

**Document to Support a  
Water Reservation Rule for the  
CERP Caloosahatchee River (C-43)  
West Basin Storage Reservoir Project**

**January 15, 2014**



DRAFT

## Executive Summary

3 This document summarizes information to support a water reservation rule for the Caloosahatchee  
4 River (C-43) West Basin Storage Reservoir Project (C-43 Reservoir). The South Florida Water  
5 Management District (SFWMD) proposes to reserve from allocation, all water stored within and  
6 transferred from the C-43 Reservoir to the Caloosahatchee River for the protection of fish and wildlife  
7 located downstream of the S-79 Structure (Franklin Lock and Dam). For the purpose of this document  
8 and the water reservation rule, the term “Caloosahatchee River” means the surface waters that flow  
9 through the S-79 Structure, combined with tributary contributions below the S-79 Structure that  
10 collectively flow southwest to San Carlos Bay as defined in SFWMD rule Chapter 40E-8.021 F.A.C. The  
11 area between the S-79 Structure and Shell Point can contain freshwater, marine water or brackish water (a  
12 combination of fresh and marine waters) and is referred to as Caloosahatchee River, river, or estuary in  
13 this document. The channelized area between the S-77 and S-79 structures is referred to as the C-43  
14 Canal.

15 The purpose of the C-43 Reservoir is to help promote a more balanced and healthy salinity regime  
16 for the Caloosahatchee River by providing more consistent flows during periods of low flow, typically  
17 occurring in the dry season, and reducing great influxes of fresh water from high flow discharges,  
18 typically occurring in the wet season. When complete, the reservoir, which will be located in the West  
19 Caloosahatchee Basin upstream of the S-79 Structure, will capture and store watershed runoff and  
20 freshwater releases from Lake Okeechobee, and release the water to the Caloosahatchee River as needed.

21 A water reservation rule sets aside water for the protection of fish and wildlife or public health and  
22 safety and protects it from allocation to consumptive uses. A water reservation rule is required by the  
23 Water Resources Development Act of 2000 since the C-43 Reservoir is a component of the  
24 Comprehensive Everglades Restoration Plan (CERP). Once in effect, the SFWMD’s water use permitting  
25 program uses the reservation rule to prevent water use permit allocations of the reserved water.

26 The Caloosahatchee River ecosystem is a highly productive estuary where the influx of nutrient-rich  
27 freshwater runoff mixes with salt water from the Gulf of Mexico. The estuary is an important nursery  
28 ground for many species, including some commercially and recreationally important or endangered fish  
29 and shellfish. Alterations to the watershed upstream and downstream of the S-79 Structure have resulted  
30 in wide variations in freshwater inflows to the estuary on both an annual and inter-annual basis. The  
31 extreme fluctuations in freshwater inflows affect water quality including salinity, which impacts estuarine  
32 fish and wildlife health and productivity. Protection of estuarine species including habitat-forming  
33 organisms (submerged aquatic vegetation and oysters), requires a less extreme range of flows through the  
34 S-79 Structure.

35 The information used to establish the water reservation is largely based on existing evaluations  
36 contained in the *Caloosahatchee River (C-43) West Basin Storage Reservoir Project Final Integrated*  
37 *Implementation Report and Environmental Impact Statement* (PIR) (USACE and SFWMD 2010)<sup>1</sup> with  
38 consideration of additional information compiled since the PIR was finalized. The information and data  
39 collected in this document include summaries of: historical alterations that occurred within the  
40 Caloosahatchee Watershed, salinity monitoring data, research conducted on several important species  
41 within the estuary, and an analysis of the effects of a revised Lake Okeechobee regulation schedule. In  
42 conjunction with the PIR, the information presented herein provides the basis for protecting fresh water  
43 for the natural system.

44 The PIR, using a 36 year period of record, concluded that all of the surface water from the reservoir  
45 should be reserved for the natural system. Updated assessments presented in this document using the 36-

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<sup>1</sup> Available online at [http://www.evergladesplan.org/pm/projects/docs\\_04\\_c43\\_pir\\_final.aspx](http://www.evergladesplan.org/pm/projects/docs_04_c43_pir_final.aspx).

46 year period of record (1965–2000) were compared to the modeling results from the PIR and confirmed  
47 this conclusion. Based on monitoring data, the volume of water released at the S-79 Structure that may be  
48 required to ameliorate the effects of saltwater intrusion varies from year to year. As a result, water  
49 releases from the C-43 Reservoir will also vary from year to year and will vary with different lake  
50 regulation schedules. Therefore, the SFWMD proposes to reserve all surface water stored in and released  
51 from the C-43 Reservoir for the protection of fish and wildlife in the Caloosahatchee River.

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## Section 1. Introduction

### 1.1 Purpose and Scope of the Document

This document summarizes information to support a rule to reserve water for fish and wildlife in the Caloosahatchee River. Specifically, fresh water will be provided by the Caloosahatchee River (C-43) West Basin Storage Reservoir Project (C-43 Reservoir) as described in the *Caloosahatchee River (C-43) West Basin Storage Reservoir Project Final Integrated Project Implementation Report and Final Environmental Impact Statement (PIR)* (USACE and SFWMD 2010). A water reservation rule is a legal mechanism that sets aside water for the protection of fish and wildlife or public health and safety and protects that volume of water from allocation for consumptive uses. A water reservation consists of a quantification of the water to be protected, which may include a seasonal or geographical component. State rules allow for reservations to be adopted prospectively for water anticipated to be made available from a project yet to be constructed.

The relationships and evaluations in the PIR form the basis of a water reservation rule for the Caloosahatchee River. The PIR established relationships among freshwater flows discharged from Lake Okeechobee and the watershed, salinity, and downstream estuarine ecologic responses. The key information contained in this document is based on the PIR and provides:

- A basis for the water reservation rule
- A description of the Caloosahatchee River, the watershed, and the C-43 Reservoir
- An overview of ecosystem and improvements expected after construction of the reservoir as identified in the PIR
- Identification of water to be reserved by rule

The South Florida Water Management District (SFWMD) is undertaking rule development to reserve water for the Caloosahatchee River. For the purpose of this document and the water reservation rule, the term “Caloosahatchee River” means the surface waters that flow through the S-79 Structure, combined with tributary contributions below the S-79 Structure that collectively flow southwest to San Carlos Bay as defined in SFWMD rule Chapter 40E-8.021(2) F.A.C. The area between the S-79 Structure and Shell Point can contain freshwater, marine water or brackish water (a combination of fresh and marine waters) and is referred to as Caloosahatchee River, river, or estuary in this document. The channelized area between the S-77 and S-79 structures is referred to as the C-43 Canal.

The reservation rule will fulfill legal requirements for constructing the C-43 Reservoir. Section 601(h)(4) of the Water Resource Development Act of 2000 (WRDA 2000; US Congress 2000) and the Programmatic Regulations for Implementation of the Comprehensive Everglades Restoration Plan (33 C.F.R. § 385.26-27) set implementation requirements for Comprehensive Everglades Restoration Plan (CERP) projects. These federal requirements ensure that each CERP project provides the intended benefits for the natural system by protecting water for the natural system through the SFWMD’s reservation or allocation authority. The SFWMD has elected to use its reservation authority pursuant to Section 373.223(4), Florida Statutes (F.S.) to protect water made available by the C-43 Reservoir.

The reservation rule and accompanying water use criteria will require permit applicants to provide reasonable assurances that their proposed use of water will not withdraw water that is reserved for the protection of fish and wildlife.

### 1.2 Project Purpose

Currently, freshwater flows to the Caloosahatchee River fluctuate widely, producing a salinity regime that often impacts the health and productivity of fish and wildlife found in the estuary (USACE and SFWMD 2010). Salinity levels are typically either too low during the wet season (due to high inflows from basin runoff and/or Lake Okeechobee discharges) or too high during the dry season (due to

171 insufficient freshwater inflows). Extreme and extended high and low salinity levels can trigger die-offs of  
172 submerged aquatic vegetation (SAV) and oysters, species that are indicators of the estuary’s overall  
173 health (USACE and SFWMD 2010).

174 The C-43 Reservoir will store watershed runoff and Lake Okeechobee discharges to ensure a more  
175 natural, consistent flow of fresh water to the estuary. The project consists of an aboveground reservoir  
176 with a capacity of 170,000 acre-feet (ac-ft) located on the south side of the C-43 Canal and west of the  
177 Ortona Lock (S-78 Structure). The reservoir will be operated to capture a portion of peak flows during the  
178 wet season (consisting of basin stormwater runoff and regulatory releases from Lake Okeechobee) and  
179 release this captured water to prevent harmful salinity increases in the Caloosahatchee River during the  
180 dry season. Reducing some high damaging discharges in the wet season and enhancing flows in the dry  
181 season will moderate changes in salinity that are detrimental to fish and wildlife located downstream of  
182 the S-79 Structure.

### 183 1.3 Identification of Water Reservation Water Body

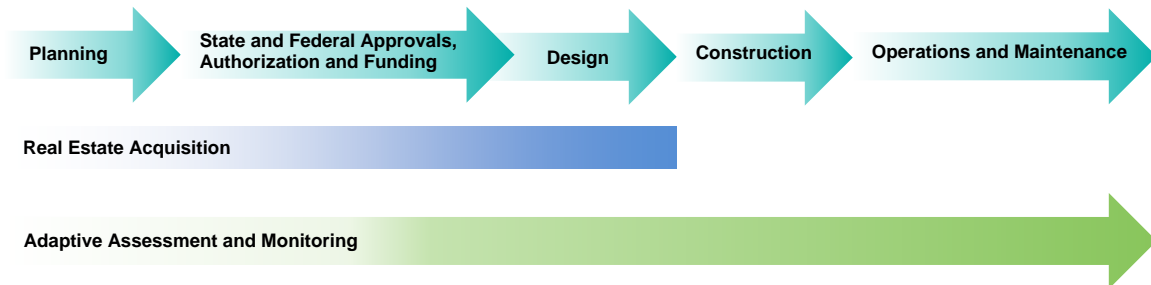
184 All waters stored within and released from the C-43 Reservoir are the subject of the proposed water  
185 reservation. These waters are to be protected from allocation for the purposes of protecting fish and  
186 wildlife within the Caloosahatchee River as defined in SFWMD rule 40E-8 F.A.C. including the  
187 associated estuarine resources contained therein.

