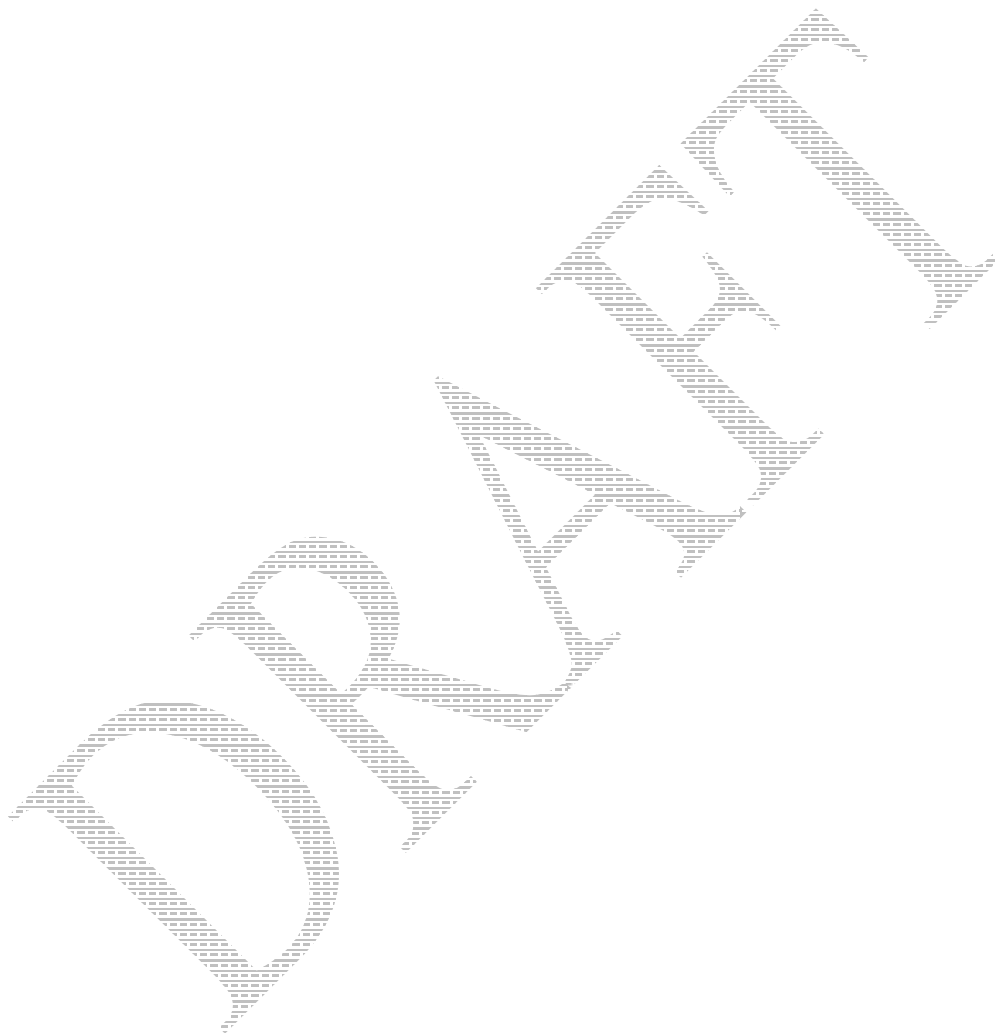


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Table 1-1  
Design Memoranda (DM) for the Central and Southern Florida Project

- 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

<u>Part</u>	<u>Supplement*</u>	<u>Title</u>	<u>Date</u>
1 I	(Basic report)	Agricultural and conservation areas (with preliminary information on Lake Okeechobee and principal outlets)	10 Jul 51
2 I	1	Geology and soils	6 Dec 51
3 I	(1) 2	Agricultural area levees	29 Dec 51
4 I	3	DM, Pumping Station 5A	28 Nov 52
5 V	2	DM, Canal 4	22 Feb 52
6 V	3	DM, Canal 9 and Structure 29	22 Feb 52
7 V	(2) 4	Hydrology and hydraulic design, Greater Miami area (preliminary draft)	23 Feb 52
8 V	(3) 1	DM, Canal 11	27 Feb 52
9 I	6	DM, Gates and operating machinery of control structures 5A-E, 5A-W, and 5A-S	5 Mar 52
10 I	Addendum to 3	DM, Pumping Station 5A	24 Mar 52
11 VI	(1) Section 1	Modified first phase plan	26 Mar 52
12 I	5	Test levee investigations	28 Mar 52
13 VI	(1) Section 3 (advance copy)	Schedules, outlines, and costs for preparation of definite project report	8 May 52
14 VI	(1) Section 2 (advance copy)	Construction schedule and cost estimates, authorized first phase	9 May 52

\* See NOTES (1) through (6) at end of table.

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
15 I	4	Structural design (works planned for construction through FY 1953)	18 Jul 52
16 V	7	DM (revised), Canal 11, Pumping Station 3, Control Structure 13A	8 Aug 52
17 V	8	DM, Canals 12 and 13, Control Structures 33 and 36	31 Oct 52
18 V	9	DM (revised), Canal 11, Pumping Station 13	17 Nov 52
19 V	(4) 6	DM, Pumping Station 9	28 Nov 52
20 V	10	DM, Vehicle-operated gate hoists	4 Dec 52
21 I	8	DM, Development of plan of protection for agricultural area	6 Feb 53
22 I	7	DM, Permeability investigations by well-pumping tests	16 Feb 53
23 VI	Section 4	Modified first phase plan, 1953	20 Feb 53
24 IV	I	DM, Effectiveness of Lake Okeechobee outlets	12 Mar 53
25 V	5	DM, Geology and soils	30 Apr 53
26 V	Section 5	DM, Channel roughness	1 May 53
27 I	10	DM, Pumping Station 6	27 May 53
28 I	9	DM, Hydrology and hydraulic design of West Palm Beach Canal and related works (L-10 and L-12)	8 Jun 53
29 I	11	DM, Hydrology and hydraulic design of West Palm Beach Canal and related works (L-18, L-19, L-20, and S-7)	17 Jun 53

