analyzed on its own merits. Approval for these minor deviations will normally be obtained from the Chief, Water Management and Meteorology Section (or his designee), Jacksonville District, by telephone, who in turn will seek approval from SAD. A written confirmation showing the deviation and conditions will be furnished to SAD by SAJ after the deviation is complete.

c. Planned Deviations. The Damtender will receive specific instructions on planned deviations. These instructions will be followed in lieu of the normal regulation schedule. Upon completion of the planned deviation, the normal regulation schedule shall resume.

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX F

USFWS BIOLOGICAL OPINION FOR COP PERTINENT INFORMATION

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

Placeholder for excerpts from BO

DRAFT

SYSTEM OPERATING MANUAL
VOLUME 4

WATER CONSERVATION AREAS,
EVERGLADES NATIONAL PARK, AND
ENP-SOUTH DADE CONVEYANCE SYSTEM

APPENDIX G

WATER CONTROL PLANS
AND
PROJECT OPERATING MANUALS

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
JANUARY 2020

CENTRAL AND SOUTHERN FLORIDA PROJECT

INTERIM WATER CONTROL PLAN FOR SEMINOLE BIG CYPRESS RESERVATION WATER CONSERVATION PLAN CRITICAL PROJECT – BASIN 1

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
19 March 2012

List of Acronyms

BMP	Best Management Plan
CAP	Corrugated Aluminum Pipe
cfs	cubic feet per second
EA	Environmental Assessment
ENP	Everglades National Park
EPA	Everglades Protection Area
HDPE	High Density Polyethylene
IC	Irrigation Storage Cell
NGVD	National Geodetic Vertical Datum
ppb	parts per billion
SBC	Seminole Big Cypress
SFWMD	South Florida Water Management District
SOF	Statement of Finding
STA	Stormwater Treatment Area
STOF	Seminole Tribe of Florida
WCA	Water Conservation Area
WCP	Water Control Plan
WRA	Water Resource Area
WRDA	Water Resources Development Act

TABLE OF CONTENTS

Section	Title	Page
7-01.	General Objectives	1
7-02.	Constraints	2
	High Permeability of Impoundment Soil	2
7-03.	Overall Plan for Water Management	2
a.	External Project Features	3
1.	Structure 190 (S-190)	3
2.	Pump Station G-404	3
3.	Pump Station G-409	4
b.	Pump Stations	4
c.	Water Resource Areas	5
d.	Outfall Structures	6
e.	Irrigation Storage Cells	7
1.	Overflow Structures	7
2.	Irrigation Return Structures	8
3.	Irrigation Return/Overflow Structures	9
f.	Levees	10
g.	Canals	11
7-04.	Standing Instructions to Project Operator	11
a.	Pump Stations	11
b.	Structures	12
c.	Unusual Conditions/Emergency Situations	12
7-05.	Flood Control	12
7-06.	Recreation	13
7-07.	Water Quality	13
7-08.	Water Supply	13
7-09.	Navigation	13
7-10.	Drought Contingency Plan	13
7-11.	Flood Emergency Action Plan	14
7-12.	Deviation from Normal Regulation	14
a.	Emergencies	14
b.	Unplanned Minor Deviations	14
c.	Planned Deviations	15

List of Figures

Figure 1 - General Location Map
Figure 2 - Basin 1 Layout

VII - INTERIM WATER CONTROL PLAN

7-01. General Objectives. The Seminole Big Cypress Reservation Water Conservation Plan Project (SBC Project) is authorized under Section 528 (b)(3) of the Water Resources Development Act (WRDA) of 1996, P.L. 104-303 (Central and Southern Florida Ecosystem Restoration Critical Project) to improve quality of agricultural water runoff within the reservation; restore storage capacity, and return native vegetation within the Big Cypress Reservation (Reservation). The network of surface water management structures in the SBC Project is intended to produce the following substantial restoration, preservation, and protection benefits:

- Remove phosphorous and other pollutants from water discharged from Reservation lands flowing to the Everglades Protection Area (EPA)
- Provide the opportunity to restore more natural hydroperiods to wetlands in the Big Cypress National Preserve
- Restore a more natural hydropattern and hydroperiod in the 14,000 acres of the Native Area, located south of the West Feeder Canal on the Reservation and north of Big Cypress Preserve
- Increase water storage capacity
- Provide improved flood control designed to mimic the historic timing and distribution of flows

This is an Interim Water Control Plan to be placed in the Water Conservation Areas, Everglades National Park (ENP) and ENP-South Dade Conveyance System Master Water Control Manual. This Interim Water Control Plan is for implementation prior to the construction of other Basins of the SBC Project and will be updated as other SBC Project Basins become available. The SBC Project is separated into four basins, identified as Basins 1 through 4 (Figure 1). This Interim Water Control Plan contains water management operating criteria for Basin 1 only (Figure 2).

7-02. Constraints. Constraints to achieve the objectives of the project include:

High Permeability of Impoundment Soil. The high permeability of the impoundment soils, specifically the irrigation storage cells, has resulted in much higher seepage losses out of the impoundments than was originally expected, resulting in shorter retention times and less water for irrigation and water supply. See Section 7-03 for more detailed information.

7-03. Overall Plan for Water Management. Basin 1 is located in the northwest corner of the Reservation. It is bound by the West Feeder Canal to the south, the Reservation's western boundary to the west, the existing field ditch system to the east that serves as a common boundary between Basin 1 and Basin 2, and the existing field ditch system to the north. Basin 1 consists of a newly constructed Water Resource Area (WRA), which is split into two parts, WRA1E and WRA1W. Basin 1 also contains six newly constructed Irrigation Storage Cells (ICs), named I1A, I1B, I1C, I1D, I1E and I1F. The ICs will not function fully as designed. The ICs were intended to hold water for up to six months for irrigation and water supply. Because of high soil permeability, the ICs will not store water for a sufficient period of time to serve a water supply function. Instead, the ICs are used to attenuate stormwater runoff and/or to convey excess water to the WRA. Basin 1 also includes a system of levees, canals, culverts, a siphon and pump stations.

Water is pumped into 3-Mile Canal (to the east of Basin 1) from G-409, which is a water supply pump station in the L-3 borrow canal. The 3-Mile Canal is hydraulically connected to the E-1 Canal. The E-1 Canal is hydraulically connected to the E-1A Canal and the E-2 Canal. Water can be pumped or gravity flowed through gated culverts from the E-1A Canal, the E-1 Canal and the E-2 Canal into the North Feeder Canal. The North Feeder Canal is hydraulically connected to the West Feeder Canal. Water is pumped into Basin 1 from the West Feeder Canal via pump station P1. Additionally, water enters Basin 1 via rainfall. Rainfall runoff within the project area is pumped into the ICs for stormwater attenuation. Discharges from the ICs may occur during major rainfall events to safely convey excess water

located in the ICs back to the existing field ditch system. Excess water in the ICs may also be conveyed to the WRAs through culverts. When water levels in I1C and I1D reach a certain stage, excess water will flow into the adjacent WRA through culverts. Basin 1 discharges water through Siphon 1 to the Native Area to the south. Basin 1 also discharges to the West Feeder Canal through OUT1A and OUT1B, the outfall structures described below. Optimum stages in the West Feeder Canal are maintained by the SFWMD gated structure S-190. The structure descriptions for S-190, G-409, and G-404 are given below. G-409 pumps are operated by the South Florida Water Management District (SFWMD) to provide a maximum of 47,000 acre-feet of water per year into the East Conveyance Canal System to meet the entitlement for the Seminole Tribe of Florida as established by the 1996 Compact Agreement, the entitlement Technical Report and associated District Final Order.

a. External Project Features. Although structures S-190, G-404, and G-409, operated by the SFWMD, are not part of the SBC Project, they provide inflow to the project and prevent over drainage of the canals. The structure descriptions here are provided for reference only. Flows from the SFWMD G-409 pump station represent Basin 1's available water sources. G-409 supplies irrigation water to the Reservation from the Miami Canal via G-404 pump station and the L-4 borrow canal (or the L-3 extension canal), west over the L-28 borrow canal. Structure 190 (S-190) is a gated spillway that helps control water levels in the West Feeder Canal and North Feeder Canal.