### 188 1.4 Comprehensive Everglades Restoration Plan

189 The C-43 Reservoir is one of many CERP projects. CERP provides a framework and guide to restore,  
190 protect, and preserve the water resources of central and southern Florida, including the Everglades. CERP  
191 covers 16 counties over an 18,000-square-mile area and modifies Central & Southern Florida (C&SF)  
192 project features (USACE and SFWMD 1999). CERP includes more than 60 elements and will take more  
193 than 30 years to construct.

194 The SFWMD is the state-designated local sponsor of the C-43 Reservoir with the U.S. Army Corps of  
195 Engineers (USACE) as the federal sponsor. The execution of the Record of Decision in April 2011  
196 completed the planning phase of the C-43 Reservoir and enables its submittal to Congress for  
197 authorization and appropriation of funds (see **Figure 1-1**). The USACE anticipates project authorization  
198 to occur in 2014 with the appropriation of funding to follow at a later date. Once Congressional funding  
199 has been appropriated, a timetable for the completion of the reservoir will be developed. Construction is  
200 expected to take three to four years. Once Congress acts, the USACE and SFWMD will enter a Project  
201 Partnership Agreement that outlines the cost-share arrangements to initiate construction. A prospective  
202 water reservation is needed since the reservation rule to support the C-43 Reservoir must be adopted and  
203 verified prior to execution of the Project Partnership Agreement consistent with WRDA 2000 (US  
204 Congress 2000).

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**Figure 1-1.** Schematic of the CERP project development process.

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## Section 2. Water Reservation Rules

211 The SFWMD is undertaking this water reservation as required by commitments made for CERP. For  
212 this water reservation, the water to be protected is the water made available for the natural system once  
213 the C-43 Reservoir is constructed and there is formal determination by the Governing Board that the  
214 reservoir is operational. The water reservation must be in effect prior to project construction in order for  
215 the SFWMD, as local sponsor for the C-43 Reservoir, to receive its 50 percent federal cost share for the  
216 project.

### 217 2.1 Legal Basis of the Water Reservation

218 As stated in Section 1.1, a water reservation is a legal mechanism to set aside water from consumptive  
219 use for the protection of fish and wildlife or public health and safety.

220 Section 373.223(4), F.S. states:

221 The governing board or the department, by regulation, may reserve from use by permit  
222 applicants, water in such locations and quantities, and for such seasons of the year, as in  
223 its judgment may be required for the protection of fish and wildlife or the public health  
224 and safety. Such reservations shall be subject to periodic review and revision in the light  
225 of changed conditions. However, all presently existing legal uses of water shall be  
226 protected so long as such use is not contrary to the public interest.

227 Protection of fish and wildlife means “ensuring the health and sustainability of fish and wildlife  
228 communities through natural cycles of drought, flood, and population variation”. *Assoc. of Florida Cmty.*  
229 *Developers, et al. v. Dep’t of Envil. Prot., et al.*, DOAH Case No. 04-0880RP, Div. of Admin. Hrg., Final  
230 Order Feb. 24, 2006. Existing legal uses of water are protected so long as such uses are not contrary to the  
231 public interest. An existing legal use is a water use that is authorized under a SFWMD water use permit or  
232 is existing and exempt from permit requirements.

233 It is also important to understand what a water reservation does not do. While Part II of Chapter 373,  
234 F.S., authorizes water management districts to establish reservations, it does not authorize a water  
235 management district to establish criteria for operations of a CERP project. The SFWMD’s authority to act  
236 as local sponsor of a CERP project is found in Part I of Section 373.1501, F.S. Programmatic Regulations  
237 in 33 C.F.R. §385.28 require operating plans for CERP projects to be consistent with an established water  
238 reservation or allocation. While the CERP project operational criteria and the water reservation are  
239 related, they derive from distinct federal and state authorities.

#### 240 2.1.1 Prospective Water Reservation

241 Subsection 62-40.474(3), F.A.C. states that reservations may be adopted prospectively for water  
242 quantities anticipated to be made available at a future date. Surface water from the C-43 Reservoir will  
243 not be made available for the Caloosahatchee River until the reservoir is constructed and operational.  
244 Therefore, this will be a prospective water reservation rule.

### 245 2.2 Water Reservation Rule Development Process

246 General rulemaking requirements and procedures are described in Chapter 120, F.S. Consistent with  
247 statute and SFWMD policy, **Figure 2-1** summarizes the general steps in the rule development process. In  
248 2009, the Governing Board authorized the publication of a Notice of Rule Development for the water  
249 reservation to support the C-43 Reservoir, fulfilling the first step. This document fulfills the second step  
250 and summarizes data and information that supports a rule to reserve water for the benefit of fish and  
251 wildlife in the Caloosahatchee River. Independent scientific peer review of this document is not anticipated  
252 nor mandated by state statute or rule (*See* 62-40.474, F.A.C.). However, the USACE Agency Technical

253 Review/External Peer Review of the Caloosahatchee River (C-43) West Basin Storage Reservoir document  
254 was carried out through collaboration with the USACE Planning Centers of Expertise in compliance with  
255 Engineer Circular 1105-2-408, *Peer Review of Decision Documents*, dated May 31, 2005.

256 Using this supporting document, the SFWMD will propose rule language and conduct rule  
257 development workshops, ensuring a public process for stakeholders and interested persons. Interested  
258 parties can provide comments on the proposed draft rule language, including suggestions for alternative  
259 rule language. Once the proposed rule language is finalized, SFWMD staff will seek the Governing  
260 Board's authorization to publish a Notice of Proposed Rule. The Notice of Proposed Rule will identify the  
261 public hearing date and provide stakeholders with the opportunity to provide written comments,  
262 alternative rule language, or a lower cost regulatory alternative for consideration by the Governing Board.  
263 The SFWMD will then forward a copy of the Notice of Proposed Rule, including the rule text, to the  
264 Florida Department of Environmental Protection, Joint Administrative Procedures Committee (JAPC) and  
265 Office of Fiscal Accountability and Regulatory Reform (OFARR). With the acceptance of JAPC and  
266 OFARR, the Governing Board will then consider adopting the proposed rule at a noticed public hearing.  
267 The adopted rule will be filed with the Florida Department of State 14 days after the public hearing and  
268 the rule becomes effective 20 days later.

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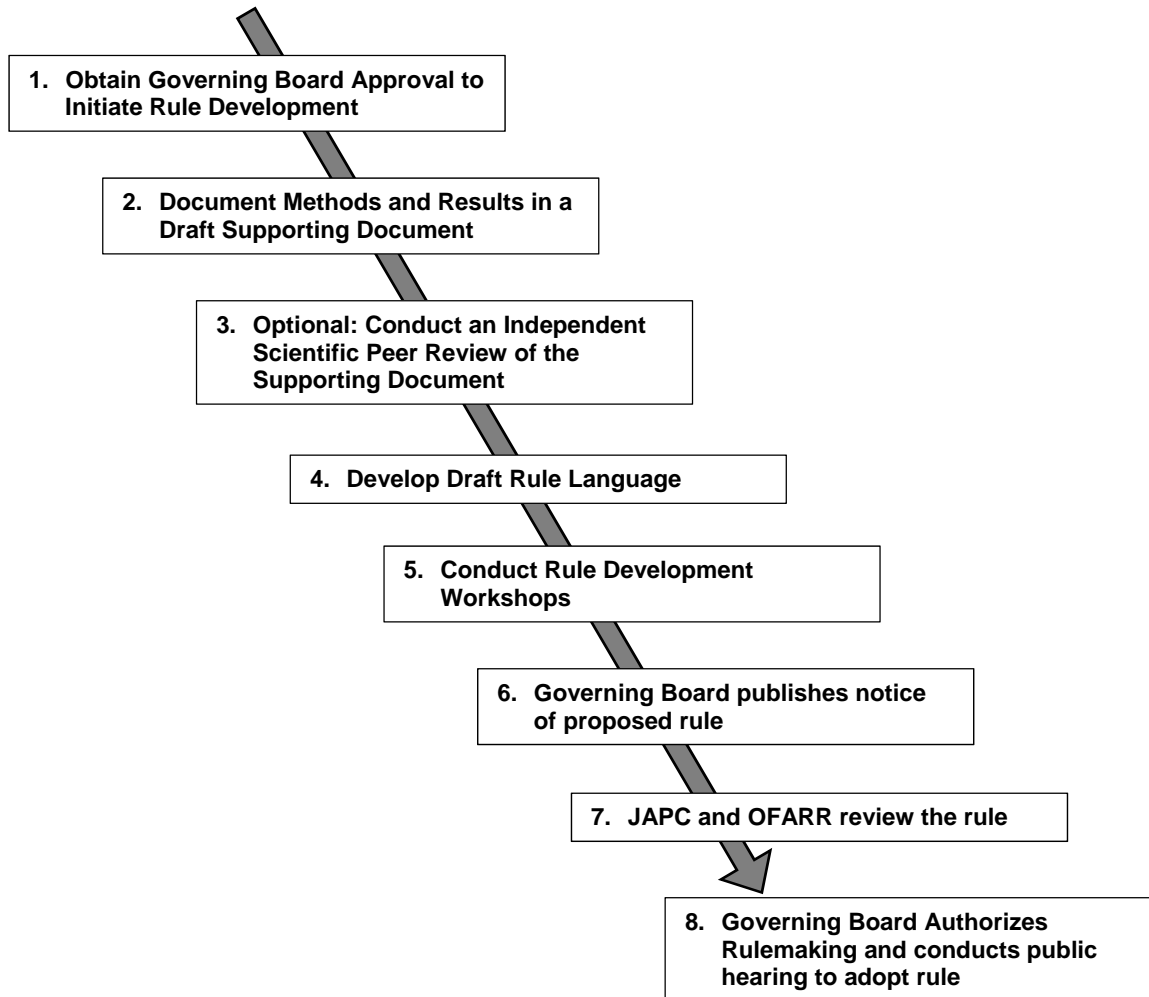
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## Key Steps in Rule Development Process

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**Figure 2-1.** Process steps of water reservation rule development process.