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

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<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
30 I	13	DM, Hydrology and hydraulic design of North New River Canal and related works (L-18, L-19, L-20, and S-7)	6 Jul 53
31 I	12	DM, Hillsboro Canal (Levees 14 and 15)	15 Jul 53
32 I	15	DM, Pumping Station 2	29 Jul 53
33 V	11	DM, Hydrology and hydraulic design of design of Hollywood Canal (C-10)	31 Jul 53
34 I	14	DM, Hydrology and hydraulic design of Miami Canal and related works (L-23, L-24, L-25, S-3, and S-8)	17 Aug 53
35 VI	Section 6	DM, Rainfall-frequency estimates	4 Sep 53
36 IV	Supplement 2, Section 1	Hydrology and hydraulic design DM, Storage level in Lake Okeechobee at beginning of critical hurricanes	13 Oct 53
37 I	16	DM, West Palm Beach Canal (Levees 10 & 12)	15 Oct 53
38 I	17	DM, Pumping Station 13	30 Oct 53
39 I	18	DM, Revision of hydrology and hydraulic design of West Palm Beach, Hillsboro, North New River, and Miami Canals	16 Nov 53
40 I	19	DM, North New River Canal (Levees 20, 19, and 18)	1 Dec 53
41 IV	Supplement 2, Section 2	Hydrology and hydraulic design DM, Hurricane winds over Lake Okeechobee	31 Dec 53
42 IV	Supplement 2, Section 5	Hydrology and hydraulic design DM, Lake-regulating facilities	12 Jan 54
43 IV	Supplement 2, (1) Section 3	Hydrology and hydraulic design DM, Wind tides produced by hurricanes	21 Jan 54

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
44 IV	3	DM, Prototype tests of Lake Okeechobee type sector gates at Ortona Lock	28 Jan 54
45 I	30	DM, Miami Canal (Levees 25, 24, and 23)	5 Feb 54
46 V	12 (revised)	DM, Hydrology and hydraulic design, canals in Greater Miami area (C-2 through C-9)	23 Mar 54
47 VI	Section 7	DM, Interim report on evaluation of Manning's n in vegetated areas	2 Apr 54
48 IV	Supplement 2, (1) Section 4	Hydrology and hydraulic design DM, Wave action coincident with wind tides	27 Apr 54
49 V	13	DM, Water- and salinity-control structures in Greater Miami area	2 Jul 54
50 IV	Supplement 2, Section 6	Hydrology and hydraulic design DM, Resistance of levees to wave erosion	13 Aug 54
51 V	14	DM, Snapper Creek Canal (C-2) and Control Structure 22	1 Oct 54
52 IV	4	DM, Effects of fresh-water discharges through St. Lucie Canal	27 Oct 54
53 I	21	DM, Agricultural area levees, Levees 4 (east), 5, and 6	1 Nov 54
54 I	22	DM, Agricultural area levees, Levees 2, 3, and 4 (west)	19 Nov 54
55 V	15	DM, Snake Creek Canal extension (C-9, section 4)	15 Dec 54
56 VI	Section 8	DM, Rainfall-excess evaluation	5 Jan 55
57 VI	(1) Section 10	Project authorizations	10 Mar 55
58 VI	Section 9	DM, Regimen of runoff	16 Mar 55

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
 (Part V indicates Coastal Areas South of St. Lucie Canal)

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<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
59 IV	Supplement 2, Section 5A	Hydrology and hydraulic design DM, additional lake-regulating facilities	28 Mar 55
60 V	16	DM, Canal 17 and Control Structures 43 & 44	5 Apr 55
61 V	17	DM, Snapper Creek Canal (C-2) navigation requirements	13 May 55
62 I	(1) 23	DM, Levee 39 and Spillway 10	20 Jun 55
63 II	1	DM, Moore Haven-Newhall area (C-19, L-41, L-42, L-51, S-47B, S-47D, and S-81)	21 Jul 55
64 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
65 I	24	DM, Pumping Station 7	13 Dec 55
66 V	19	DM, Canal 9, section	16 Dec 56
67 V	18	DM, Little River Canal (C-7)	17 Jan 56
68 II	4	General DM, Hydrology and hydraulic design, Fisheating Creek area (C-22 and S-69)	24 Apr 56
69 II	3	DM, Lake Istokpoga-Indian Prairie area (Canals 39A, 40, and 41, and Structures 70, 71, 72, 75, and 82)	31 May 56
70 VI	Section 11	DM, Meteorologic and water- level networks, parts I and V	19 Jun 56
71 IV	5	Special report on mullet migrations through St. Lucie Lock and Dam, 1955-56	20 Jun 56

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

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<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
72 IV	Supplement 2, Section 3 (Revised)	Hydrology and hydraulic design DM, Wind tides produced by hurricanes	26 Jul 56
73 IV	Supplement 2, Section 4 (Revised)	Hydrology and hydraulic design DM, Wave action coincident with wind tide	27 Jul 56
74 V	20	General and Detail DM, Canal 18 and Control Structure 46	20 Aug 56
75 V	21	Detail DM, Biscayne Canal (C-8) and Control Structure 28	24 Sep 56
76 II	5	General DM, Kissimmee River Basin	8 Oct 56
77 VI	Section 12	Summary report, 1954 authorized work on which general DM studies will not be completed by end of 1956	11 Oct 56
78 II	6	DM, Plan of regulation for Lake Istokpoga	12 Oct 56
79 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
80 III	2	General DM, Upper St. Johns River Basin	20 Mar 57
81 IV	6	General DM, Caloosahatchee River and control structures (Canal 43 and Lock and Spillway Structures 77, 78, and 79)	24 Apr 57
82 I	26	Detail DM, Pumping Station 8	27 May 57
83 V	(1) 22	Detail DM, Canal 10 (Hollywood and Spur Canals)	26 Sep 57
84 I	25	General DM, Plan of regulation for Conservation Area No. 1	29 Nov 57

Table 1-1 (continued)  
Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
85 II	7	Detail DM, Canal 41A (Slough and Stub Canals) and Structures 66, 68, 83, & 84	22 Jan 58
86 I	27	General DM, Plan of regulation for Conservation Area No. 2	28 Feb 58
87 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
88 V	23	General and Detail DM, Canal 14 and Control Structures 37A, 37B, and 38A	5 May 58
89 IV	8	DM, General development plan, recreation, public use, and operation	6 May 58
90 I	23 (Revised)	DM, Levee 39, Spillway 10, and interim modifications to Levees 7 and 40	Jul 58
91 III	3	Detail DM, Canals 23A and 24 (North Fork St. Lucie River and Diversion Canal) and Control Structure 49	19 Sep 58
92 II	8	Detail DM, Automatic electric control system for Structures 66, 68, 70, 71, 72, 75, 82, 83, and 84, Lake Istokpoga-Indian Prairie area	30 Oct 58
93 II	5 Section 1	Kissimmee River Basin, General DM, Modification of Kissimmee River (C-38) for fish and wildlife	31 Oct 58
94 I	28	Detail DM, Levee 38 (east), Section 1	23 Dec 58
95 V	24	General DM, Canals 15 and 16 and Control Structures 40, 41, and 42	31 Dec 58
96 IV	Supplement 2, Section 7	Hydrology and hydraulic design General DM, Combinations of hydrologic and hydraulic factors affecting height of levees	25 Feb 59