1. Structure 190 (S-190). The structure is located on the L-28 Interceptor Canal about 32 miles south of Clewiston. This structure is a reinforced concrete, gated spillway with discharge controlled by two cable-operated, vertical lift gates. Operation of the gates is automatically controlled in accordance with the established operational criteria. This structure maintains optimum upstream water control stages in the North and West Feeder Canals, and prevents over drainage of these canals.

2. Pump Station G-404. Pump station G-404 is located in Broward County on the Miami Canal at the confluence with the L-4 borrow canal. The pump station is located adjacent to structure G-357, just north of the S-8 pump station, and adjacent to the southeastern corner of the Rotenberger Wildlife Management Area. G-404 provides

supplemental irrigation water supply to the Reservation and to US Sugar Southern Division's Unit 2 farm.

3. Pump Station G-409. Pump station G-409 is located in Hendry County immediately south of STA-6 in the L-3 borrow canal at the point commonly referred to as "Confusion Corner." Waters are then delivered to various locations within the eastern portion of the Reservation for irrigation and also to the North and West Feeder Canals.

b. Pump Stations. Basin 1 contains 10 pump stations (P1 through P10, see Figure 2) which may function for flood control and water supply. Pumps P4, P5, P8, P9 and P10 transfer excess water away from the citrus groves and other agricultural fields located inside the basin to the ICs. P6 and P7 transfer water from agricultural fields and pastures to ICs located adjacent to a WRA. P1 provides irrigation water from the West Feeder Canal into citrus groves. P2 and P3 transfer water from the agricultural fields and Billie Swamp Safari wildlife area into WRA1W. See Table 1 for pump station data.

Table 1: Pump Station Data

Pump	Intake Level ft, NGVD	Auto-matic or manual	Shutoff Level ft, NGVD	Discharge Level ft, NGVD	Flow (cfs)	Total Dynamic Head (ft)	Max HP
P1	*	Manual	12.0	18.0	40	11.08	82
P2-1	14.0	Auto	13.5	20.2	35	9.52	62
P2-2	15.5	Auto	15.0	20.2	35	8.02	52
P3-1	17.3	Auto	16.8	20.2	56	6.49	67
P3-2	17.8	Auto	17.3	20.2	100	7.99	147
P3-3	18.8	Auto	18.3	20.2	100	6.99	129
P4	*	Manual	14.6	22.7	15	15.55	43
P5	*	Manual	14.2	22.4	14	17.87	45
P6-1	13.7	Auto	13.2	23.1	48	15.3	135
P6-2	15.2	Auto	14.7	23.1	48	13.8	122
P7-1	14.3	Auto	13.8	23.0	34	11.99	75
P7-2	15.8	Auto	15.3	23.0	53	10.8	106
P8	*	Manual	14.2	22.7	14	18.52	48
P9	*	Manual	13.8	22.7	56	12.87	133
P10	*	Manual	14.2	22.7	7	15.82	21

*Activated when water levels rise to within two feet of the average ground elevation

c. Water Resource Areas. Water Resource Areas (WRAs) are designed to improve the hydroperiod of historically impacted wetlands and the water quality of surface water as it flows from the basins. They have relatively shallow (approximately one foot) flow depths with a nine month long hydroperiod. Basin 1 contains one WRA (WRA1), which is split into two parts, WRA1W and WRA1E, by a road (See Figure 2). An equalization structure, EP1, connects WRA1W and WRA1E to allow unrestricted movement of water between the two cells. See Table 2 for EP1 structure data. WRA1 is designed for a maximum stage of 20.2 feet, National Geodetic Vertical Datum of 1929 (ft, NGVD), preserving a minimum of one foot of freeboard between the maximum stage and the crest of the levee. WRA1 outfall culvert structures, OUT1A and OUT1B (Table 3) and Siphon 1 (Table 4) have control elevations set to prevent exceeding this maximum stage criterion. OUT1A and OUT1B discharge treated stormwater to the West Feeder Canal. These structures have been sized not to exceed the total allowable discharge to the West Feeder Canal dictated by the operating capacity of S-190 to discharge water from the West Feeder Canal and the North Feeder Canal to the L-28 interceptor canal. S-190 can achieve a discharge rate of 2960 cfs (cubic feet per second). When the design capacity is achieved, water is siphoned under the West Feeder Canal for flood protection through Siphon 1. The siphon’s tailwater elevation will equalize to, or be below that of the pool elevation of WRA1. A spreader swale will spread the discharged water into the Native Area south of the West Feeder Canal.

Table 2: EP1 Connection WRA1W and WRA1E Structure Data

Culvert Data	**EP1**
Number of Barrels	5
Barrel Type	CAP
Culvert Diameter	60 inches
Culvert Length	250 feet
Upstream Invert Elevation	6 ft, NGVD
Slide Gate Control	No

Table 3: OUT1A and OUT1B Structure Data

Culvert Data	**OUT1A**	**OUT1B**
Number of Barrels	2(West and East)	2 (West and East
Barrel Type	CAP	CAP
Culvert Diameter	48 inches	48 inches
Culvert Length	70 feet	70 feet
Upstream Invert Elevation	12.62 (West) 12.69 (East)	11.97 (West) 12.31 (East)
Slide Gate Control	No	No
Riser Data		
Riser Diameter	48 inches	48 inches
Riser Fixed Crest Elevation	18.75 (West) 19.04 (East)	18.20(West) 18.24(East) 18.70(Design El.)

Table 4: Siphon 1 Structure Data

WRA Data	**Siphon 1**
Bottom Elevation	17.5 ft, NGVD
Top of Berm Elevation	21.3 ft, NGVD
Culvert Data	
Number of Barrels	2
Barrel Type	HDPE
Culvert Diameter	60 inches
Culvert Length	450 feet
Upstream Invert Elevation	11.2 ft, NGVD
Slide Gate Control	NO
Riser/Weir Box Data	
Weir Box Length	42 feet
Riser Fixed Crest Elevation	19.2 ft, NGVD
Spreader Swale	
Swale Crest Elevation	18.5 ft, NGVD
Swale Length	2400 ft, NGVD

d. Outfall Structures. Basin 1 contains two outfall structures, OUT1A and OUT1B. Each outfall structure contains two culverts (OUT1A East, OUT1A West, OUT1B East and OUT1B West). These structures allow water to flow from WRA1E into the West Feeder Canal when the water surface

elevation in WRA1E exceeds the riser crest elevations. See Table 3 for outfall structure data.

e. Irrigation Storage Cells. Basin 1 contains six ICs, named I1A, I1B, I1C, I1D, I1E and I1F. Water is pumped into these ICs when flood protection for adjacent lands is needed. The ICs contain three types of culvert structures: overflow structures (OF1A, OF1C2, OF1C3, OF1D2 and OF1D3), irrigation return structures (IR1A, IR1C, IR1D and IR1E), and irrigation return/overflow structures (OF1B, OF1C1, OF1D1, OF1E, and OF1F). The IC soils have proven to be too porous to hold water for storage.