### Section 3. Caloosahatchee River Watershed and Project Features

#### 3.1 Caloosahatchee River Watershed

297 The Caloosahatchee River, C-43 Canal, and the associated watershed, are located on the lower west  
 298 coast of Florida (**Figure 3-1**). The Caloosahatchee River receives surface water from Lake Okeechobee,  
 299 runoff from five basins, which is defined as the Caloosahatchee Watershed (S-4, East Caloosahatchee,  
 300 West Caloosahatchee, Tidal Caloosahatchee, and Coastal), and base groundwater flow from the Surficial  
 301 Aquifer System. Other surface water bodies in the watershed include lakes, rivers, and canals, which  
 302 provide limited storage and allow conveyance of surface water. The C-43 Canal runs 40 miles (70 km)  
 303 from Lake Okeechobee at Moore Haven (S-77 Structure) to the Franklin Lock and Dam (S-79 Structure)  
 304 at Olga. The major tributaries of the Caloosahatchee River are the Orange River and Telegraph Swamp,  
 305 which drain into the river downstream of the S-79 Structure. The Caloosahatchee Watershed consists of  
 306 approximately 1,090,380 acres (4412 km<sup>2</sup>) in parts of Lee, Glades, Charlotte, Collier, and Hendry  
 307 counties. Lake Hicpochee is the largest lake in the area and is bisected by the C-43 Canal just west of  
 308 Lake Okeechobee.



**Figure 3-1.** Caloosahatchee River, C-43 Canal, and watershed showing major basins, water management structures, and location of the C-43 Reservoir.

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Separating fresh and brackish water, the S-79 Structure demarcates the head of the Caloosahatchee River. The estuary extends 26 miles (42 km) downstream to Shell Point, where it empties into San Carlos Bay in the southern portion of the greater Charlotte Harbor system. The width of the estuary is irregular, ranging from 525 ft. (160 m) in the upper portion to 8200 ft. (2500 m) near its mouth. The narrow section between the S-79 Structure and Beautiful Island has a mean depth of about 20 ft. (6 m), while the area downstream has an average depth of 4 ft. (1.5 m) (Scarlotos 1988). The surface area of the estuary is about 16,000 acres (65 km<sup>2</sup>). Surface water leaving the estuary at Shell Point enters San Carlos Bay. Most of this water takes a southerly route, flowing to the Gulf of Mexico under the Sanibel Causeway (Goodwin 1996). When freshwater inflows are high, tidal action pushes some of this water back up into

322 Matlacha Pass and Pine Island Sound. Additionally, some water exits to the south and flows into Estero  
 323 Bay through Matanzas Pass.

324 **3.1.1 Land Use in Caloosahatchee Watershed**

325 Various land uses in a watershed dictate water demands and runoff volumes to surface water. For the  
 326 Caloosahatchee Watershed as a whole, agricultural categories comprise the primary land-use type, with  
 327 44 percent of the total area. Natural land uses occupy the next largest group, at 30 percent, followed by  
 328 urban at 14 percent and open water at 12 percent (**Table 3-1**).

329 Within the S-4 Basin, 82 percent of the area is agricultural land use, and is almost entirely sugar cane.  
 330 Within the East Caloosahatchee Basin, 75 percent of land use is agricultural, with most of the remainder  
 331 is natural. Similarly, within the West Caloosahatchee Basin, 61 percent of land use is agricultural, with  
 332 most of the remainder natural. Within the Tidal Caloosahatchee, 37 percent of land use is natural, with  
 333 urban and agricultural land uses comprising 31 percent and 23 percent, respectively. Within the Coastal  
 334 Basin, 44 percent of the land use coverage is open water, followed by natural at 31 percent, urban at  
 335 17 percent, and agriculture at 8 percent.

336 **Table 3-1.** Land use by basin, in acres for the Caloosahatchee Watershed (Balci and Bertolotti 2012).

Land Use Categories (Grouped)	East		West	Tidal	Coastal	Total	Percent of Total
	S-4	Caloosahatchee	Caloosahatchee	Caloosahatchee			
<b>Urban</b>	4,825	5,802	19,709	82,507	39,476	152,319	14.0%
<b>Agriculture</b>	34,527	153,342	212,130	60,865	18,399	479,262	44.0%
<b>Natural Areas</b>	2,136	42,825	114,621	98,594	70,191	328,367	30.1%
<b>Open Water</b>	658	2,125	3,654	22,741	101,256	130,432	12.0%
<b>Total</b>	<b>42,146</b>	<b>204,093</b>	<b>350,114</b>	<b>264,705</b>	<b>229,322</b>	<b>1,090,380</b>	<b>100.0%</b>

337 **3.1.2 Alterations to the Caloosahatchee River**

338 The present day Caloosahatchee River and C-43 Canal has been highly altered from its natural state  
 339 by human intervention and engineering. Historically, the present day C-43 Canal was sinuous river,  
 340 originating near Lake Flirt, approximately 2 miles (3.2 km) east of La Belle at Ft. Thompson (**Figure**  
 341 **3-2**). Beginning in the 1880s, the river channel was straightened, deepened, and connected to Lake  
 342 Okeechobee. This resulted in a loss of 76 river bends and 8.2 miles (13.2 km) of river length (Antonini et  
 343 al. 2002).

344 In 1930, the first federal effort at flood control in Florida occurred with the passage of the River and  
 345 Harbor Act of July 3, 1930, which authorized improvement of the Caloosahatchee River and canal. Based  
 346 on this authorization, the river was improved by 1937 to provide a navigable channel at least 6 ft. (2 m)  
 347 deep and 80 ft. (24 m) wide, with locks and water control structures at Ortona and Moore Haven. Under  
 348 authority of the Rivers and Harbor Act of March 2, 1945, the river was improved for navigation purposes  
 349 to include a channel 8 ft. (2.5 m) deep and 90 ft. (27 m) wide. The canal also is part of the Okeechobee  
 350 Waterway, which allows boat traffic to navigate across Florida between Ft. Myers and Stuart.

351 In 1957, the USACE prepared *The Report on C&S Fla. Project, Part IV, Supplement6--General*  
 352 *Design Memorandum, Caloosahatchee River and Control Structures (Canal 43 and Lock and Spillway*  
 353 *Structures 77, 78, and 79)* (GDM) that focused specifically on the drainage, water control, and navigation  
 354 needs of the Caloosahatchee Watershed. The recommended plan as specified in the 1957 document  
 355 provided for improvement of the C-43 Canal and construction of three structures in the main canal (S-77,  
 356 S-78, and S-79) for water control and regulation.

357 The purposes and objectives for these additional improvements as envisioned in the GDM was to  
 358 (1) provide additional capacity for removal of runoff from the Caloosahatchee Watershed, (2) provide  
 359 water control for the area adjacent to the C-43 Canal to prevent excessive depletion of groundwater

360 during normal or dry periods, (3) provide regulatory discharge capacity for Lake Okeechobee, (4) provide  
361 adequate spillway capacity so that existing navigation locks would not have to be used for flood or  
362 regulatory discharges, and (5) prevent saltwater encroachment and maintain freshwater supplies in the  
363 lower reaches of C-43 Canal. Overall, the economic analysis of the proposed improvements established  
364 that they created two types of benefits: reduction of flood damage and subsequent increased flood  
365 protection, and improvement in fresh water supply to allow an increase in agricultural land use while  
366 providing additional water supply for urban areas.

367 The specific purpose of the S-79 Structure set forth in the GDM was to provide salinity and water  
368 control in lands adjacent to the C-43 Canal that are dependent upon it to recharge groundwater levels and  
369 serve as water supply. During the wet season, the S-79 Structure was designed to be a spillway structure  
370 to pass permissible releases from Lake Okeechobee, which at the time were between 4200 to 9300 cubic  
371 feet per second (cfs). During the dry season, the S-79 Structure was designed to address the lack of  
372 freshwater supply for irrigation in the lower river basin. Under conditions existing at the time, freshwater  
373 supply was depleted by uncontrolled downstream discharges to such an extent that the water table near  
374 the river was as much as 10 ft. (3 m) below ground (a depth of 2 or 3 feet [1 m] was considered  
375 optimum). Construction of the S-79 Structure was designed to (1) eliminate undesirable salinity upstream  
376 of the structure, (2) prevent the rapid depletion of water supplies, and (3) raise the prevailing dry-weather  
377 water table levels.

378 The U.S. Fish and Wildlife Service (USFWS) analyzed the environmental impacts of the proposed  
379 improvements on the Caloosahatchee River. At the time, the USFWS concluded that existing fisheries of  
380 the river and estuary were of relatively low quality and value due to adverse effects on the natural  
381 environment caused by past construction works such as the prior history of channelization. In addition,  
382 past regulatory and flood control discharges through the C-43 Canal had adverse effects on the sport and  
383 commercial fisheries of the estuary. The USFWS report concluded that these conditions were likely to  
384 persist and may be worsened by the deepening of the channel and the installation of the S-79 Structure,  
385 primarily in that the effects may be extended over a greater area, including inshore waters  
386 (USFWS 1957).

387 No additional capital project components have been made to the C-43 Canal, water control structures  
388 or watershed to improve estuary salinity regime since completion of the S-79 Structure in 1966.

389 A network of secondary and tertiary canals exists in the Caloosahatchee Watershed that is  
390 hydrologically connected to the C-43 Canal and Caloosahatchee River. These canals convey water for  
391 both drainage and irrigation to accommodate citrus groves, sugar cane, cattle grazing, urban development,  
392 and other uses. As a result, the river and canal now serve many functions, including irrigation water,  
393 drainage, and navigation, as well as conveyance of watershed runoff and regulatory releases of water  
394 from Lake Okeechobee to tide.



**Figure 3-2.** Caloosahatchee River showing water control structures, connection to Lake Okeechobee, and historical headwaters at Lake Flirt and Lake Bonnet.

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The Caloosahatchee River’s estuary has also been significantly altered (Chamberlain and Doering 1998a). Early descriptions of the estuary characterize it as barely navigable due to extensive shoals and oyster bars (Sackett 1888). A navigation channel was dredged and a causeway was built across the mouth of San Carlos Bay in the 1960s, which altered the natural configuration and flow of water within the estuary. Historic oyster bars upstream of Shell Point were mined and removed to be used in the construction of roads. Seven automobile bridges and one railroad bridge now connect the north and south shores of the estuary.