Table 1-1 (continued)  
Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
97	V 25	General DM, Canal 1 and Control Structure 21	27 Feb 59
98	V 26	Detail DM, Cathodic Protection for Control Structures 22 & 29	10 Mar 59
99	V 27 (Section 5)	General and Detail DM, Canal 9 and Control Structure 30	20 Apr 59
100	IV (5) 9	Detail DM, Detail development plan, recreation facilities on Canals 43 & 44	14 May 59
101	IV 7	General and Detail DM, Lake Okeechobee northwest shore levees (Levees 48, 49, and 50; Interceptor Dikes 59, 60, and 61; and Pumping Stations 127, 128, 129, 130, 131, and 132)	29 May 59
102	I 29	Detail DM, Levee 38, Section 2 (raising U.S. Highway 27 between Structures 11A and 11C)	28 Jul 59
103	I 30	General DM, Levee 28 (Section 2) and related works	15 Sep 59
104	IV 11	General DM, Prevention of levee erosion by tree planting	24 Sep 59
105	I 31	Detail DM, Levees 35B and 38 (Section 3); spoil islands--Levees 35B and 38 (Section 2); and Control Structure 38	13 Oct 59
106	IV (6) 10	General DM, Biological investigations of St. Lucie Estuary in connection with Lake Okeechobee discharges through St. Lucie Canal	15 Oct 59
107	V 29	General and Detail DM, Modification of Control Structure 13A in Canal 11	22 Oct 59
108	V 28	Detail DM, Canal 1 (Black Creek) and Control Structure 21	30 Oct 59

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
109 V	30	General DM, Levee 31 and related works	6 Nov 59
110 III	4	Detail DM, Canal 25 (Belcher Canal) and Control Structures 50, 98, and 99	10 Dec 59
111 V	22 (Revised)	Detail DM, Canal 10 (Hollywood and Spur Canals)	20 May 60
112 I	33	General DM, Conservation Area No. 3	22 Jun 60
113 VI	Section 13	Detail DM, Hydraulic design of inlet structures	24 Jun 60
114 III	5	Detail DM, Canal 23 and Control Structures 48 and 97	18 Jul 60
115 IV	13	Detail DM, Pumping Stations 127, 129 & 131	7 Sep 60
116 IV	12	Detail DM, Canal 43, Section 1 (Caloosahatchee River)	22 Sep 60
117 V	31	General and Detail DM, Canal 1 and Control Structures 21, 148, and 149	29 Sep 60
118 I	34	Detail DM, Levees 67A and 29, Section 3, and Control Structure 151	30 Sep 60
119 I	35	Detail DM, Levee 29, Sections 1 and 2, and Control Structures 12A, B, C, D, E, and 14	7 Nov 60
120 IV	14	Detail DM, Herbert Hoover Dike, Levees D-1, D-2 (part), and D-3 (part)	26 May 61
121 I	36	General DM, Hydrologic and meteorologic gaging programs, Conservation Area No. 3	31 May 61
122 II	9	Detail DM, Canal 38, Section 1 (Kissimmee River), and Control Structure 65E	21 Jun 61

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
123 II	10	Detail DM, Canals 31 and 35 (St. Cloud and South Port Canals) and Control Structures 59 and 61	23 Jun 61
124 IV	16	Detail DM, Structure 79, lock and spillway on Canal 43	7 Jul 61
125 IV	15	Detail DM, Canal 43, Section 2 (Caloosahatchee River)	4 Aug 61
126 V	32	Detail DM, Levee 31 East, Section 1 (Old Cutler Road to Goulde Canal), and Control Structure 21B	5 Jan 62
127 V	33	Detail DM, Canal 1, Section 3, and Control Structure 149	26 Jan 62
128 I	32	Detail DM, Levee 28, Sections 2, 3, and 5	2 Mar 62
129 II	11	Detail DM, Structure 65D	14 Mar 62
130 I	38	Detail DM, Levee 68A	22 Mar 62
131 I	37	Detail DM, Structures 24B, 31, and 150 (Conservation Area No. 3)	27 Apr 62
132 V	34	Detail DM, Canals 15 and 16 and Control Structures 40 and 41	28 Jun 62
133 II	13	Detail DM, Spillways and locks on Canal 38, Structures 65, 65A, 65B, and 65C	20 Jul 62
134 II	12	Detail DM, Canal 38, Sections 2 and 3 (Kissimmee River)	17 Aug 62
135 IV	17	Detail DM, Canal 43, Section 3 (Caloosahatchee River)	22 Aug 62
136 IV	18	Detail DM, Herbert Hoover Dike, Levees D2 (Part), D9 and D4	18 Sep 62

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
137 II	14	Detail DM, Canals 36 and 37 (Cypress-Hatchineha Canal and Hatchineha-Kissimmee Canal)	19 Sep 62
138 IV	20	Detail DM, Structures 77 & 78 on Canal 43	15 Nov 62
139 II	15	Detail DM, Canal 38, Sections 4, 5 and 6 (Kissimmee River)	11 Feb 63
140 IV	21	Detail DM, Lake Okeechobee northeast shore area (L-47, L-62, L-63, L-64, L-65, S-133, S-134, S-135, S-152, S-153, S-154, tieback levees, inlet structures, etc.)	12 Mar 63
141 V	35	Detail DM, Levee 31E, Section 2 (Goulds Canal to Florida City Canal), and Structures 20G and 21A	29 Mar 63
142 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
143 VI	Section 14	Project authorizations to date	30 Apr 63
144 IV	19	Preliminary Master Plan, Caloosahatchee River	31 May 63
145 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
146 I	40	Detail DM, Levee 28 interceptor and feeder canals	23 Aug 63
147 IV	22	Detail DM, Herbert Hoover Dike, Levee D3 (remainder)	5 Sep 63
148 V	37	General DM, South Dade County	12 Sep 63

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

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<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
149 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
150 V	38	Detail DM, Canal 111, Section 1, and Control Structure 18C	31 Dec 63
151 I	41	Detail DM, Pumping Station 140	19 Jun 64
152 IV	23	Detail DM, Canal 43, Sections 4 and 5 (Caloosahatchee River)	9 Sep 64
153 II	16	Detail DM, Canals 33 and 34 (Alligator-Gentry Canal and Canoe Creek Canal)	28 Sep 64
154 V	39	Detail DM, Canals 102 (Princeton Canal, 102(N), and Control Structures 165, 194, and 195	19 Nov 64
155 V	41	General and Detail DM, Structures 124 and 125 (C-42 and related areas)	15 Dec 64
156 V	40	Detail DM, Canals 103 (Mowry Canal), 103(N), and 103(S), and Control Structures 20F, 166, 167, 179, and 196	22 Jan 65
157 I	42	Detail DM, Levee 38 (West), Section 1	11 Feb 65
158 IV	24	Detail DM, Herbert Hoover Dike, Levee 47, and Control Structure 191	8 Mar 65
159 IV	25	Detail DM, Pumping Stations 133 and 135	30 Apr 65
160 IV	19B (C-1)	Construction DM, Olga Lock and Dam (S-79), Public-use facilities	8 Jun 65
161 V	42	Detail DM, Levee 31 East, Section 3 (Florida City Canal to Card Sound Road) and Control Structures 20 and 20A	30 Jul 65