1. Overflow Structures. I1A self-contains water up to a depth of approximately four feet before discharging into the I1AS canal via overflow structure OF1A (Table 5). I1C and I1D self-contain water up to a depth of approximately four feet before discharging into WRA1E via overflow structures OF1C1, OF1C2, OF1C3, OF1D1, OF1D2 and OF1D3 (Table 6 and 7). The riser fixed crests of the overflow structures allow water from the ICs to overflow when the water surface elevation exceeds the crest elevation. The function of OF1C1 and OF1D1 is similar to the other overflow structures with the following exception. Both of these structures contain a gate at the ground surface elevation that can be opened to allow water to drain from its respective IC. OF1C1 and OF1D1 provide overflow from I1C and I1D, respectively, into WRA1E.

Table 5: OF1A Structure Data

Culvert Data	**OF1A**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	48 inches
Culvert Length	75 feet
Upstream Invert Elevation	11.42 ft, NGVD
Slide Gate Control	No
Riser Data	
Riser Diameter	96 inches
Riser Fixed Crest Elevation	22.36 ft, NGVD

Table 6: OF1C1, OF1C2 and OF1C3 Structure Data

Culvert Data	**OF1C1**	**OF1C2**	**OF1C3**
Number of Barrels	1	1	1
Barrel Type	CAP	CAP	CAP
Culvert Diameter	48 inches	48 inches	48 inches
Culvert Length	80 feet	70 feet	70 feet
Upstream Invert Elevation	15.07 ft, NGVD	15.13 ft, NGVD	15.46 ft, NGVD
Slide Gate Control	Yes	No	No
Riser Data			
Riser Diameter	96 inches	96 inches	96 inches
Riser Fixed Crest Elevation	22.30 ft, NGVD	22.14 ft, NGVD	22.21 ft, NGVD

Table 7: OF1D1, OF1D2 and OF1D3 Structure Data

Culvert Data	**OF1D1**	**OF1D2**	**OF1D3**
Number of Barrels	1	1	1
Barrel Type	CAP	CAP	CAP
Culvert Diameter	48 inches	48 inches	48 inches
Culvert Length	80 feet	70 feet	70 feet
Upstream Invert Elevation	15.14 ft, NGVD	15.33 ft, NGVD	15.64 ft, NGVD
Slide Gate Control	Yes	No	No
Riser Data			
Riser Diameter	96 inches	96 inches	96 inches
Riser Fixed Crest Elevation	22.30 ft, NGVD	22.22 ft, NGVD	22.23 ft, NGVD

2. <u>Irrigation Return Structures</u>. When water is available within the ICs for irrigation of adjacent pasture, citrus fields and vegetable fields, irrigation return structures (Table 8) allow water stored in the ICs to be returned to the irrigation system as needed. Each of these structures contains a gate at the ground surface elevation that can be opened to allow water to drain from its respective IC.

Table 8: IR1A, IR1C, IR1D and IR1E Structure Data

Culvert Data	**IR1A**	**IR1C**	**IR1D**	**IR1E**
Number of Barrels	1	1	1	1
Barrel Type	CAP	CAP	CAP	CAP
Culvert Diameter	24 inches	24 inches	24 inches	24 inches
Culvert Length	105 feet	105 feet	105 feet	105 feet
Upstream Invert Elevation	12.26 ft, NGVD	13.39 ft, NGVD	13.25 ft, NGVD	13.26 ft, NGVD
Slide Gate Control	Yes	Yes	Yes	Yes

3. <u>Irrigation Return/Overflow Structures</u>. These structures are dual-purpose control structures. The primary purpose is to limit stages in the ICs during major rainfall events. The overflow elevation for these structures is approximately four feet above the cell bottom. Overflows released from these structures are conveyed through the existing field ditch system to pump stations that discharge to WRA1. The secondary purpose of these structures is to control the release of water stored in the ICs to the existing field ditch system for use in irrigation (Tables 9, 10 and 11). Each of these structures contains a sluice gate in an inlet sump that can be opened manually to allow water to drain from its respective IC.

Table 9: OF1B Structure Data

Culvert Data	**OF1B**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	48 inches
Culvert Length	87 feet
Upstream Invert Elevation	12.22 ft, NGVD
Slide Gate Control	Yes
Riser Data	
Riser Diameter	96 inches
Riser Fixed Crest Elevation	22.10 ft, NGVD

Table 10: OF1E Structure Data

Culvert Data	**OF1E**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	48 inches
Culvert Length	87 feet
Upstream Invert Elevation	12.34 ft, NGVD
Slide Gate Control	Yes
Riser Data	
Riser Diameter	96 inches
Riser Fixed Crest Elevation	22.20 ft, NGVD

Table 11: OF1F Structure Data

Culvert Data	**OF1F**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	48 inches
Culvert Length	87 feet
Upstream Invert Elevation	12.58 ft, NGVD
Slide Gate Control	Yes
Riser Data	
Riser Diameter	96 inches
Riser Fixed Crest Elevation	22.40 ft, NGVD

f. Levees. Basin 1 levees encompass two WRAs and six ICs. See Table 12 for levee elevations.

Table 12: Levee Design Elevations for WRAs and ICs

Area	Levee Crest Elev. (ft, NGVD)
WRA1-W	21.30
WRA1-E	21.30
I1A	25.30
I1B	25.10
I1C	25.30
I1D	25.30
I1E	25.20
I1F	25.20

g. Canals. Basin 1 contains four canals (I1ANE, I1AS, I1FS and I1ES) used for the conveyance of basin water. See Table 13 for canal data.

Table 13: Basin 1 Canal Data

Canal	Design Discharge (cfs)	Min. Cross Sectional Flow Area (sq ft)	Side Slopes	Bottom Width (ft)	Length (ft)
I1ANE	50 - 256	18 - 102	2H:1V	5 (Varies)	6472
I1AS	256	102	2H:1V	5	1524
I1FS	50	18	2H:1V	5	2794
I1ES	87	33	1H:1V	6	2385

7-04. <u>Standing Instructions to Project Operator</u>. During normal conditions, the project structures shall be operated in accordance with this Interim Water Control Plan, and in accordance with the structure design criteria as described in Tables 1 through 13.

a. Pump Stations. Some of the pumps serve citrus groves. These pumps may be started when the water level rises to within four feet of the average citrus grove ground elevation. For pump stations serving pastures and vegetable fields, pumps will be activated automatically when water levels rise to within two feet of the average ground elevation. The shutoff water level for all pumps (except those manually operated) will be one-half foot below the startup water level to prevent pumps from

starting up and shutting down in response to rapid drawdown. The pump connecting the West Feeder Canal to WRA1W (P1) is manually started and stopped. Pumps adjacent to isolated Irrigation Cells (P4, P5, P8, P9 and P10) can be set to run automatically. Where multiple pumps are available (P2, P3, P6 and P7), the second pump will activate at one foot below the average ground level. See Table 1 for pump station on/off trigger elevations.

b. Structures. In transition periods from irrigation purposes back to flood control purposes, the gates on the structures should be set at an elevation to be determined by the owners to maintain anticipated levels of flood damage reduction. The surface level gates at OF1C1, OF1D1, the irrigation return structures and the irrigation return/overflow structures must be fully closed in order to provide flood protection.

c. Unusual Conditions/Emergency Situations. In the event that unusual conditions arise requiring a deviation from normal regulation, refer to Section 7-12. During emergency situations where communication is interrupted, the damtender (Project Operator) shall take any action deemed necessary. Such actions shall be documented in writing and shall be forwarded to the Jacksonville District at the address below as soon as is practicable:

U.S. Army Corps of Engineers, Jacksonville District
Chief, Water Management Section
701 San Marco Blvd.
Jacksonville, FL 32207
Phone: 904.232.2914

Upon the resumption of normal communications, the Project Operator shall report the sequence of events that lead to unplanned releases and receive additional instructions from the Water Management Section, Jacksonville District.