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As might be expected for a watershed characterized by extensive drainage features (see Hopkinson and Vallino 1995), runoff is more variable with higher wet season discharges and lower dry season discharges leading to lasting ecological consequences. Conveyance of storm water to the estuary is highly variable and seasonally affects salinity levels in the estuary. Large volumes of fresh water during the wet season can flush most of the salt water from the estuary. By contrast, dry season inflow at the S-79 Structure can stop entirely, sometimes allowing the head of the estuary to reach a practical salinity of 20<sup>2</sup> (Chamberlain and Doering 1998a, 1998b). Wide salinity fluctuations throughout the estuary cause mortality of flora and fauna at both ends of the salinity gradient (Doering et al., 2002).

<sup>2</sup> Common practice no longer uses units for measurements of salinity. These results were previously reported as parts per thousand (ppt) or practical salinity units (psu).

414 The construction of the Sanibel Causeway, which crosses the mouth of San Carlos Bay at Punta  
415 Rassa, may have influenced the seaward end of the system. The U.S. Fish and Wildlife Service (1960)  
416 predicted that this barrier would restrict the exchange of fresh water with salt water from the Gulf of  
417 Mexico, causing the retention of fresh water and a decrease in salinity in southern Charlotte Harbor.  
418 Reductions in salinity were expected to adversely affect a flourishing bay scallop fishery, which collapsed  
419 after the construction of the causeway was completed in 1963. Twenty years later, the Florida Department  
420 of Natural Resources reported a significant decline in seagrass coverage in deeper areas and attributed  
421 this, in part, to an increased amount of colored fresh water due to the exchange restriction (Harris et al.  
422 1983).

## 423 **3.2 Freshwater Inflows to the Caloosahatchee Estuary**

424 The two major sources of surface water inflows to the estuary are the C-43 Canal, which discharges at  
425 the S-79 Structure, and the Tidal Caloosahatchee Basin surrounding the estuary to the west and  
426 downstream of S-79 (**Figure 3-1**).

427 Historically, inflows from the Tidal Caloosahatchee Basin (TCB) to the estuary are not well known  
428 but this is changing as collection of 5 years of flow data from selected creeks has recently been  
429 completed. Despite limited data, modeling efforts have estimated annual Tidal Caloosahatchee Basin  
430 inflows. A linear reservoir model estimated daily flows from the Tidal Caloosahatchee Basin over 1966–  
431 2005 (Y. Wan, SFWMD, personal communication). Annual flows averaged 344 Kac-ft/yr (thousand acre-  
432 feet per year), ranging from a low of 157 Kac-ft in 1990 to a high of 788 Kac-ft in 1995. The median  
433 daily flow from the Tidal Caloosahatchee Basin was 270 cfs, 157 cfs during the dry season and 497 cfs  
434 during the wet season.

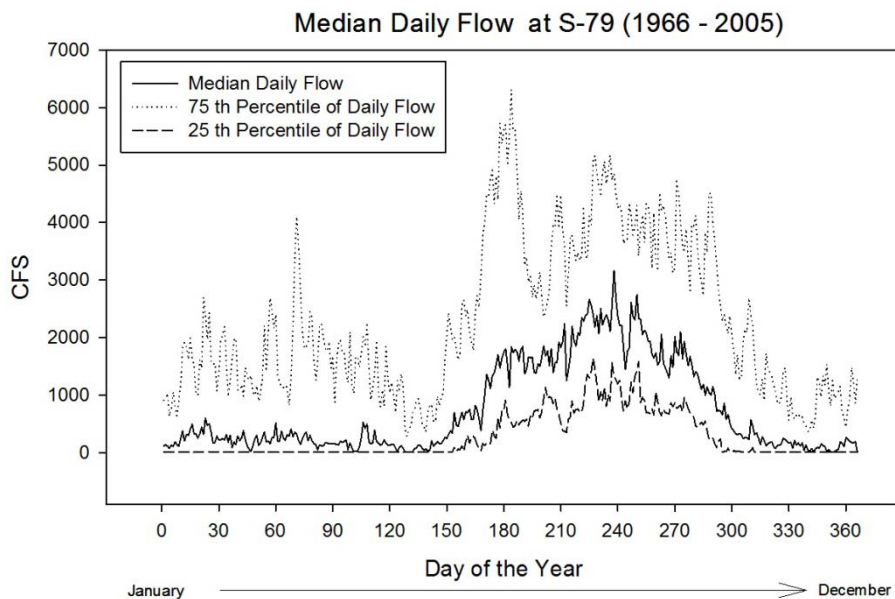
435 The relative contribution of freshwater flows to the downstream estuary from TCB and the S-79  
436 Structure varies from year to year and during the wet and dry seasons. On average, the contribution of  
437 flows from the TCB to the downstream estuary accounts for about 20 percent of the total freshwater  
438 inflows on an annual basis, 23 percent during the wet season and 16 percent during the dry season. The  
439 lower percentage for the dry season than the wet season reflects the unproportional releases from Lake  
440 Okeechobee. Overall, the contribution of freshwater flows to the estuary from the Tidal Caloosahatchee  
441 Basin can be relatively significant in some years.

### 442 **3.2.1 Flows Over the S-79 Structure**

443 Discharge at the S-79 Structure varies by day, month, and year, and is largely driven by variations in  
444 rainfall and flood control releases from Lake Okeechobee to manage lake water levels and provide water  
445 supplies. The fluctuations in Lake Okeechobee releases occur because lake water levels can change  
446 drastically from year to year due to the variable rainfall input from the lake's northern watersheds  
447 (SFWMD, et al. 2009). Annual flows averaged 1,321 Kac-ft/yr, ranging from a low of 216 Kac-ft in 1972  
448 to a high of 3,877 Kac-ft in 2005 (based on measured flow data from 1966 through 2005).

449 Flow records from the period 1966 through 2005 indicate that there is considerable seasonal variation  
450 in median daily flows at the S-79 Structure (**Figure 3-3**). The median daily flow of 1260 cfs during the  
451 wet season was about seven times greater than the median dry season flow of 183 cfs. During June and  
452 September, the wettest months of the wet season, 25 percent of the flows measured on a particular day of  
453 the year may exceed 3700 cfs. During the dry season, 25 percent of the flows measured on a particular  
454 day can be less than 10 cfs.

455 These same records can also be used to illustrate annual variability represented by the inter-quartile  
456 range<sup>3</sup>. During the wet season the inter-quartile range was 2894 cfs or 230 percent of the median flow.  
457 Similarly, the median dry season inter-quartile range was 1240 cfs or 679 percent of the median flow.



458  
459 **Figure 3-3.** Median daily discharge (cfs) at the S-79 Structure for 1966 through 2005.  
460 Also shown are the 25th and 75th percentiles.

### 461 3.2.2 Salinity Downstream of the S-79 Structure

462 Salinity downstream of the S-79 Structure is largely a function of freshwater inflow (e.g., Bierman  
463 1993) and has been measured at several monitoring stations since 1992 (**Figure 3-4**). Variations in  
464 salinity in the estuary reflect the high variability in freshwater inflow at the S-79 Structure and from the  
465 Tidal Caloosahatchee Basin (**Figure 3-1**). **Figures 3-5 to 3-8** show examples of variability in the portions  
466 of the river just downstream of the S-79 Structure, the Route 31 Bridge, the Interstate 75 Bridge, and  
467 Fort Myers for 1992 through 2011. These data reflect both past and current lake operations; current  
468 operations include low-level lake releases to the estuary and adaptive protocols. Additional details  
469 regarding the current lake regulation schedule are included in Section 3.4.

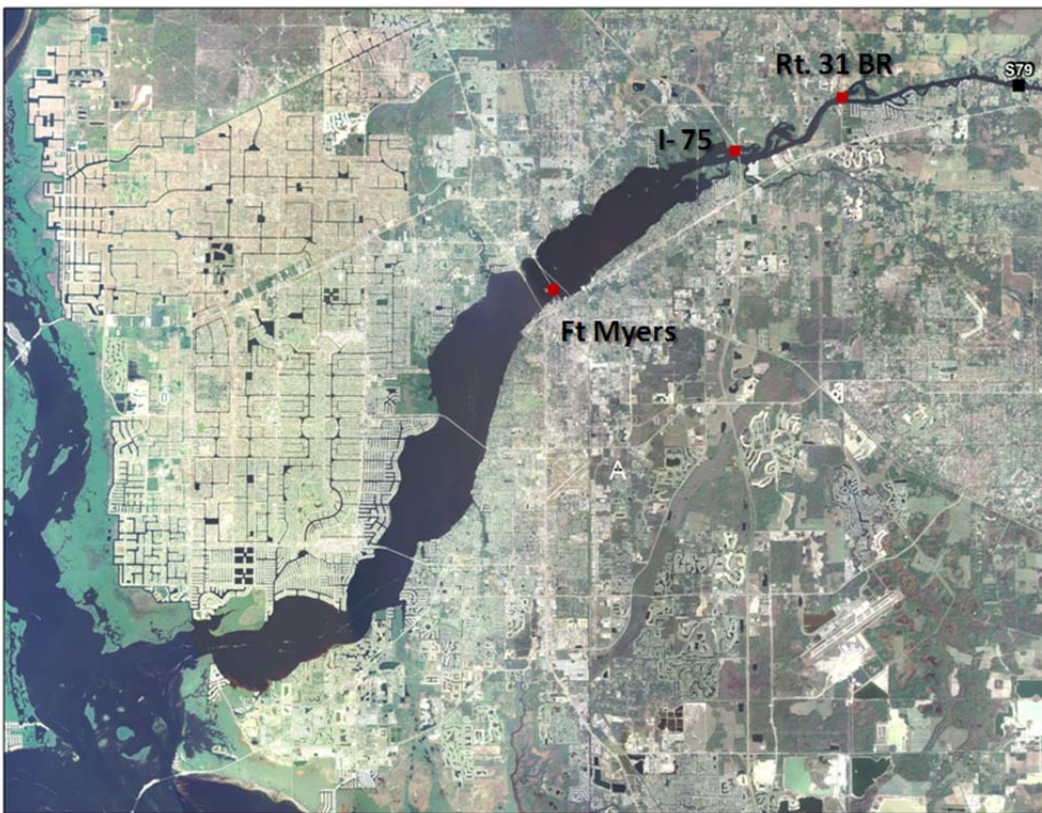
470 Median daily salinity data gathered just downstream of the S-79 Structure over the period 1992–2011  
471 (**Figure 3-5**) indicate that the estuarine salinity gradient is truncated during the dry season of most years  
472 and the extent of this truncation varies from year to year. Salinity data indicate at the end of the dry  
473 season in May (Day 150), there is at least a 10 percent chance that practical salinity will exceed 18 at the  
474 S-79 Structure indicating that 90 percent of the time oligohaline and mesohaline<sup>4</sup> conditions occur within  
475 portions of the estuary. This same pattern occurs further downstream at the Route 31 Bridge (**Figure 3-6**).  
476 Although the period of record is far shorter, the same pattern of salinity intrusion can be seen at the I-75  
477 Bridge (**Figure 3-7**).