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
162 V	43	Detail DM, Canal 111, Sections 2 and 3; Canal 111(E); and Control Structures 176, 177, and 178	31 Aug 65
163 II	17	Detail DM, Canals 30 and 32 and Control Structures 57 and 58	30 Nov 65
164 V	44	Detail DM, Levee 31(N) and Control Structure 173	31 Jan 66
165 II	18	Detail DM, Canals 29, 29A, 29B, and Control Structure 62	29 Jul 66
166 IV	26	Detail DM, Levees 64, 65, St. Lucie Canal north tieback levee, and Control Structure 153	28 Oct 66
167 V	45	Detail DM, Canals 109 and 110, and Control Structure 18	15 Dec 66
168 V	46	General DM, Canals 4, 5, and 6, and Control Structures 25, 25A, 25B, and 26	18 Apr 67
169 IV	28	Detail DM, Lock Structure 193	5 Jun 67
170 IV	27	Detail DM, Levees 62, 63(N), 63(S); Canal 59 and Control Structure 192	14 Sep 67
171 I	43	Detail DM, Levee 13 (Cross Canal)	31 Oct 67
172 V	47	Detail DM, Levee 31(W), Canal 113, and Control Structures 174 and 175	17 Nov 67
173 III	7	Detail DM, Levee 73, Section 2, Canals 57 and 58, and Control Structures 161, 162, 163, and 221	28 Feb 68
174 I	44	Detail DM, Pumping Station 4	22 Apr 68
175 V	48	Detail DM, Canals 106, 107, and 108 and Control Structures 19 and 198	23 Aug 68

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
176 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
177 I	45	Detail DM, Canal 21 and Control Structure 169	6 Jun 69
178 V	45 (Revised)	Detail DM, Canals 109 and 110, and Control Structures 18 and 199	14 Oct 69
179 IV	27 (Revised)	Detail DM, Levees 62, 63(N), 63(S); Canal 59; and Control Structure 192	20 Oct 69
180 IV	29	Detail DM, Seaboard Coast Line Railroad Bridge B-142 Over Levee 63(N) Borrow Canal	10 Aug 70
181 III	9	Detail DM, Levee 72, Control Structure 160, Culverts 1 through 6	18 Aug 70
182 I	47	Detail DM, Canal 20, Levees D1 and D3 Connecting Canal and Control Structures 47, 233, 234, and 235	30 Dec 70
183 V	50	Detail DM, Coastal Areas South of St. Lucie Canal - Control Structure 25 in Miami Canal (C-6)	26 Nov 71
184 IV	30	Detail DM, Lake Okeechobee and Outlets St. Lucie Canal Tieback Levees	13 Jan 72
185 I	46	General and Detail DM, Pumping Station 236	28 Feb 72
186 V	49	General and Detail DM, Canals 12N and 13, Control Structures 224 and 237	4 Apr 72
187 V	51	General and Detail DM, West Palm Beach Canal and Related Areas with Detail Design Appendix on Pumping Station 319	Jun 72

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
 (Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
188 I	47	Detail DM, Canal 20 (Revised)	12 Jun 72
189 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
190 V	54	Detail DM, Canal 51 and Control Structures 155 and 155A	Nov 72
191 V	53	Detail DM, Control Structures 25 and 25A in Comfort Canal (C-5) and 25B in Tamiami Canal (C-4)	Nov 72
192 IV	31	General and Detail DM, Port Mayaca Lock (S-308B) and Spillway (S-308C)	Nov 72
193 V	52	General DM Conveyance Canals to Everglades National Park and South Dade County with Detail Design Appendix on Pumping Station 331 and Enlargement of Reaches of Levee 31(N) Borrow Canal, C-1, and C-103	Jun 73
194 V	55	Detail DM, Levee 29, Section 3, Borrow Canal Enlargement, Pumping Station 332, and Control Structures 194(Mod), 333, 334, 335, 336, and 338	Aug 74
195 V	56	Detail DM, Levee 30, Borrow Canal Enlargement and Control Structures 32A and 337	Mar 76
196 IV	52	General and Detail DM, Lock Structure 310 (S-310)	May 76
197 I	48	General DM, Hendry County Area with Detail Design Appendix on Structure 239 and Canals 139 and 139 South	Feb 77
198 I	53	General and Detail DM on Structures 339 and 340	Sep 77

Table 1-1 (continued)  
Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

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<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
199 I	51	General and Detail DM on L-18 and L-19 (North New River Canal), and L-24 and L-25 (Miami Canal) Hump Removal	Mar 78
200 V	52 (Addendum 1)	General and Detail DM, Enlargement of Canal 304 and Culvert Structure 151	Jun 78
201 V	57	Buttonwood Canal Improvements and Related Works, Everglades National Park, Structure 341	Jul 79
202 V	51 (Addendum 1)	Detail DM, Canal 51-East End and Control Structure 155	Dec 81
203 II	19	General DM, Nicodemus Slough Area	Jan 82
204 IV	33 (HGS-4)	General DM, Spillway Structures 351	Jun 84
205 III	11	General DM, St. Lucie County Water Supply Element, C-131, Enlargement C-28 Portion, PS-214, S-115, S-116, S-117, S-118, PS-307, PS-313, S-112, and S-348	Jun 84
206 III	2 (Addendum 3)	General DM Upper St. Johns River Basin with Draft Environmental Impact Statement	Jul 84
207 V	54	Detail DM Canal 51-West End, Control Structure 155A and Pumping Station 319	Jul 85
208 IV	34	DM, Spillway Structure 351 (HGS-4)	Jun 85
209 IV	35	General DM, Spillway Structure 352 (HGS-5)	Aug 85
210 IV	37	Detail DM Spillway Structure 352 (HGS-5)	May 86
211 III	12	Detail DM Structure 96B and Tieback Levee	Jul 86
212 IV	36	General DM, Spillway Structure 354 (HGS-3)	Dec 86
213 III	13	Detail DM, Structure 161A and Tieback Levee, Structure 255, Levee 74N (Part) and Levee 74E	Mar 87

Table 1-1 (continued)  
Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas South of St. Lucie Canal)