7-05. Flood Control. As indicated in Section 7-03. Overall Plan for Water Management, water is pumped from the Basin 1 watershed into the ICs when flood protection is needed. From the IC, flood waters are discharged through an overflow structure where it enters, or is conveyed, to WRA1. From WRA1, water is discharged to the West Feeder Canal via OUT1A or OUT1B, or to the Native Area via Siphon 1. The siphon inlet control elevation prevents the WRA control structures from exceeding their maximum

allowable discharge so that the WRA will not overtop the levee during storm conditions. For example, flood control operations in I1A would begin with manually-started pumping through P4 into I1A when the elevation in the canal adjacent to P4 reaches 14.6 (ft, NGVD). Pumping should continue until the elevation recedes back below 14.6 (ft, NGVD). When the water elevation within I1A reaches 22.3 (ft, NGVD), discharges at OF1A should begin. The discharged water is conveyed to pump P3 where it enters WRA1W.

7-06. Recreation. This plan has no specified water management operational provisions for recreation. However, recreation in the project area may consist of eco-tourism.

7-07. Water Quality. The project has Critical Project designation because it is designed to improve water quality by removing phosphorous and pollutants from water discharged from the Reservation that ultimately flows into the Big Cypress National Preserve and the Everglades Protection Area. This is accomplished by allowing phosphorus and other pollutants to settle out. The project also seeks to re-establish sheet flow into the Native Area south of the West Feeder Canal and establish a more natural hydropattern that will subsequently re-water the Big Cypress National Preserve.

7-08. Water Supply. Currently Basin 1 consists of approximately 1,317 acres of existing citrus groves, 305 acres of improved pasture and 357 acres of native range. Rainfall on the project area and flows from the SFWMD's G-409 pump station to the West and North Feeder Canals represent Basin 1's available water sources. Water also enters the West Feeder Canal from the West Weir, by P1. Excess water that is pumped from the Basin 1 watershed and captured within the ICs may be temporarily stored for stormwater attenuation, or may be conveyed through I1C or I1D to the WRA.

7-09. Navigation. This project has no specified water management operational provisions for navigation.

7-10. Drought Contingency Plan. There is no Drought Contingency Plan for this project at this time. Should one become available, it may be added as an attachment to this Interim Water Control Plan.

7-11. Flood Emergency Action Plan. The Flood Emergency Action Plan is part of the Interim Operation, Maintenance, Repair, Replacement, and Rehabilitation document for this project.

7-12. Deviation from Normal Regulation.
The Jacksonville District US Army Corps of Engineers Water Management Section is responsible for handling deviation requests and transmitting them through the District Commander to the Division Engineer for final decision. The District Commander is occasionally requested to deviate from normal operating criteria. Prior approval for a deviation is required from the Division Engineer except as noted in subparagraph "a" below. Deviation requests usually fall into the following categories:

a. Emergencies. Examples of some emergencies that can be expected to occur at a project are: drowning and other accidents, failure of the operation facilities, chemical spills, treatment plant failures and other temporary pollution problems. Water control actions necessary to abate the problem are taken immediately unless such action would create equal or worse conditions. Districts must inform their division office as soon as practicable. Prepare written confirmation of the deviation and description of the cause and furnish it to the division water control manager. Divisions may develop forms to facilitate the reporting of emergency deviations.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulation plan, although they are not considered emergencies. Construction accounts for the major portion of these incidents and typical examples include utility stream crossings, bridge work, and major construction contracts. Deviations are sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to upstream watershed conditions, potential flood threats and alternative measures that can be taken. In the interest of maintaining good public relations, requests generally are complied with providing there are no foreseen adverse effects on the overall regulation of the project (or projects) for the authorized purposes. Approval for these

minor deviations normally will be obtained from the division office by telephone. Written confirmation explaining the deviation and its cause will be furnished to the division water control manager.

c. Planned Deviations. Each condition should be analyzed on its own merits. Sufficient data on flood potential, watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the district recommendation, will be presented by letter or facsimile to the division for review and approval.