478 **Figures 3-5 through 3-8** illustrate a seasonal migration of salt water up the river from Fort Myers to  
479 the S-79 Structure during the dry season. The volume of low salinity water decreases as saltwater

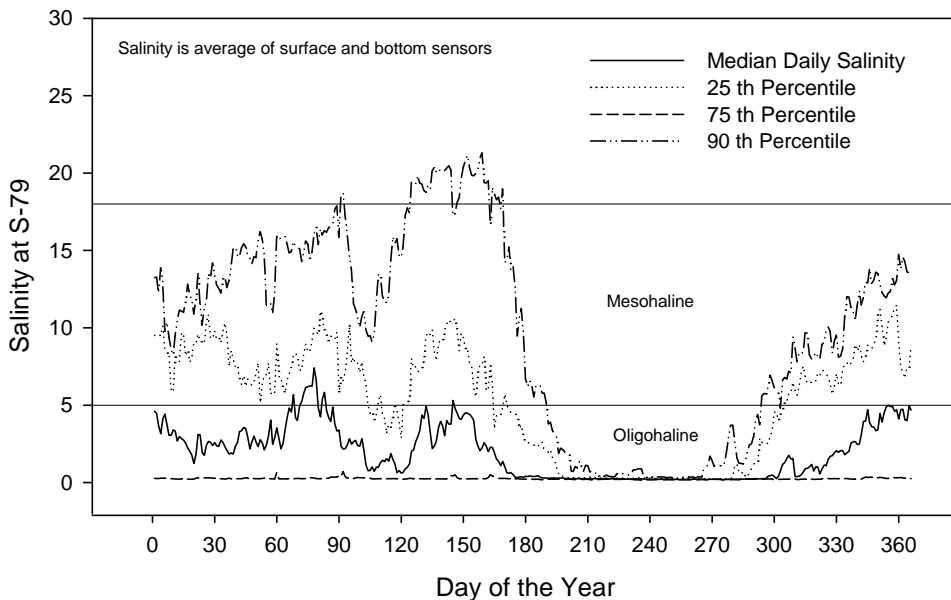
<sup>3</sup> Inter-quartile range represents the difference between the 75<sup>th</sup> and 25<sup>th</sup> percentile.

<sup>4</sup> The Venice System for Classification of Marine Waters defines estuarine conditions by salinity as oligohaline:  $\pm 0.5\text{--}\pm 5$ , mesohaline:  $\pm 5\text{--}\pm 18$ , and polyhaline:  $\pm 18\text{--}\pm 30$  (Anonymous 1958).

480 intrusion proceeds upstream. By the end of the dry season in April and May, there is at least a 25 percent  
 481 chance that the oligohaline zone and at least a 10 percent chance that the mesohaline zone will be absent  
 482 from the estuary.



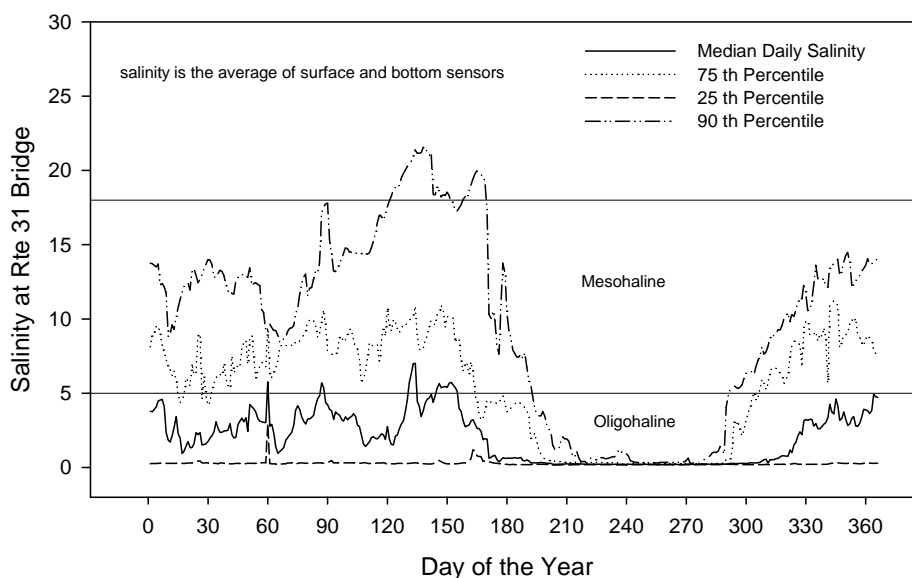
483  
 484 **Figure 3-4.** Location of continuous salinity monitoring stations. Locations shown are the  
 485 S-79 Structure, Rt. 31 Bridge, I-75 Bridge, and the Fort Myers Yacht Basin.



486  
 487 **Figure 3-5.** Median daily salinity just downstream of the S-79 Structure for 1992–2011.

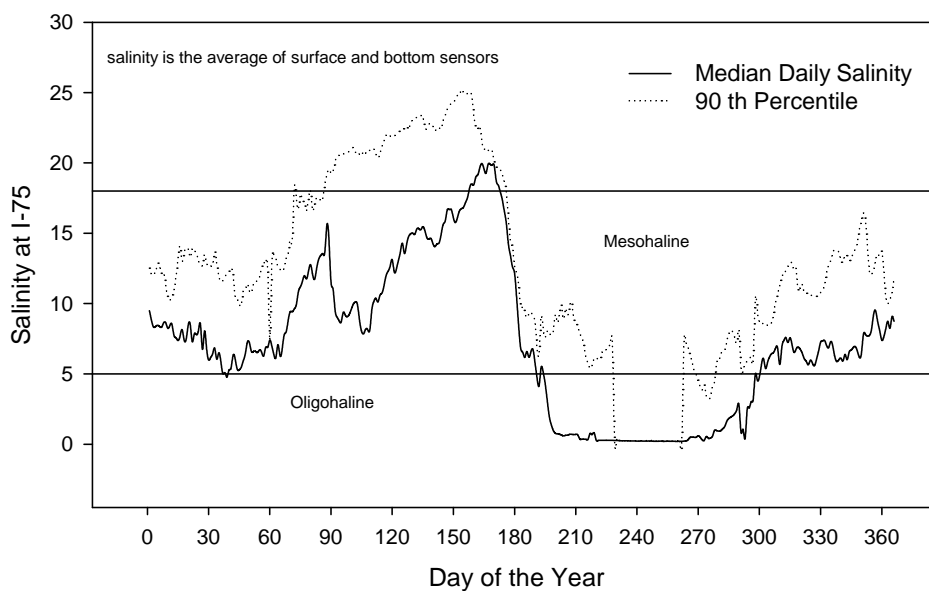
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Also shown are the 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Upper limits of the oligohaline (5) and mesohaline zones (18) are shown for reference.



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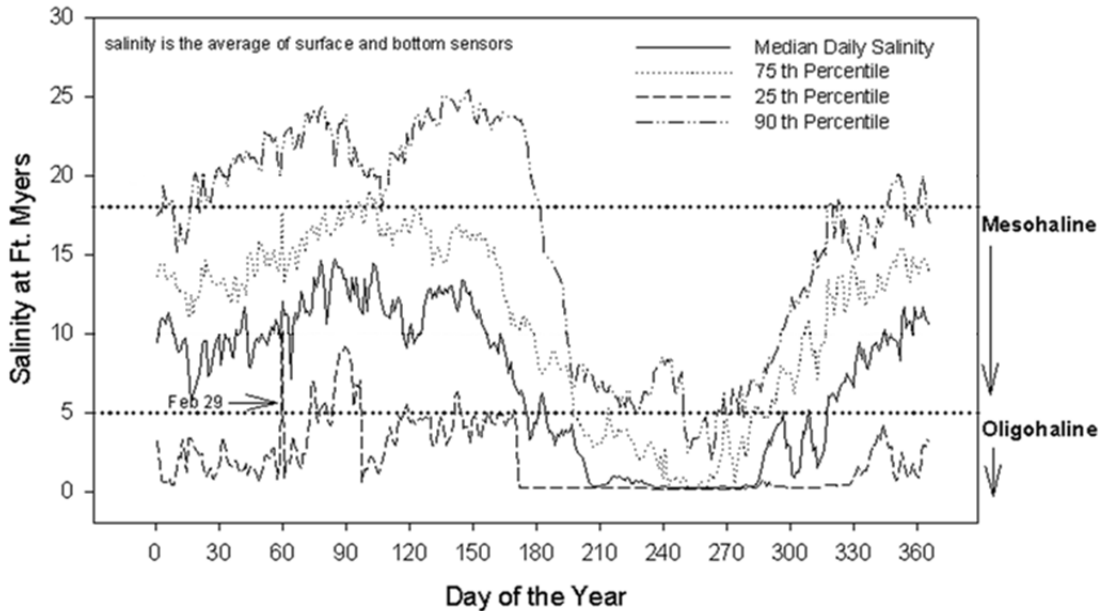
**Figure 3-6.** Median daily salinity at the Route 31 Bridge for 1992–2011. Also shown are the 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Upper limits of the oligohaline (5) and mesohaline zones (18) are shown for reference. Salinity is measured at two depths and values from the two depths were averaged to produce one salinity value for each day in the period of record.