<u>Part</u>	<u>Supplement</u>	<u>Title</u>	<u>Date</u>
214 IV	38	Detail DM, Spillway Structure 354 (HGS-3)	Apr 87
215 III	14	Detail DM, S-252A, S-252B and S-252C Levee 78 and Levee 79	Aug 87
216 III	15	Detail DM, Structure 96C and 96D	Oct 88
217 III	15	Detail DM, Structure 96C and 96D (Revised)	Feb 89
218 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
219 V	54 (Addendum 2) (Revised)	Detail DM, Canal 51-West End, Control Structures 155A and 360, Pumping Station 319 and Levee 85	Sep 89
220 II	20	General DM, Shingle Creek, C-120A, C-120B, S-353 and Environmental Structures ES-1, ES-2, and ES-3	Sep 89
221 III	17	Detail DM, Levee 75 (Section 1)	Oct 89
222 III	18	Detail DM, Levee 74 N. Part, Levee 75 Remainder, and Structure 256	Mar 91
223 III	19	General Design Memorandum, Master Plan - Recreation, Upper St. Johns	Oct 91

\* 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 Detail Design Memorandum No. 1, Okeechobee  
Waterway, Florida, dated 17 December 1959

Table 1-1 (continued)

Design Memoranda (DM) for the Central and Southern Florida Project  
(Part V indicates Coastal Areas south of St. Lucie Canal)

\* NOTES (continued):

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

Design Memorandum is abbreviated DM

Hurricane Gate Structure is abbreviated HGS

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Table 7-1

Summary of Regulation Procedures for St. Lucie Canal

ZONE

ACTION

A

Water Management and Meteorology Section, Hydrology and Hydraulics Branch, Engineering Division, Jacksonville District Office, will advise and coordinate the St. Lucie Spillway (S-80) discharge and final desired gate setting with the South Florida Operations Office (SFOO) and the lockmasters and will direct the activities of the lockmasters at S-80 and Port Mayaca Lock (S-308B) and Spillway (S-308C). Increase flow as directed by the Jacksonville District Office using the following constraints. S-80 gate opening is to be accomplished in 0.5-foot increments. Do not proceed with the next 0.5-foot increment of gate opening if the new discharge after the change will exceed the 125 percent rating curve (See Figure 7-3) based on the most recently obtained three-station Lake Okeechobee average stage using HGS-2, HGS-6, and S-308 lake side gages. The current S-80 headwater reading and the 125 percent curve will determine when the next 0.5-foot increment of gate opening can be made. However for S-80 headwaters up to 15.5 ft., NGVD, incremental gate changes be made no more frequently than once every 30 minutes. When the S-80 headwater is rising rapidly, gate changes may be made more often to keep the headwater below 15.5 ft., NGVD. Increase or decrease S-308C discharge as necessary to hold a tailwater elevation at a current level between 14.0 and 14.5 ft., NGVD until the S-80 headwater has been drawn down to the headwater on the S-80 rating curve (find in Appendix A) which corresponds with the maximum discharge obtained from the 125 percent curve, or 17,000 cfs, whichever is less. Minimum headwater elevation is 10.0 ft., NGVD when Lake Okeechobee is below 18.5 ft., NGVD. Then, gradually open S-308C to fully open (14,800 cfs, maximum) allowing the tailwater to rise above 14.5 until equilibrium is reached. When directed by the Jacksonville District Office, discharge reduction will be accomplished in a slow and careful manner that will not create surges in the canal.

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Table 7-1 (Cont'd)

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ZONE

ACTION

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B

Jacksonville District Office will direct S-80 discharge and gate setting based on flow rate prescribed in the Interim Regulation Schedule for Lake Okeechobee up to 3,500 cfs, except when exceeded by local inflow. Increase or decrease S-308C discharge to hold a headwater elevation of approximately 14.0 feet at S-80. S-308C discharges will be influenced by consumptive withdrawals or inflows between Port Mayaca and St. Lucie Lock and will be increased or decreased as necessary to produce the directed flow at S-80.

3

C

Jacksonville District Office will direct S-80 discharge and gate setting based on flow rate prescribed in the Interim Regulation Schedule for Lake Okeechobee up to 2,500 cfs, except when exceeded by local inflow. Increase or decrease S-308C discharge to hold a headwater elevation of approximately 14.0 feet at S-80. S-308C discharges will be influenced by consumptive withdrawals or inflows between Port Mayaca and St. Lucie Lock and will be increased or decreased as necessary to produce the directed flow at S-80.

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D

Jacksonville District Office will direct S-80 discharge based on flow rate prescribed for pulse releases (Levels I, II, or III). This discharge may be exceeded during times of large local inflows. Increase or decrease S-308C discharge to hold a headwater elevation of approximately 14.5 feet at S-80. S-308C discharges will be influenced by consumptive withdrawals or inflows between Port Mayaca and St. Lucie Lock and will be increased or decreased as necessary to produce the directed flow at S-80.

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E

With Lake Okeechobee above 14.5 Feet. Optimum range of St. Lucie Canal is 14.0 - 14.5 ft., NGVD, based on S-308C tailwater elevation. Supply water to the canal from Lake Okeechobee only when the S-308C tailwater falls below 14.0 feet. During local floods, discharge at S-80 only when the headwater elevation exceeds 14.5 ft., NGVD, then only at a rate necessary to restore the S-80 headwater to 14.5 feet. Local water users should be given the option of drawing the canal level down to 14.0 feet at S-80 headwater. S-308C should be opened when water levels will permit drainage of the canal inflow to Lake Okeechobee. S-308B will be used to supplement the S-308C discharge when necessary to keep the head less than 0.5-foot when discharging to the lake.

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Table 7-1 (Cont'd)

ZONE

ACTION

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With Lake Okeechobee below 14.5 Feet. During declared water shortage periods manage the St. Lucie Canal level between 0.2- and 1.0-foot below the average Lake Okeechobee stage. SFWMD will set water allocations from the lake to the canal when operating between these limits. S-308B will not be used for discharge purposes unless devices are in place to measure the flow. All local inflow is to be directed to Lake Okeechobee unless unusual circumstances require other actions.

Table 7-2

Example S-80 Gate Opening Table

1. This example applies primarily when Lake Okeechobee is in Zone A; however, it should be applied during anytime that large local inflow is expected above S-80.
2. Assume Thursday conditions at 0800 hours are as follows:  
Lake Okeechobee average stage 16.7', rainfall 7.52" at St. Lucie Lock, rising stage with current gate setting 7 gates open 2.0' as reported to Jacksonville District Office by 0800 hours.
3. At 0900 hours Jacksonville District Office orders maximum gate opening at St. Lucie Spillway (S-80).
4. Jacksonville District Office would compute the following table showing headwater elevations for various permissible gate changes. The table would be revised each day when the lake average is available.