Figures

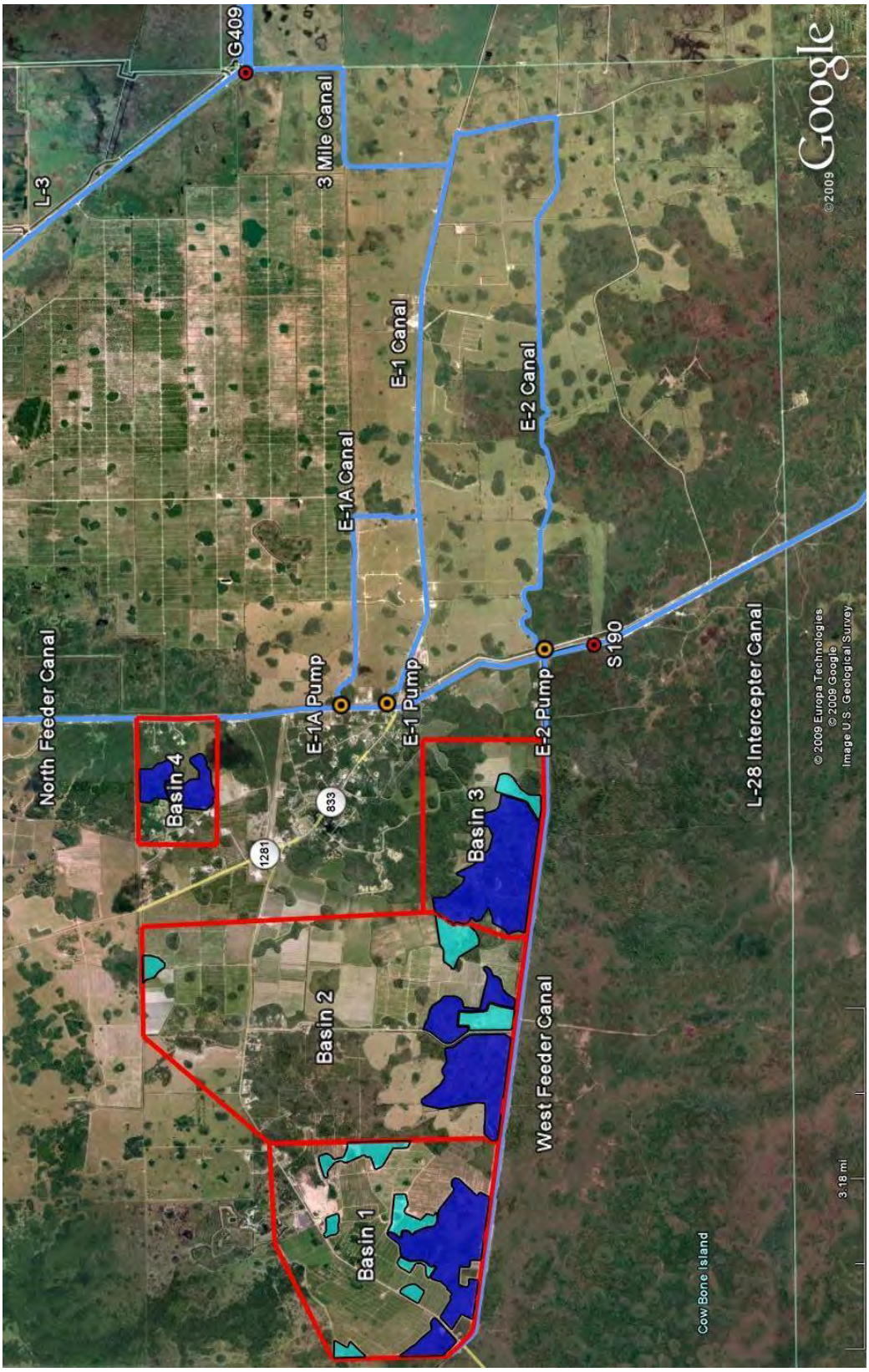


Figure 1: General Location Map

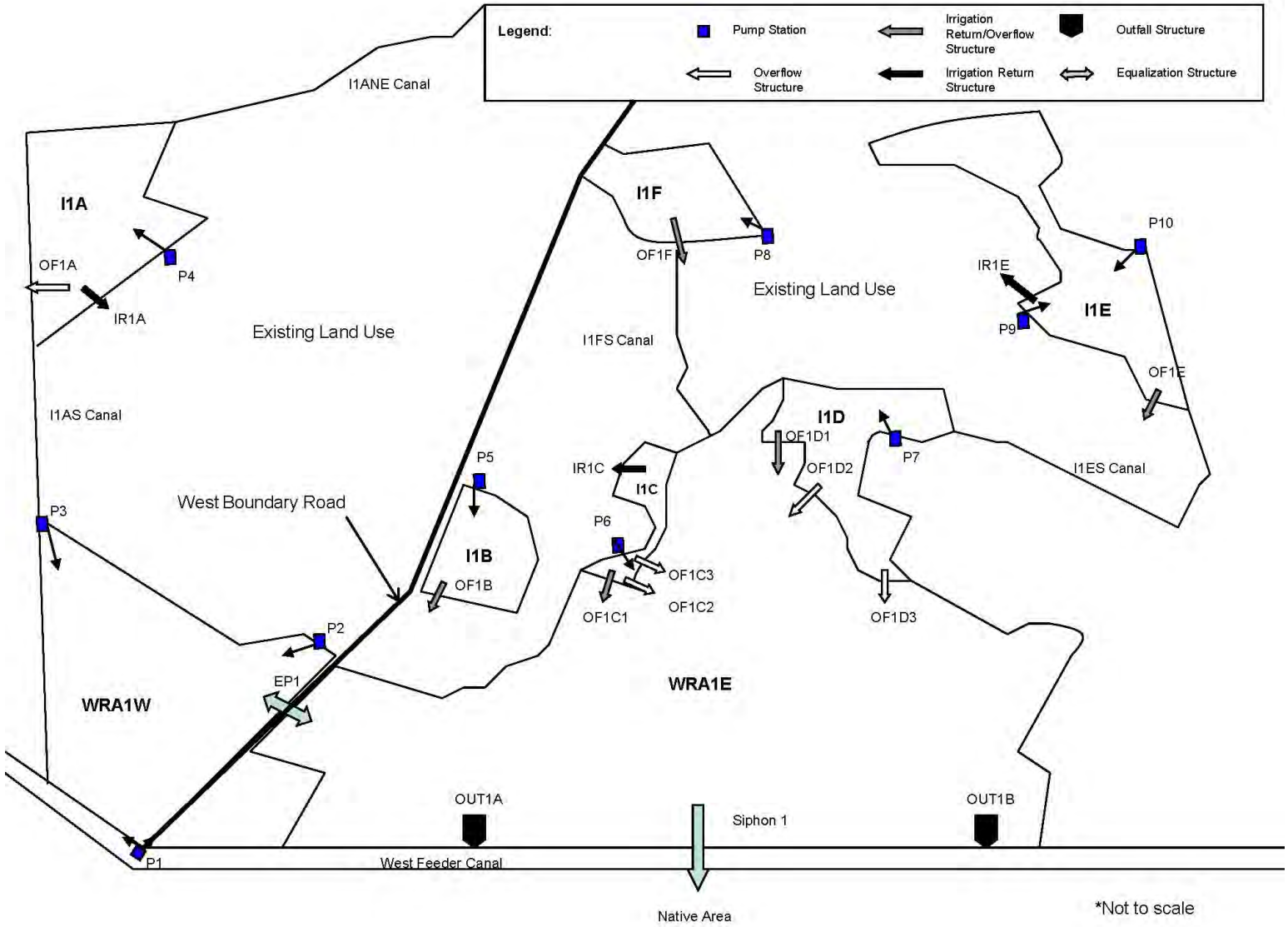


Figure 2: Basin 1 Layout

CENTRAL AND SOUTHERN FLORIDA PROJECT

BIG CYPRESS SEMINOLE INDIAN RESERVATION
WATER CONSERVATION PLAN CRITICAL RESTORATION PROJECT
WATER CONTROL PLAN FOR BASIN 4

JACKSONVILLE DISTRICT
U.S. ARMY CORPS OF ENGINEERS
May 17, 2013

List of Acronyms

CAP	Corrugated Aluminum Pipe
cfs	cubic feet per second
EA	Environmental Assessment
ENP	Everglades National Park
EPA	Everglades Protection Area
ft	Feet
HDPE	High Density Polyethylene
NGVD	National Geodetic Vertical Datum
ppb	parts per billion
SBC	Seminole Big Cypress
SFWMD	South Florida Water Management District
STOF	Seminole Tribe of Florida
WCP	Water Control Plan
WRA	Water Resource Area
WRDA	Water Resources Development Act

TABLE OF CONTENTS

Section **Title** **Page**

7-01. General Objectives..... 4
7-02. Constraints..... 5
7-03. Overall Plan for Water Management..... 5
a. External Project Features 5
Structure 190 (S-190): 5
Culvert PC-17: 6
b. Pump Stations..... 6
c. Water Resource Area..... 6
d. Outfall Structure..... 7
e. Stormwater Cell..... 8
f. Levees..... 8
g. Canals..... 8
7-04. Standing Instructions to Project Operator..... 9
a. Pump Stations..... 9
b. Unusual Conditions/Emergency Situations..... 9
7-05. Flood Control..... 10
7-06. Recreation..... 10
7-07. Water Quality..... 10
7-08. Water Supply..... 10
7-09. Navigation..... 11
7-10. Drought Contingency Plan..... 11
7-11. Flood Emergency Action Plan..... 11
7-12. Deviation from Normal Regulation..... 11
a. Emergencies..... 11
b. Unplanned Minor Deviations..... 11
c. Planned Deviations..... 12

List of Figures

Figure 1: General Location Map..... 14
Figure 2: Basin 4 Layout..... 15

VII - WATER CONTROL PLAN

7-01. General Objectives. The Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project (SBC Project) (Figure 1) is authorized under Section 528 (b)(3) of the Water Resources Development Act (WRDA) of 1996, P.L. 104-303 (Central and Southern Florida Ecosystem Restoration Critical Project), for the purpose of environmental restoration through improving the quality of agricultural water runoff, improving flood control, and promote water conservation within the Big Cypress Seminole Indian Reservation. The SBC Project is separated into four basins, identified as Basins 1 through 4 (Figure 1). This Water Control Plan contains water management operating criteria for Basin 4 only (Figure 2). The network of surface water management structures in the SBC Project Basin 4 is intended to produce the following substantial restoration, preservation, and protection benefits:

- The project features improve the quality, quantity, timing and distribution of water flows to the ecosystem. Historically, most rainwater soaked into the ground in the wetlands. The Feeder canal system effectively drained much of the marsh to prevent flooding. The drained water now carries phosphorous and other pollutants. The storage features of the Plan serve multiple objectives including recharge to ground water and attenuation of peak discharges to mimic the historic timing and distribution of flows.
- Remove phosphorous and other pollutants from water discharged from Reservation lands flowing into the Big Cypress National Preserve and the Everglades Protection Area (EPA). The EPA comprises several defined regions: the Arthur R. Marshall Loxahatchee National Wildlife Refuge, which contains Water Conservation Area 1; Water Conservation Areas 2A and 2B; Water Conservation Areas 3A and 3B; Everglades National Park; and Florida Bay.