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**Figure 3-7.** Median daily salinity at I-75 Bridge for October 2006–March 2012. Also shown is the 90<sup>th</sup> percentile. Upper limits of the oligohaline (5) and mesohaline zones (18) are shown for reference. Salinity is measured at two depths and values from the two depths were averaged

501 to produce one salinity value for each day in the period of record.  
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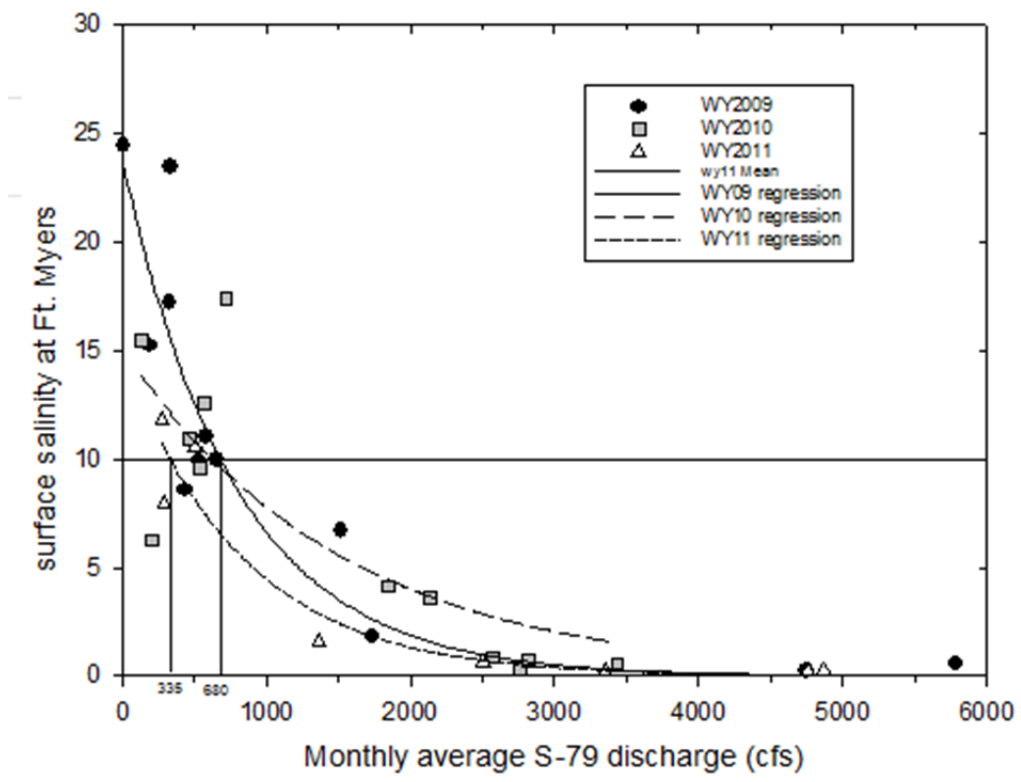


503  
504 **Figure 3-8.** Median daily salinity at the Fort Myers Yacht Basin for 1992–2011.  
505 Also shown are the 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Upper limits of the  
506 oligohaline (5) and mesohaline zones (18) are shown for reference.  
507 Salinity is measured at two depths and values from the two depths were  
508 averaged to produce one salinity value for each day in the period of record.

509  
510 Salinity downstream of the S-79 Structure is dependent upon discharges from the S-79 Structure and  
511 other inflows, including those from the Tidal Caloosahatchee Basin. For this reason, the same discharge at  
512 the S-79 Structure will contribute to different salinities at a particular point in the river in different years.  
513 In other words, the amount of discharge required at the S-79 Structure to produce a particular salinity at a  
514 particular site in the river also varies depending upon the magnitude of other contributing inflows. This  
515 scenario is illustrated in **Figure 3-9** where 335 cfs of freshwater discharges at the S-79 Structure  
516 combined with downstream conditions, were sufficient to achieve a practical salinity of 10 at Ft. Myers in  
517 2011, while 680 cfs achieved the same salinity at the same location in 2009.

518 Average monthly inflow at the S-79 Structure and salinity at Fort Myers were calculated from Water  
519 Years (WY is defined from May 1–April 30) 1993-2013 (C. Buzzelli, SFWMD, personal  
520 communication). The relationship between the two variables was used to estimate the inflow needed to  
521 obtain a salinity of 10 at Ft. Myers for each WY. The predicted amount of freshwater inflow that resulted  
522 in a salinity of 10 ranged from 125-1193 cfs (**Figure 3-10**). This value was below 450 cfs in WY1999  
523 (201 cfs), WY2004 (346 cfs), and WY2011 (125 cfs) and was greatest in WY1997 (657 cfs), WY2008  
524 (1193 cfs), WY2009 (719 cfs), WY2012 (677 cfs), and WY2013 (773 cfs). The amount of freshwater  
525 inflow at S-79 for a salinity of 10 at Fort Myers varies inter-annually. One potential reason for the  
526 variability in flow related to a salinity of 10 is tidal basin inflows that occur downstream of the S-79  
527 Structure. Less inflow years generally follow a wet year, while higher inflow years occur when the  
528 preceding year was dry.  
529

530 The PIR also described the variability of the volumes of water needed to achieve the desired dry  
 531 season salinity targets associated with the protection of fish and wildlife. The PIR flow target identifies  
 532 that approximately 70 percent of the flows at the S-79 Structure are needed to achieve the target (USACE  
 533 and SFWMD, 2010). Under severe dry season conditions, flows of these magnitudes may be insufficient  
 534 to achieve the target salinity in part due to the low volume of flow from the Tidal Caloosahatchee Basin.



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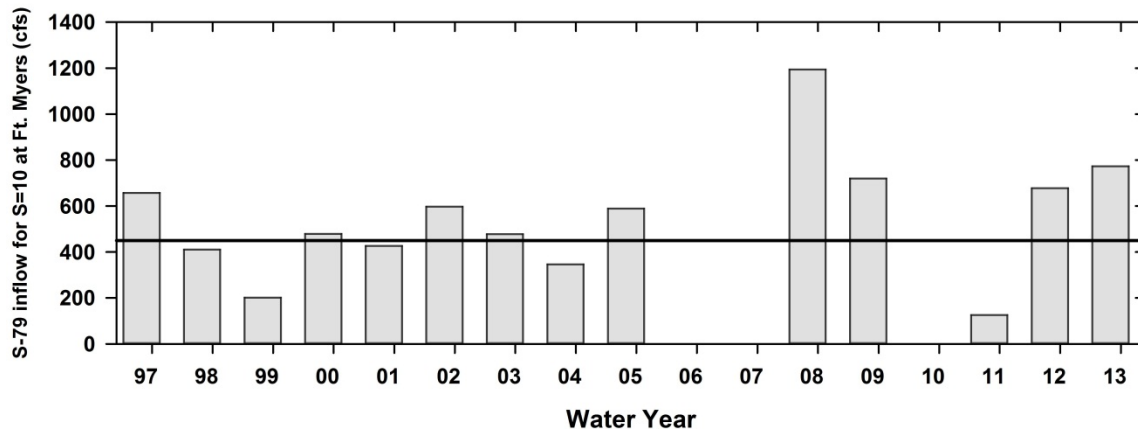
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**Figure 3-9**

**Figure 3-9.** Relationship between mean monthly surface salinity at Ft. Myers and monthly average discharge at the S-79 Structure in three different years. Vertical lines indicate the mean monthly flow required to achieve a salinity of 10 at Ft. Myers in 2009 and 2011.

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542 **Figure 3-10.** Time series of the estimated freshwater inflow at S-79 required to maintain salinity = 10 at  
 543 Ft. Myers (bars). The value could not be predicted for WY2006, 2007, and 2010. WY=water year (May 1  
 544 – April 30).

545 **3.3 C-43 Reservoir Features and Operations**

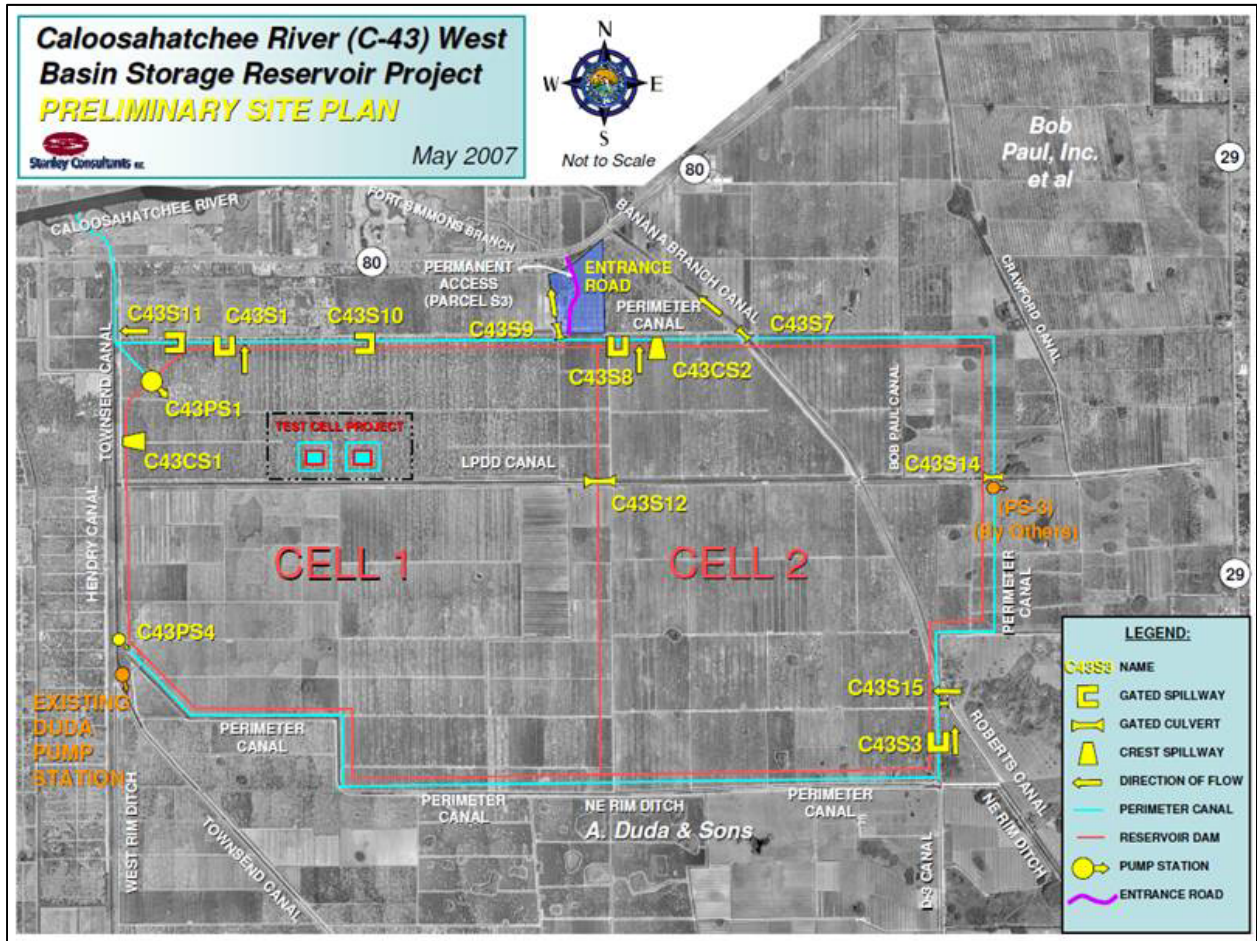
546 The C-43 Reservoir will be located in the West Caloosahatchee Basin in Hendry County, west of  
 547 LaBelle and on the east side of the Townsend Canal (**Figure 3-1**). This aboveground facility will have a  
 548 storage capacity of 170,000 ac-ft with an average depth of 17–19 feet at normal pool. The project  
 549 footprint is 10,700 acres (42 km<sup>2</sup>). Its major features include a two-cell reservoir, soil-bentonite slurry  
 550 walls (cut off walls) within and beneath the external embankments, an internal embankment separating  
 551 the two cells, a pump station with a 1500 cfs capacity, and a perimeter canal. Other features include  
 552 spillways with an emergency overflow, perimeter canal structures, and a pump station with a capacity of  
 553 195 cfs, internal control and discharge (outflow) control structures, and multiple culverts (**Figure 3-11**)  
 554 (see USACE and SFWMD 2010 for more details).