Gate Opening Table

Day	0800 hours lake stage	Discharge from 125% rating curve (cfs).	Before changing gate opening to:	Allow headwater to drop to elev.:
Thursday	16.7	9,900	7@2.5	16.7
			7@3.0	16.7
			7@3.5	15.6
			7@4.0	13.6
			7@4.5	12.6
			7@5.0	11.7
			7@5.5	10.8
Friday	16.9	10,200	7@6.0	10.0 min
			7@4.0	14.1
			7@4.5	13.2
			7@5.0	12.2
			7@5.5	11.2
			7@6.0	10.5
			7@6.2	10.0 min

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Gate Opening Table (Cont.)

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Day	0800 hours lake stage	Discharge from 125% rating curve (cfs).	Before changing gate open- ing to:	Allow headwater to drop to elev.:
Saturday	17.1	10,400	7@4.5 7@5.0 7@5.2	12.4 10.5 10.0 min

Table 7-3

Example of St. Lucie Canal Operations

<u>Day</u>	<u>Time</u>	<u>H.W.</u>	<u>Gate Opening</u>	<u>Discharge</u>	<u>Remarks</u>
Wed	1600	11.20	7@2.0	4,950	Before storm.
	2400	13.00	7@2.0	5,500	Storm has begun.
Thur	0800	15.10	7@2.0	6,150	Lake stage 16.7. Max. Q=9,900 cfs based on 125% rating curve.
	0900	15.30	7@2.0	6,200	D. O. orders maximum gate opening at S-80 and orders closing of S-308C. D. O. computes Gate Opening Table (see Table 7-2) and gives to Lockmaster and Chief, South Florida Operations Office (SFOO).
	0930	15.40	7@2.5	7,700	Lockmaster makes first half-foot increase at S-80.
	1000	15.45	7@3.0	8,600	Lockmaster makes second half-foot increase at S-80.
	1030	15.50	7@3.5	10,000	Lockmaster makes next half-foot increase even though it exceeds maximum discharge in table because maximum stage is reached.
	1100	15.50	7@4.0	10,800	Keep on increasing gate opening to hold stage at or below 15.5' at S-80 H.W.

Table 7-3 (Cont'd)

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Day	Time	H.W.	Gate Opening	Discharge	Remarks
	1600	15.30	7@4.0	10,800	Delay next S-80 gate change because it would exceed maximum discharge of 9,900 cfs. Peak local inflow has occurred. Begin re-opening S-308C. This can take place reasonably rapidly because of low head across S-308C. Must be started now to avoid loss of canal pool and to avoid large wave in canal.
	2400	14.50	7@4.0	10,300	Delay next change because it would exceed maximum discharge of 9,900 cfs. Keep lock tender on duty because of volatility of water surface.
Fri	0800	13.80	7@4.0	9,800	Lake stage 16.9'. Re-compute Gate Opening Table (See Table 7-2). Max. Q=10,200 cfs during gate change based on higher lake stage. Delay next gate change at S-80 because maximum discharge would be exceeded.
	2200	12.60	7@4.0	9,300	Lockmaster off duty. Delay gate change because additional half-foot gate opening would exceed 10,200 cfs maximum. No danger of losing pool since S-308C has been fully opened.
Sat	0600	12.1	7@4.0	9,000	Lockmaster returns to duty.
	0600	12.1	7@4.5	10,200	Makes first half-foot increase in S-80 gate opening because it won't exceed yesterday's maximum discharge of 10,200 cfs.

Table 7-3 (Cont'd)

Day	Time	H.W.	Gate Opening	Discharge	Remarks
	0800	12.00	7@4.5	10,100	Lake stage 17.1'. Max. Q=10,400 cfs. D. O. computes new Gate Opening Table (See Table 7-2) and furnishes to Lockmaster and Chief, SFOO. Delay next gate change at S-80 because maximum discharge of 10,400 cfs would be exceeded.
	1800	10.50	7@4.5	9,200	Ready for next half-foot gate change.
	1800	10.50	7@5.0	10,400	Make next gate change indicated by table 7-2. When headwater drops to 10.0' minimum H.W., reduce gate openings as necessary to maintain H.W.=10.0'
	2200	10.00	7@4.5	8,800	Local inflow has dropped off considerably. Lockmaster can leave for night after further reduction in gate opening at S-80.
	2200	10.50	7@4.3	8,800	Additional headwater will hold pool above 10.0 overnight.
Sun	0800	10.00	7@4.1	7,800	St. Lucie Canal profile is stabilized after most local inflow has passed. (Note that there is a 7.1' drop over 23 miles between Lake Okeechobee and S-80. This has to be undone very carefully when it is time to close the gates.)

**Table 7-5**  
**Optimum Water Control Elevations**

	<u>Structure</u>	<u>Canal Name</u>	<u>in ft., NGVD</u>
5	Optimum water-control elevation		
8	S-2	Hillsboro & N. New River	11.5 - 12.0
9	S-3	Miami Canal	11.5 - 12.0
10	S-4	Canal 20	13.0
11	S-5A	West Palm Beach Canal	11.5 - 12.0
12	S-5AE	Levee and Canal 8	---- (1)
13	S-5AW	Levee and Canal 8	---- (1)
14	S-5AS	Levee and Canal 8	---- (1)
15	S-5AX	Levee 13 Borrow Canal	---- (2)
16	S-6	Hillsboro Canal	11.5 - 12.0
17	S-7	N. New River Canal	11.5 - 12.0
18	S-8	Miami Canal	11.5 - 12.0
19	S-47D	Canal 19	12.3 - 12.9
20	S-47B	Canal 19	13.0 - 15.0
21	S-65E	Canal 38	---- (3)
22	S-71	Canal 41	---- (3)
23	S-72	Canal 40	---- (3)
24	S-76	Levee and Canal 8	---- (1)
25	S-77	Lake Okeechobee	---- (4)
26	S-78	Canal 43	10.6 - 11.5
27	S-79	Canal 43	2.8 - 3.2
28	S-80	St. Lucie Canal	14.0 - 14.5
29	S-84	Canal 41A	---- (3)
30	S-127	L-48 Borrow Canal	13.0 - 14.0
31	S-129	L-49 Borrow Canal	13.0 - 13.5
32	S-131	L-50 Borrow Canal	13.0 - 13.5
33	S-133	L-D4 Borrow Canal	13.0 - 14.0
34	S-135	L-47 Borrow Canal	13.0 - 14.0
35	S-153	L-65 Borrow Canal	18.6 - 19.1
36	S-154	L-62 Borrow Canal	23.0 - 24.0
37	S-169	Industrial Canal	15.0 (5)
38	S-191	C-59 and L-63(N) and	
39			L-63(S)
40	Borrow Canals 19.0		
41	S-192	Taylor Creek	19.0
42	S-236	L-D1 Borrow Canal Connector	13.0
43	S-236	Bare Beach Drainage District	13.0
44	S-308C	Lake Okeechobee	---- (4)

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Notes:

- (1) Same as WCA No. 1.
- (2) Divide structure between drainage areas.
- (3) Refer to Volume 2, Kissimmee River - Istokpoga Basin.
- (4) Same as Lake Okeechobee.
- (5) Same as Lake Okeechobee when lake is below 15.5; same as S-4 during hurricane alert.