This Water Control Plan is to be placed as an annex of the Central and Southern Florida Project for Flood Control and Other Purposes, Master Water Control Manual, Water Conservation Areas, Everglades national Park, and ENP-South Dade Convenience System, Volume 4, June 1996 (C&SF WCA-ENP WCM VOL 4). A standalone Big Cypress Seminole Indian Reservation Water Conservation Plan Critical Restoration Project Water Control Manual will be also prepared at the end of construction of all four Basins. This standalone

Water Control Manual will contain specifics that are located throughout C&SF WCA-ENP WCM VOL 4.

7-02. Constraints. Constraints to achieve the objectives of the project include the high permeability of the impoundment soils is expected to result in high seepage losses out of the storage areas, resulting in relatively shorter retention times.

7-03. Overall Plan for Water Management. Basin 4 is located north of the Reservation in (Figure 1). The northern boundary is an unimproved road along the north boundary of Township 48 South which is also the divide line of Township 47 South (T47S) and 48 South (T48S) of Hendry County (USGS Quad Sheets Goddens Strand, FLA and Cow Bone Island, FLA) and the southern boundary is approximately one mile south of the northern boundary. The eastern boundary runs along the North Feeder Canal and the westward extent is near vicinity of County Road No. 833 (BIA Road No.1281).

Basin 4 consists of a Stormwater Attenuation Cell (S4A) and a Water Resource Area (WRA4) (Figure 1). Basin 4 also includes a system of levees, borrow canals, culverts, and two pump stations (Figure 2). The borrow canal with conveyance are 1) outside S4A named S4A canal, 2) outside of WRA4 on western side named WRA4A canal, and 3) outside of WRA4 on eastern side named WRA4C canal. The borrow canals with no conveyance are 1) inside WRA4 on northern side named WRA4B canal and 2) inside WRA4 along S4A and WRA4 boundary named WRA4D canal.

Basin 4 water is pumped into S4A from the S4A canal via pump stations P25 and P26. Additionally, water enters Basin 4 via rainfall. S4A discharges water into the WRA4 via uncontrolled culvert structure (OF4A). WRA4 discharges water to WRA4E Canal (Figure 2) through Outfall 4 (OUT4). WRA4E canal moves the water to North Feeder Canal through an existing culvert named PC-17. Excess stormwater runoff from the Basin not pumped into S4A is collected in the canals S4A, WRA4A, and WRA4C. The water from these canals is discharged into WRA4E canal, which discharges into the North Feeder Canal via an existing culvert named PC-17.

a. External Project Features

Structure 190 (S-190): The West and North Feeder Canals join together at the headwaters of the L-28 Interceptor (L28-I) Canal (Figure 1). Approximately one third of a

mile downstream of this connection, flow is controlled by S-190, an automated reinforced concrete gated spillway with 2-24.8 feet vertical gates. This structure maintains optimum upstream water control stages in the North and West Feeder Canals, and prevents over drainage of these canals. The operations of S-190 are included in C&SF WCA-ENP WCM VOL 4.

Culvert PC-17: WRA4E canal discharges into the North Feeder Canal via an existing culvert named PC-17. This is a single barrel steel culvert 72 inches diameter and 88 feet long through the west levee of L28-I. The flashboard risers are located on the canal side of the levee and the discharge end is on the land side of the levee. The riser width is 94 inches, riser height is 12 feet, and board length is 47 inches.

b. Pump Stations. Basin 4 contains two manually operated pump stations (P25 and P26, see Figure 2) which provide flood control capacity. P25 and P26 transfer water from S4A's borrow Canal (S4A canal) (Figure 2) into S4A. The shutoff water level is one-half foot below the startup level to prevent pumps from starting pump up and shutting down in response to rapid drawdown. See Table 1 for pump startup (i.e. intake level), shutoff levels, and the discharge level (i.e. Maximum Water Surface Elevation in the receiving water body). Excess stormwater runoff from the Basin not pumped into S4A is discharged into WRA4E canal. WRA4E canal discharges into North Feeder Canal through PC-17, an existing culvert.

Table 1: Pump Station Data

Pump	Intake Level ft, NGVD	Auto-matic or manual	Shutoff Level ft, NGVD	Discharge Level ft, NGVD	Flow (cfs)	Total Dynamic Head (ft)
P25	17.0	Manual	16.5	21.2	12	12.98
P26	17.6	Manual	17.1	21.2	12	11.98

*Activated when water levels rise to within two feet of the average ground surface elevation of 18.5 ft, NGVD of the agricultural land around S4A

c. Water Resource Area. Water Resource Areas (WRA) is designed to improve the hydroperiod of historically impacted wetlands and the water quality of surface water as it flows from the basins. It has relatively shallow flow

depth. Basin 4 contains one WRA (WRA4, See Figure 1) with an area of 58 acres. WRA4 is designed for a maximum stage of 20.5 feet, National Geodetic Vertical Datum of 1929 (ft, NGVD), preserving a minimum of one and half foot of freeboard between the maximum stage and the crest of the levee. The average ground surface elevation in WRA4 is 18.5 ft, NGVD.

d. Outfall Structure. Basin 4 contains one outfall structure, OUT4 (Table 2). The outfall structure is a 24 inches Corrugated Aluminum Pipe (CAP) Riser Culvert with a riser crest elevation of 19.5 ft, NGVD. There are no side openings in this pipe. Under low-head conditions this will behave as a sharp-crested weir, but as the head increases it will transition to orifice flow. This structure allows water to flow from WRA4 into the North Feeder Canal via WRA4E canal when the water surface elevation in WRA4 exceeds the riser crest elevations. The maximum operable water surface elevation in WRA4 is 20.5 ft, NGVD. The northern boundary of Basin 4 is defined by a farm road, WRA4E canal is located south of the farm road. The WRA4E canal generally runs west to east discharging into North Feeder Canal through an existing culvert, PC-17. But WRA4E also extends 80 feet South along WRA4 eastern levee connecting with WRA4C canal. OUT4 discharges from WRA4 to the WRA4E canal south extension. The design releases from this structure for a head water elevation of 20.5 ft, NGVD and a tailwater elevation of 17.0 ft, NGVD will be approximately 15 cfs which is significantly smaller than the discharge capacity of 2960 cfs of S-190.