555 The reservoir will be operated to improve conditions in the Caloosahatchee River by reducing flows  
 556 through the S-79 Structure during wet periods and increasing the flows during dry periods. Operations  
 557 will vary by the season, capacity in the reservoir, and salinity downstream of the S-79 Structure. Once the  
 558 reservoir is constructed, a detailed operational plan will be established. After the initial filling of the  
 559 reservoir and operational testing and verification is completed, the operational protocol will continue to  
 560 be a function of conditions within the reservoir, at the S-79 Structure, and in the Caloosahatchee River.  
 561 The reservoir will be filled with surface water from the C-43 Canal. Water will be pumped from the C-43  
 562 Canal via the Townsend Canal into Cell 1 of the reservoir. An internal cell balancing structure in the  
 563 internal embankment will allow water to enter Cell 2. When higher flows are present in the regional  
 564 system and there is capacity in the reservoir, the main pump station will pump water into the reservoir.

565 Discharges from the reservoir will typically occur when flows are needed to maintain a desirable  
 566 salinity range in the estuary. Each cell of the reservoir is designed to discharge independently through  
 567 separate structures. Cell 1 will discharge via the S-1 Structure into the Townsend Canal as shown in  
 568 **Figure 3-11**. Cell 2 will discharge via the S-8 Structure into the perimeter canal. These structures will be  
 569 designed for incremental operation. Water may be released from both reservoir cells by outlet structures  
 570 into the perimeter canal for delivery back to the C-43 Canal via the Townsend Canal and two other direct  
 571 connections (Fort Simmons Branch and Banana Branch Canal). Additional details regarding the  
 572 operational strategy can be found in Annex D of the PIR (USACE and SFWMD 2010).

573 Numeric model simulations conducted at the time of PIR development for analyzing the effect of  
 574 the proposed reservoir on flows at the S-79 Structure were based on a 36-year period of record and the  
 575 Water Supply and Environment (WSE) regulation schedule for Lake Okeechobee, which was in effect  
 576 at the time. Comparing model results from scenarios with and without the C-43 Reservoir shows the  
 577 difference in flows at the S-79 Structure. During the wet season some of the damaging high flows will  
 578 be reduced by storing water in the reservoir and then released during the dry season to improve the  
 579 salinity regime downstream of S-79 Structure to benefit fish and wildlife. (Figure 3-12).

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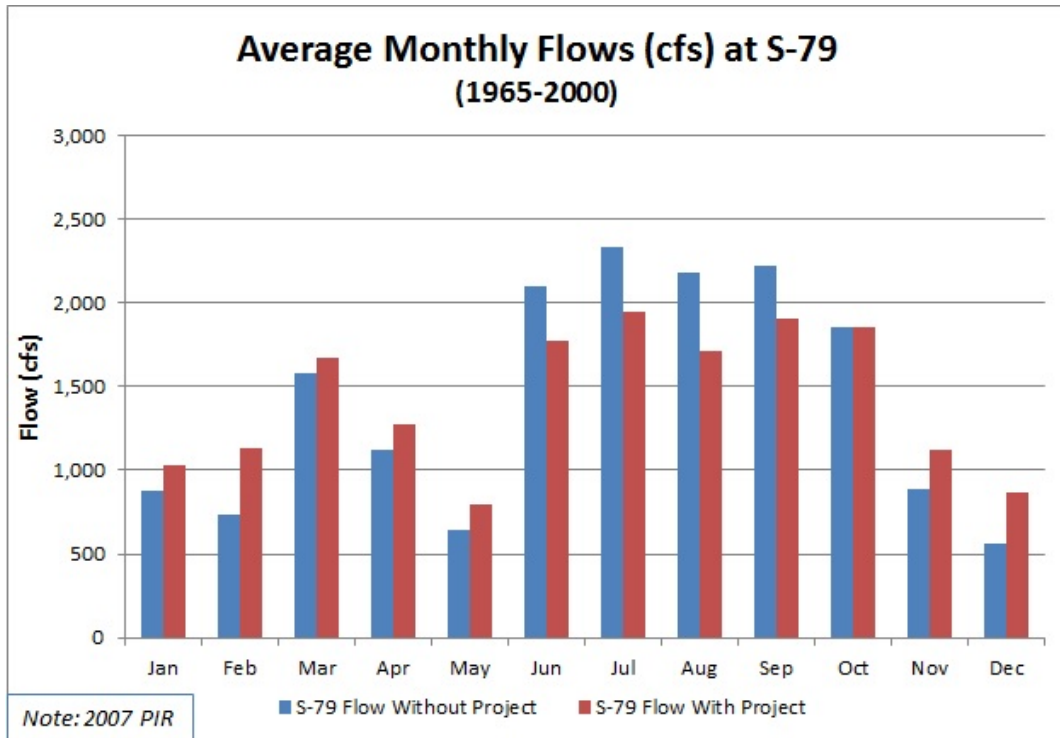


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Figure 3-11. General features of the C-43 Reservoir.



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585 **Figure 3-12.** Average monthly flows (cfs) at the S-79 Structure  
586 with and without the C-43 Reservoir based on the WSE and 36-year period of record.  
587

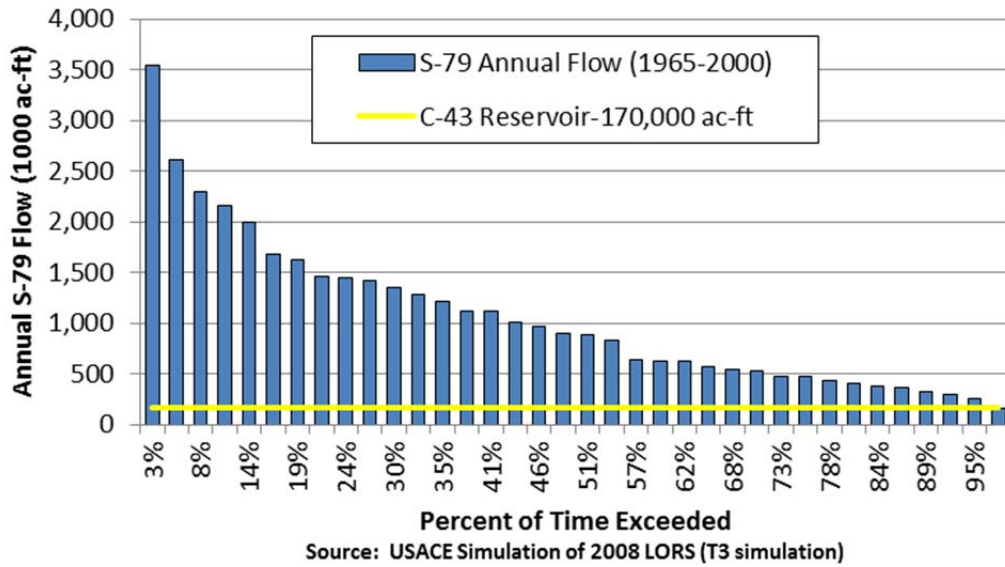
588 **3.4 Potential Effect of LORS 2008 on C-43 Reservoir Performance**

589 The USACE implemented a new regulation schedule in April 2008 for Lake Okeechobee, referred to  
590 as LORS 2008 (USACE, 2007), to protect public health and safety by reducing the lake levels. Since the  
591 PIR was completed before LORS 2008 was approved, its effect on the C-43 Reservoir’s operation and  
592 performance was not analyzed in the PIR. The revised Lake Okeechobee regulation schedule results in  
593 significant changes in the timing and amounts of water discharged from Lake Okeechobee to the  
594 Caloosahatchee River compared to the WSE schedule. In particular, with LORS 2008, low-level releases  
595 from the lake are made to the Caloosahatchee River at lower lake stage elevations than with WSE. These  
596 low-level releases during the dry season are intended to avoid larger releases during wetter periods. The  
597 low-level releases are within the Regulatory Release band and are not an environmental water supply  
598 release as called for in the Beneficial Use band (see USACE 2007 for more information).

599 When studying LORS 2008, the USACE applied the South Florida Water Management Model  
600 (SFWMM) using the 36-year period of record (1965–2000) to understand the effects of lake regulation  
601 schedule changes. The model simulations did not include the C-43 Reservoir. Lake releases to the  
602 Caloosahatchee River (defined as the number of months with a mean monthly flow between 450 and  
603 2800 cfs at the S-79 Structure) increased by 48 percent under LORS 2008. In addition, LORS 2008 was  
604 shown to increase the number of months with a mean flow greater than 450 cfs at the S-79 Structure by  
605 34 percent (USACE 2007). Despite these incremental improvements in flows at the S-79 Structure, the  
606 targets identified in the PIR still remain unmet under LORS 2008 operations without the reservoir  
607 project.