**Table 7-7**

**Gate Opening Procedures for Manatees**

1. Lock Operations. The following standard operating procedures are in effect for safely locking manatees at St. Lucie Lock, Port Mayaca Lock, Moore Haven Lock, Ortona Lock and W.P. Franklin Lock:

a. Lock operators will be attentive as to the location and number of manatees in the lock chamber and approaches at all times, as well as aware that manatees may be present even if not visible.

b. Manatee sightings will be recorded on a Florida Department of Environmental Protection Manatee Sighting Form. These forms are to be submitted monthly to the Florida Department of Environmental Protection, Office of Protected Species Management, 3900 Commonwealth Boulevard, MS 245, Tallahassee, Florida, 32399-3000, with the SFOO retaining a file copy for record.

c. Every effort will be made to avoid hindering the passage of manatees through the locks and to assure their safety around vessels. Special lockages will be provided for manatees that demonstrate a desire to pass in a particular direction. According to the judgment of the lock operator on duty, vessels may be locked with manatees or delayed until the next lockage. At the W.P. Franklin Lock it will be necessary to turn off the bubbler system to allow manatees to enter and exit the lock chamber.

d. When manatees are first observed in the lock area, lock operators will inform approaching vessels of any manatees in the area and their locations, so craft can use extra caution. Lock operators will then assure that vessels are at idle speed upon entering the approach channels and inform vessels of any manatee movements necessary to their safety.

e. Every effort will be made not to crowd manatees in the lock chamber, especially with barges and tugs. Sufficient distance between vessels and gates will be maintained at all times.

f. Precautions will be made to assure manatee safety around sector gates. Operate sector gates at slowest speeds possible for the first minute to avoid manatees being trapped in strong currents. Operate both sector gates simultaneously; leaving one gate closed for any reason other than an emergency or malfunction should be avoided.

g. Delay vessels or lockage temporarily if imminent danger to a manatee exists by continuing operations. When locking manatees and vessels together delay vessels after lockage to assure manatees enough time to clear the area and gain access to safe water. Vessel operators should then be warned to proceed with caution at idle speed. If there is

doubt that the manatee has exited the chamber, the gates shall be left open to assure safe passage.

h. The SFOO will perform inspections of manatee exclusion screening devices on lock gates every six months and any time damage is suspected. Deficiencies will be corrected as soon as possible.

2. Flood Control/Spillway Gate Operations. The following standard operating procedures, in conjunction with the operating criteria contained in the approved water control plans and manuals for the Central and Southern Florida Project, are designed to reduce manatee risk during spillway operations. These procedures, however, are not intended for use at structures where manatee barriers (whether temporary or permanent) prevent manatee access to the spillway gates. The procedures below should only be used at spillways without barriers, or at spillways where barriers have been removed or are otherwise not fully functional. At spillways where barriers are functional and prevent manatee access to the spillway gates, gates should be operated in accordance with the operating criteria set forth in the water control plans and manuals.

a. Standard operating procedure for S-78, Ortona; and S-80, St. Lucie. The following procedures are designed to put the manatee at less risk during spillway operations and are based on the water surface profile (difference between the upper and lower pools) of the S-78 spillway (9' to 11') and S-80 spillway (12' to 14').

(1) On initial gate openings stop gate for 30 second period upon first sign of water movement. (Approximately .01 to .03 feet).

(2) Stop at .05' increments for 30 seconds until a .3' opening is acquired. Observe for a continuous flow across the full gate width at each increment.

(3) Continue opening gate in increments not to exceed .3' until gate is at desired opening. Operator will continuously observe for obstructions in gate opening during this procedure.

(4) If voids appear (interruptions of even water flow across the full gate width) the operator will determine to the best of his/her ability the source of the voids and make the following decision.

(a) If it appears to be trash or debris that is caught in the gate (aquatic plants, trees or other such debris) the operator will continue to open the gate at .3' increments at 30 second periods until the debris has passed through the gate and then lower the gate at .3' increments at 30 second periods until the desired gate setting is obtained.

(b) If it appears that a manatee has been entrapped, the gate should be operated as follows: If the current gate opening is less than or equal to 0.6 feet, the gate is to be closed to a height of 0.3 feet so that the manatee will be able to free itself. The gate may then be raised to the desired opening; this raising should be done in increments not to exceed

0.3 feet and with continual observations for obstructions. However, if the current gate opening is greater than 0.6 feet, then the gate should be immediately opened to allow the manatee to be washed through (up to a maximum of 2.5 feet) and then adjusted to the desired opening.

(5) Gates will always be maintained at the smallest possible opening across all gates. The minimum gate opening when more than one gate is in operation, will be .5 feet. This will allow debris to be flushed through the gate without being caught. The maximum single gate openings will be .9 feet.

(6) Spillway operations will be accomplished only by qualified operators, through on-the-job training, who are able to perform the standard operation procedures for manatee protection described herein.

b. General rule for operating single or multiple gates at S-77, S-79, S-308, S-351, S-352, and S-354, when the difference between headwater and tailwater elevations, or head, across these structures is less than or equal to three feet.

(1) To allow manatees to pass under the gates, the minimum opening for any gate under the "less than or equal to 3.0 feet of head" condition is 2.5 feet. One or more gates may be opened to 2.5 feet, subject to the following constraints: The operator should open the more central gates of the structure first, proceeding outward to those gates further from the center. The operator should also open gates on alternating sides of the structure. Thus, if there are four gates numbered 1-4 from left to right, a correct sequence for opening them would be: Gates 2, 3, 1, and 4. An equally correct sequence would be: Gates 3, 2, 4, and 1. Gates should be closed in reverse order.

(2) Gate openings greater than 2.5 feet should not be made until all gates have been opened to 2.5 feet, at which time additional gate openings may be made as follows: The operator may increase each gate opening in equal increments, in turn, in accordance with the MAGO curves until the predetermined opening is attained. At the end of the gate opening sequence, all of the gates must be set at approximately equal gate openings, all in accordance with the MAGO curves. As a practical consideration the spillway gates should not be adjusted such that gate openings differ by more than one foot.