Table 2: OUT4 Structure Data

Culvert Data	**OUT4**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	24 inches
Culvert Length	60 feet
Upstream Invert Elevation	13 ft, NGVD
Slide Gate Control	No
Riser Data	
Riser Diameter	24 inches
Riser Fixed Crest Elevation	19.5 ft, NGVD
Discharge Data	
Headwater Elevation	20.5 ft, NGVD
Tailwater Elevation	17.0 ft, NGVD
Discharge	15.0 cfs

e. Stormwater Cell. Basin 4 contains one Stormwater Cell, named S4A with an area of 84 acres. Water is pumped into this cell when flood protection for adjacent lands is needed. The hydroperiod of the stormwater cell will be dependent on the need for tribal members to protect their lands from flooding. S4A discharges water into the WRA4 via uncontrolled culvert structure OF4A (Table 3). The maximum operable water surface elevation in the stormwater cell (S4A)is 21.2 ft, NGVD, this provides 3 feet of superiority to the crest elevation of the surrounding levee. The average ground surface elevation in S4A is 18.5 ft, NGVD.

Table 3: Culvert Structure OF4A Data

Culvert Data	**S4A to WRA4**
Number of Barrels	1
Barrel Type	CAP
Culvert Diameter	36 inches
Culvert Length	56 feet
Upstream Invert Elevation	18.5 ft, NGVD
Discharge Data	
Headwater Elevation	21.2 ft, NGVD
Tailwater Elevation	20.50 ft, NGVD
Discharge	17.5 cfs

f. Levees. Basin 4 levees encompass one WRA (WRA4) and one Stormwater Cell S4A. See Table 4 for levee elevations.

Table 4: Levee Design Elevations for WRA and S4A cell

Levee	**Levee Crest Elevation (ft, NGVD)**
S4A (around S4A)	24.2
WRA4 (North/East/West)	22.0

g. Canals. Basin 4 contains borrow canals along S4A and WRA4 used for the conveyance of basin water as well as WRA4E draining the Basin 4 water to North Feeder Canal (Figure 2). See Table 5 for canal data, the side slope is 2H:1V for all canals.

Table 5: Basin 4 Canal Data

Canal	Design Discharge (cfs)	Bottom Width (ft)	Length (ft)	Invert (ft, NGVD)
WRA4E	15	5.0	2466	13.0
S4A	12	6.0	8486	10.0
WRA4A	12	8.0	2995	13.5
WRA4B	NA(2)	10.0	1585	13.5
WRA4C	12	10.0	1555	13.5
WRA4D	NA(1)	6.0	1513	10.0

(1) No conveyance, borrow canal inside S4A
(2) No conveyance, borrow canal inside WRA4

7-04. <u>Standing Instructions to Project Operator</u>. During normal conditions, the project structures shall be operated in accordance with this Water Control Plan, and in accordance with the structure design criteria as described in Tables 1 through 6.

a. Pump Stations. There are two pump stations (P25 and P26) in Basin 4. Pumps will be operated manually when flood protection is needed. See Table 1 for pump station operating parameters. Additionally, when maximum water surface elevation of 21.2 ft, NGVD in S4A or 20.5 ft, NGVD in WRA4 is reached (whichever occurs first), pumps are shutoff (Table 6).

Table 6: Additional Pump Shutdown Elevations

Water Surface Elevations	S4A	WRA4
The maximum operable water surface elevation	21.2 ft, NGVD	20.5 ft, NGVD
Levee Crest	24.2 ft, NGVD	22.0 ft, NGVD

b. Unusual Conditions/Emergency Situations. In the event that unusual conditions arise requiring a deviation from normal regulation, refer to Section 7-12 of this document. During emergency situations where communication is interrupted, the Project Operator shall take any action deemed necessary. Such actions shall be documented in writing and shall be forwarded to the Jacksonville District at the address below as soon as is practicable:

U.S. Army Corps of Engineers, Jacksonville District
Chief, Water Management Section
701 San Marco Blvd.
Jacksonville, FL 32207
Phone: 904.232.2914

Upon the resumption of normal communications, the Project Operator shall report the sequence of events that lead to unplanned deviation and receive additional instructions from the Water Management Section, Jacksonville District.

7-05. Flood Control. As indicated in Section 7-03 of this document, the overall Plan for Water Management is to pump water from Basin 4 watershed into the Stormwater Cell S4A when removal of excess water is needed from the basin. From S4A, water is discharged through a culvert structure where it enters, WRA4. From WRA4, water is discharged to the North Feeder Canal via OUT4 and WRA4E canal. For example, excess water removal operations in Basin 4 would begin with pumping through P25 and P26 into S4A when the elevation in the canal adjacent to S4A at P25 is 17 ft, NGVD and at P26 is 17.6 ft, NGVD. Pumping should continue until the elevation recedes back below 16.5 ft, NGVD and 17.1 ft, NGVD, respectively. Excess stormwater runoff from the Basin not pumped into S4A is discharged into North Feeder Canal via WRA4E canal through an existing culvert structure, PC-17.

7-06. Recreation. This plan has no specified water management operational provisions for recreation. However, recreation in the project area may consist of eco-tourism.

7-07. Water Quality. The project has Critical Project designation because it is designed to improve water quality by removing phosphorous and pollutants from water discharged from the Reservation that ultimately flows into the Big Cypress National Preserve and the Everglades Protection Area. This is accomplished by allowing phosphorus and other pollutants to be biologically removed in the WRA and other nutrients attached to soil particles settled in the S4A water column.

7-08. Water Supply. Currently Basin 4 consists of approximately 306 acres of improved pasture and 293 acres of native range. Excess water that is pumped from the Basin 4 watershed will be pumped in S4A for stormwater

attenuation, then conveyed through uncontrolled culvert structure OF4A to WRA4 for retention and discharge into North Feeder Canal through WRA4E canal. There is no structure that can be used to re-use this water.

7-09. Navigation. This project has no specified water management operational provisions for navigation.

7-10. Drought Contingency Plan. There is no Drought Contingency Plan for this project at this time. Should one become available, it may be added as an attachment to this Water Control Plan.

7-11. Flood Emergency Action Plan. The Emergency Action Plan for this project is included as part of the Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual.

7-12. Deviation from Normal Regulation.
The Jacksonville District US Army Corps of Engineers Water Management Section is responsible for handling deviation requests and transmitting them through the District Commander to the Division Engineer for final decision. The District Commander is occasionally requested to deviate from normal operating criteria. Prior approval for a deviation is required from the Division Engineer except as noted in subparagraph "a" below. Deviation requests usually fall into the following categories:

a. Emergencies. Examples of some emergencies that can be expected to occur at a project are: drowning and other accidents, failure of the operation facilities, chemical spills, and other temporary pollution problems. Water control actions necessary to abate the problem are taken immediately unless such action would create equal or worse conditions. Districts must inform their division office as soon as practicable. Prepare written confirmation of the deviation and description of the cause and furnish it to the division water control manager. Divisions may develop forms to facilitate the reporting of emergency deviations.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulation plan, although they are not considered emergencies. Construction accounts for the major portion of these incidents and typical examples include

utility stream crossings, bridge work, and major construction contracts. Deviations are sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to upstream watershed conditions, potential flood threats and alternative measures that can be taken. In the interest of maintaining good public relations, requests generally are complied with providing there are no foreseen adverse effects on the overall regulation of the project (or projects) for the authorized purposes. Approval for these minor deviations normally will be obtained from the division office by telephone. Written confirmation explaining the deviation and its cause will be furnished to the division water control manager.

c. Planned Deviations. Each condition should be analyzed on its own merits. Sufficient data on flood potential, watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the district recommendation, will be presented by letter or facsimile to the division for review and approval.