(3) This procedure should be used at S-77 only if the tail water is above +9.0 feet, NGVD; and at S-79 only if the tail water is above -2.0 feet, NGVD. In other words, in the rare event that these conditions are not met, do not exceed the MAGO criteria.

(4) Gate openings greater than 2.5 feet shall be accomplished according to the operational criteria specified in the approved water control plans and manuals for the Central and Southern Florida Project.

(5) Spillway operations will be accomplished only by qualified operators, through on-the-job training, who are able to perform the standard operating procedures for manatee protection as described herein.

(6) The procedures above are only applicable for heads less than or equal to 3.0 feet. Procedures for heads exceeding 3.0 feet are described in the paragraphs that follow. If, while operating under the low head procedures above, the head across the structure should exceed three feet, the following steps should be taken: The gates should be closed, in reverse order, to openings permitted by the MAGO curves. The operating procedures applicable to heads greater than 3.0 feet should then be used.

c. General rule for operating a single gate at S-77, S-79, S-308, S-351, S-352, and S-354, provided that the difference between headwater and tailwater elevations, or head, across these structures is greater than 3.0 feet.

(1) If it is predetermined that an opening smaller than or equal to 2.5 feet would be needed for the gate:

The gate may be initially opened to a maximum of 2.5 feet and held at that opening for up to one (1) minute. Forces of the water should "flush-through" any manatee that may be resting against the gate or in the immediate vicinity while the gate is at the 2.5-foot opening. Within the one minute period, the gate must be closed to the predetermined opening. If the predetermined opening is not permitted by the MAGO curves, the operator must close the gate to a permitted opening and wait until the discharge raises the tailwater elevation so that the opening can be increased to the predetermined opening in accordance with the MAGO curves.

(2) If it is predetermined that an opening larger than 2.5 feet would be needed for the gate:

The gate may be initially opened to a predetermined opening larger than 2.5 feet, provided that such an opening would be permitted by the MAGO curves. If the predetermined opening would not be permitted by the MAGO curves, the gate may be initially opened to 2.5 feet and held at that opening for up to one (1) minute. Forces of the water should "flush-through" any manatee that may be resting against the gate or in the immediate vicinity while the gate is at the 2.5-foot opening. Within the one minute period, the operator must close the gate to a permitted opening in accordance with the MAGO curves and wait until the discharge raises the tailwater elevation. As the tailwater rises, the gate opening may be increased to the predetermined opening in accordance with the MAGO curves.

(3) This procedure should be used at S-77 only if the tail water is above +9.0 feet, NGVD; and at S-79 only if the tail water is above -2.0 feet, NGVD. In other words, do not exceed the MAGO criteria in the rare event that these conditions are not met.

(4) Gate openings greater than 2.5 feet shall be accomplished according to the operational criteria specified in the approved water control plans and manuals for the Central and Southern Florida Project.

(5) Spillway operations will be accomplished only by qualified operators, through on-the-job training, who are able to perform the standard operating procedures for manatee protection as described herein.

d. General rule for operating multiple gates at S-77, S-79, S-308, S-351, S-352, and S-354, provided that the difference between headwater and tailwater elevations, or head, across these structures is greater than 3.0 feet.

(1) If it is predetermined that an opening smaller than or equal to 2.5 feet would be needed for the gates:

One gate may be initially opened to a maximum of 2.5 feet and held at that opening for up to one (1) minute. Forces of the water should "flush-through" any manatee that may be resting against the gate or in the immediate vicinity of the gate. Within the one-minute period, the gate must be closed to the predetermined setting. If the predetermined opening would not be permitted by the MAGO curves, then the operator must lower the gate to a permitted smaller opening. This same procedure would then be repeated for opening the remaining gates. As the tailwater rises because of the discharge, the operator may increase each gate opening in equal increments, in turn, in accordance with the MAGO curves until the predetermined opening is attained. At the end of the gate opening sequence, all of the gates must be set at approximately equal gate openings, all in accordance with the MAGO curves. As a practical consideration the spillway gates should not be adjusted such that gate openings differ by more than one foot.

(2) If it is predetermined that an opening larger than 2.5 feet would be needed for the gates:

One gate may be initially opened to a predetermined opening larger than 2.5 feet, if such an opening would be permitted by the MAGO curves. The remaining gates must also be opened to the same opening. If the MAGO curves do not permit a 2.5-foot opening, one gate may be opened to 2.5 feet and then closed to a permitted opening within a maximum period of one (1) minute. Forces of the water should "flush-through" any manatee that may be resting against the gate or in the immediate vicinity while the gate is at 2.5-foot opening. This same procedure must be repeated for opening the remaining gates. As the tailwater rises because of the discharge, the operator may increase each gate opening in equal increments, in turn, in accordance with the MAGO curves until the predetermined opening is attained. At the end of the gate opening sequence, all of the gates must be set at approximately equal gate openings, all in accordance with the MAGO curves. As a practical consideration the spillway gates should not be adjusted such that gate openings differ by more than one foot.

(3) This procedure should be used at S-77 only if the tail water is above +9.0 feet, NGVD; and at S-79 only if the tail water is above -2.0 feet, NGVD. In other words, do not exceed the MAGO criteria in the rare event that these conditions are not met.

(4) Gate openings greater than 2.5 feet shall be accomplished according to the operational criteria specified in the approved water control plans and manuals for the Central and Southern Florida Project.

(5) Spillway operations will be accomplished only by qualified operators, through on-the-job training, who are able to perform the standard operating procedures for manatee protection as described herein.

3. Culvert Operations. The following standard operating procedures are in effect to reduce manatee risk at Herbert Hoover Dike and these extension levee Culverts; 1, 1-A, 2, 3, 4-A, 5, 5-A, 6, 8, 10, 10-A, 11, 12, 12-A, 13, 14, 16, and the following pipe culverts 1 (L-50); 1, 2, 3, 4, 5, 6 (Harney Pond Canal); 1, 2, 3 (Indian Prairie Canal); 1, 2, 3, 4 (Kissimmee River) and (50) pipe culverts on C-43, Caloosahatchee River, C.M.P. with risers.

a. When the vertical lift gates are being opened from the closed position, they will be raised to an initial opening of 2.5 feet and then closed to the desired setting. This will allow a resting manatee to be flushed through the culvert rather than being pinned and drowned at the point of the gate opening.

b. When the flap gate culverts are being opened by winch or crane, the shape of the flap gate and the slow operation will alert the manatee to move before a strong current could trap it at the point of the gate opening.

c. If manatees are observed during culvert operations, they will be discouraged from passing through to the smaller canal system in order to prevent entrapment in shallow water, possible harassment in developed areas and potential starvation.