Figures

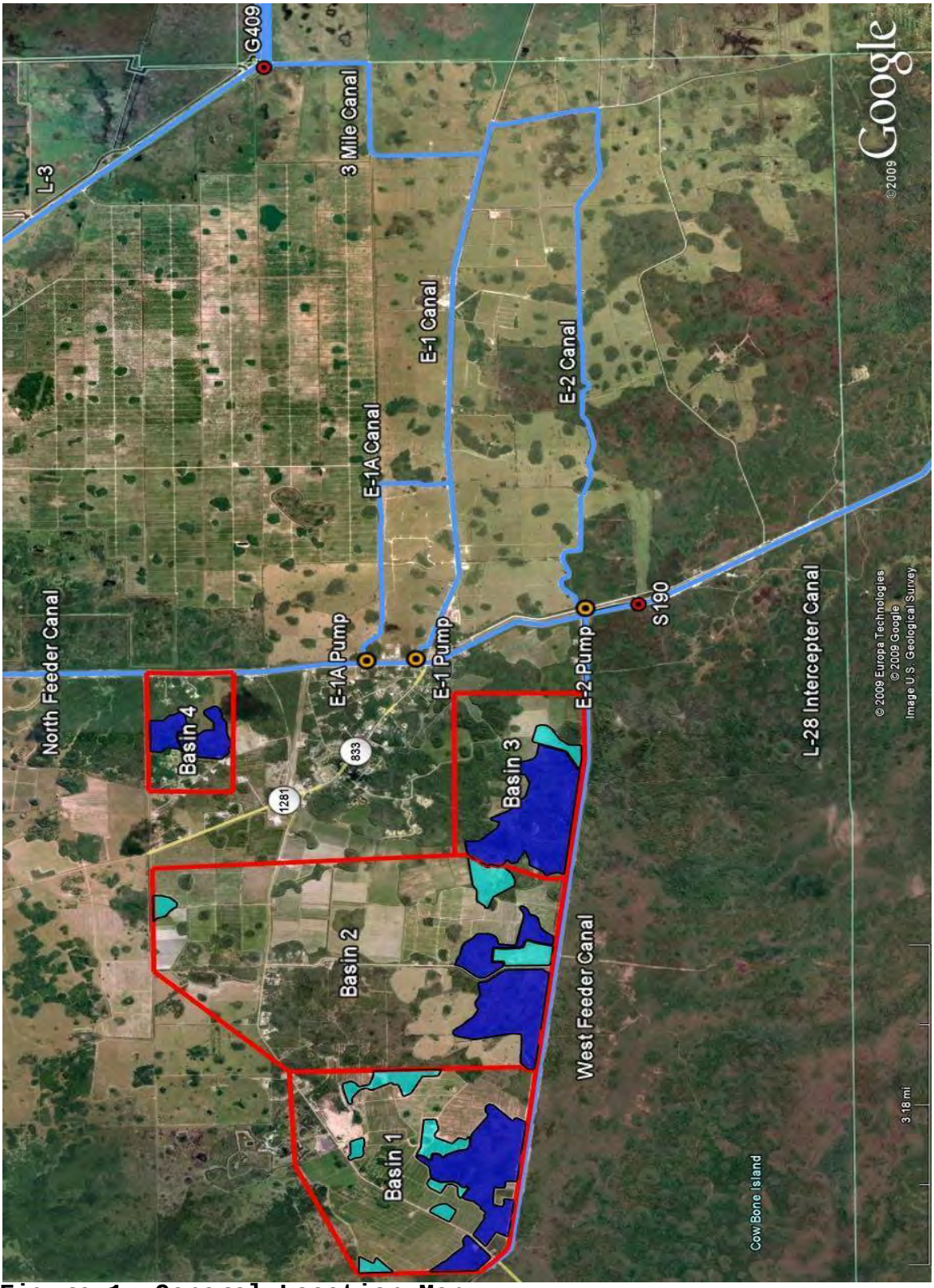


Figure 1: General Location Map

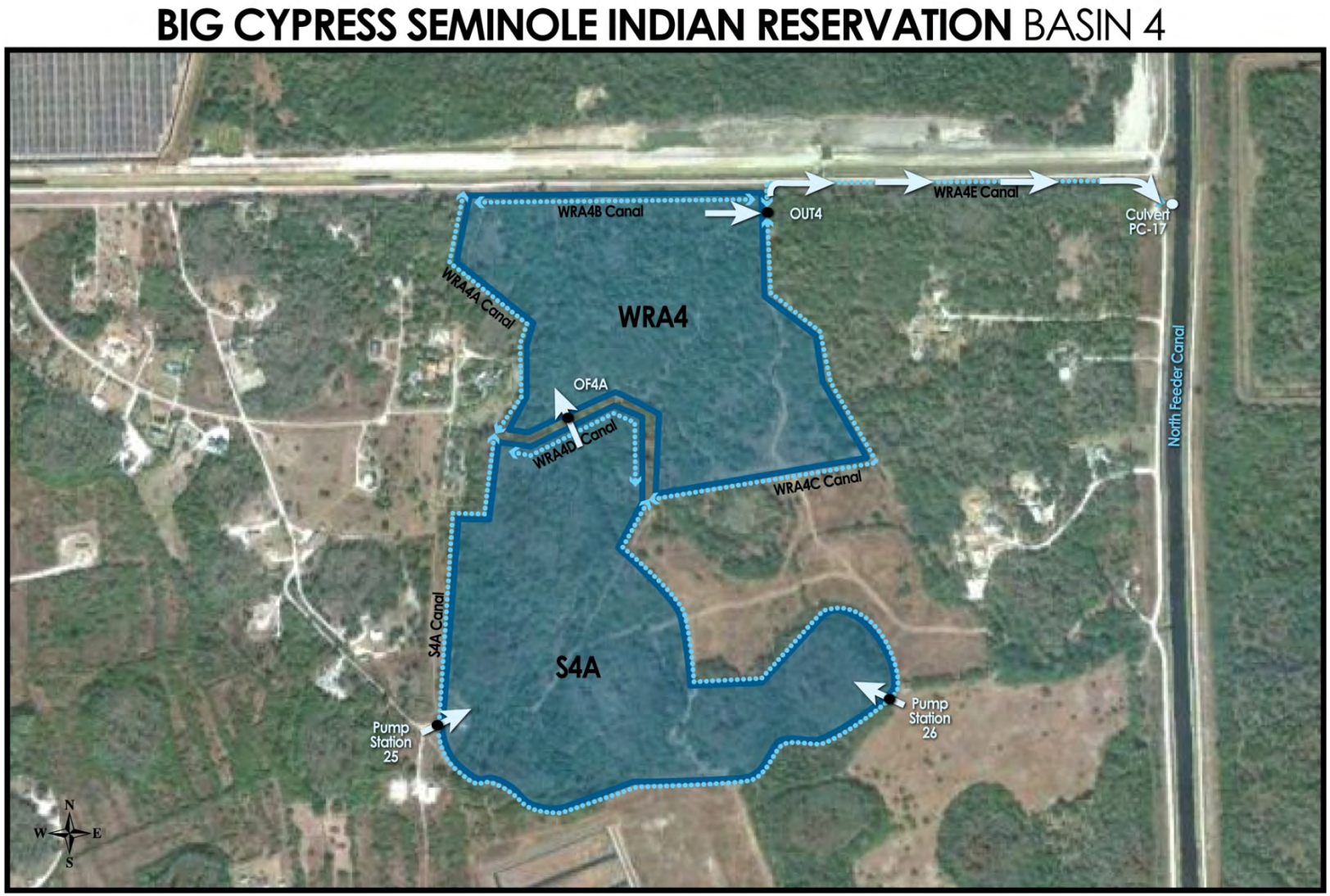


Figure 2: Basin 4 Layout