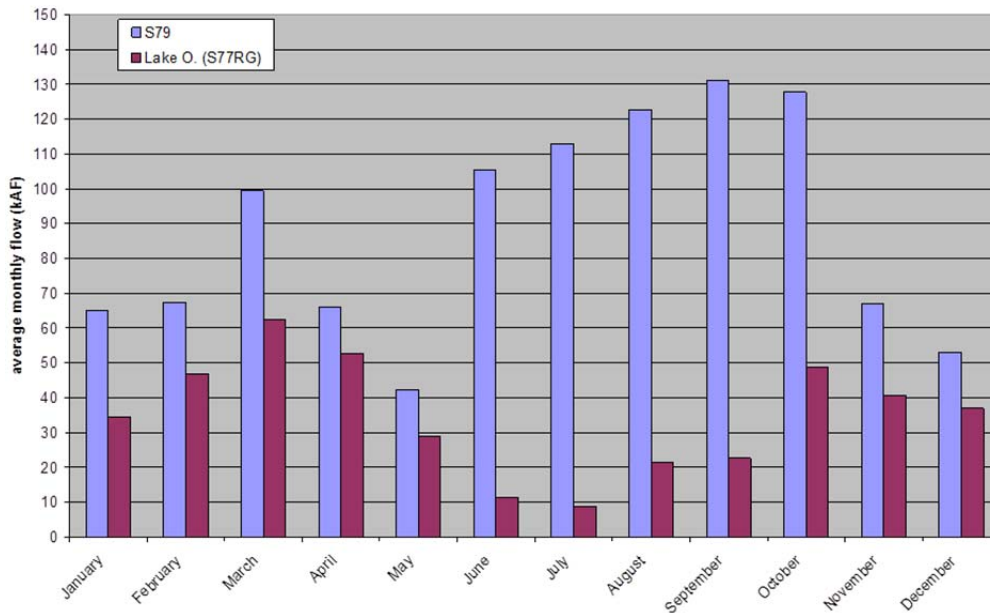
608 A distribution of annual flows at the S-79 structure, simulated under LORS 2008 and projected  
609 against the planned capacity of the reservoir (170,000 ac-ft), is given in **Figure 3-13**. Evaluation of

610 estimated annual flows under LORS 2008 operations shows that sufficient regional water is available to  
 611 fill the reservoir almost every year during the period of record (**Figure 3-13**). The distribution shows that  
 612 95 percent of the time there was regional water sufficient to fill the reservoir. Eighty-four percent of the  
 613 time, there was more than enough water to fill the reservoir at least twice during the year. The estimated  
 614 seasonal distribution of flows at the S-79 Structure (**Figure 3-14**) shows that most of the water during the  
 615 wet season comes from local basin runoff with significantly smaller volumes coming from Lake  
 616 Okeechobee. On average about 38 percent of the annual flows at S-79 Structure will come from Lake  
 617 Okeechobee and 62 percent will originate from the upstream basins. The volume of water released from  
 618 Lake Okeechobee increases toward the end of the wet season reflecting regulatory flood control releases.



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**Figure 3-13.** Annual distribution of flows at the S-79 Structure under LORS 2008.



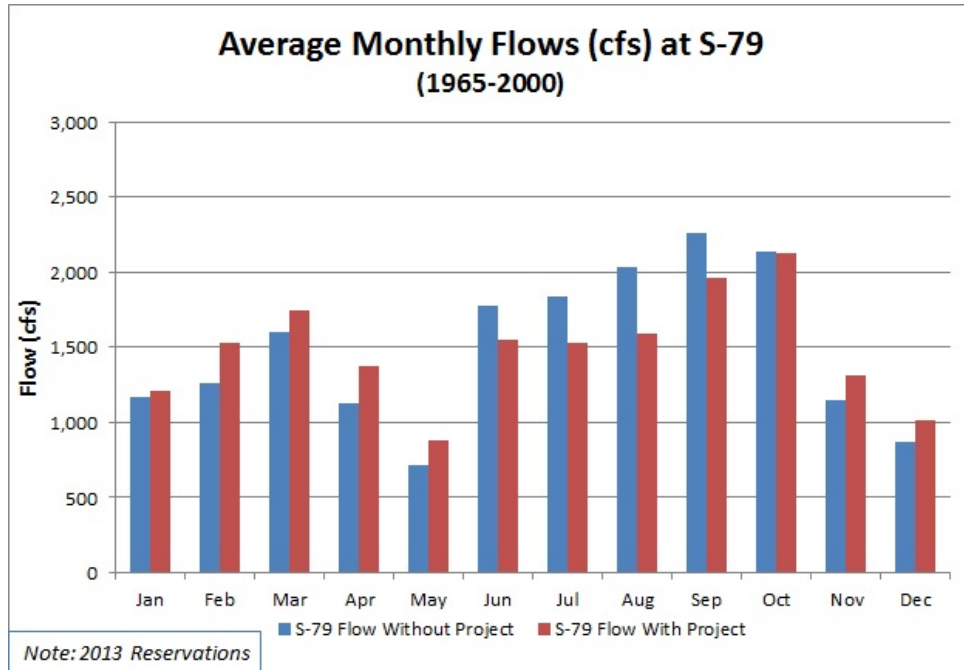
**Figure 3-14.** Average monthly flows at the S-79 Structure based on LORS 2008 (1965 – 2000).

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625 The numeric model used in the PIR to simulate reservoir operations was updated to use the 36-year  
 626 period of record (1965–2000) and the SFWMM time series using LORS 2008 for Lake Okeechobee  
 627 releases applied. Comparison of monthly average flows with and without the reservoir shows that the  
 628 reservoir can capture portions of the wet season flows and then release the water primarily in the dry  
 629 season at the S–79 Structure under LORS 2008 (**Figure 3-15**). With LORS 2008 there will be more  
 630 surface water available from the lake to the Caloosahatchee River and the C-43 Reservoir during  
 631 periods when lake stages range between 12.5 and 14.5 ft NGVD (baseflow band of LORS 2008) than  
 632 was identified in the PIR (**Figure 3-12**). This additional water effectively increases the estimated  
 633 number of days when water will be available to be captured and stored in the reservoir and reduces the  
 634 number of days when low flows occur at the S-79 Structure. The net effect is that in some years, the  
 635 combined flows at the S-79 Structure will be greater under LORS 2008 operations than originally  
 636 estimated in the PIR under WSE operations. However, despite releasing all water contained in the  
 637 reservoir to the Caloosahatchee River for the benefit of fish and wildlife, the targets identified in the  
 638 PIR still remain unmet under LORS 2008.

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**Figure 3-15.** Average monthly flows with and without the C-43 Reservoir at the S-79 Structure with LORS 2008 for the 36-year period of record (see **Figure 3-12** for flows during the 36-year period of record as simulated for the PIR).

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All water captured in the C-43 Reservoir will be released to improve salinity in the Caloosahatchee River. The PIR concluded, “To achieve the project purpose, all water made available by the project is for the natural system to attain the benefits of the project” (USACE and SFWMD 2010). The analyses provided in the PIR using the WSE regulation schedule and the analysis presented here using the LORS 2008 regulation schedule for the same 36 year period of record (1965-2000) (USACE 2007) both confirm the intent of the PIR: All of the surface water contained within and released from the C-43 Reservoir is needed to improve conditions downstream of the S-79 Structure for the benefit of fish and wildlife.

## Section 4. Ecology of the River and Identified Improvements

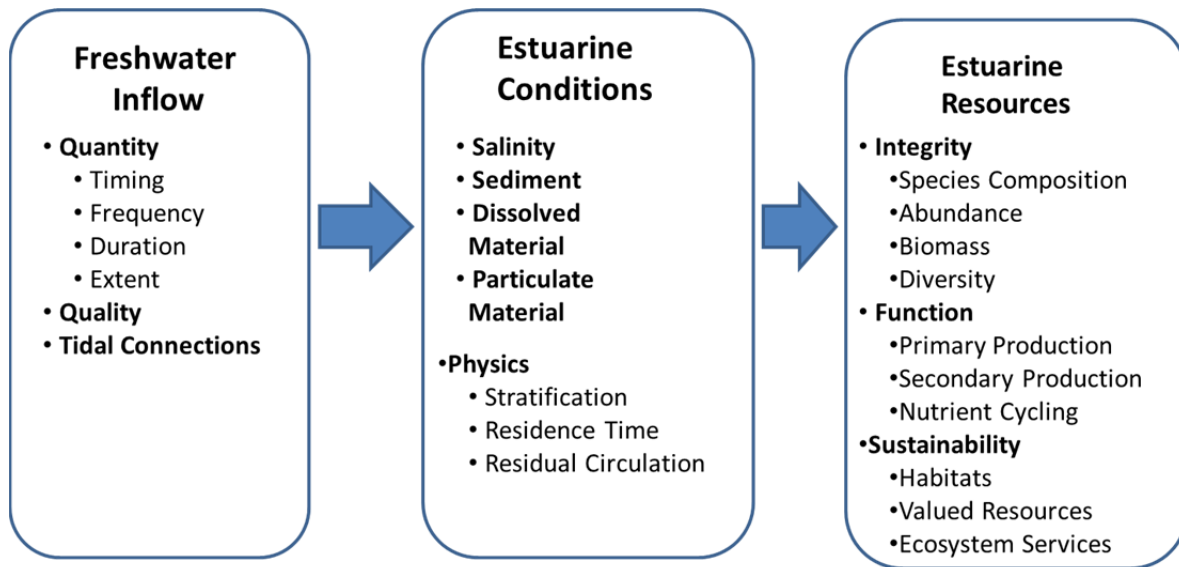
### 4.1 Freshwater and Estuaries

656 Estuaries comprise a transition zone where freshwater runoff from the land mixes with salt water  
657 from the sea. Freshwater inflow is not only a defining characteristic of an estuary, but it also influences  
658 biological structure (species composition, abundance, and distribution of flora and fauna) and ecosystem  
659 function. The latter includes creation and maintenance of a low salinity (0.5–17) nursery zone  
660 (Wasserman and Strydom 2011), the transport of sediments to coastal marshes (Stickney 1984), and the  
661 supply of nutrients to support estuarine productivity (Nixon 1981, Gillson 2011).

662 Estuaries are characterized by high primary and secondary productivity (Nixon et al. 1986, Nixon  
663 1988). It is generally agreed that freshwater inflows contribute significantly to this production (Fisher et  
664 al. 1988, Day et al. 1989, Montagna and Kalke 1992). This productivity is attributed in part to the  
665 nutrients carried to estuaries by freshwater inflows, with higher freshwater inflows generally leading to  
666 higher yields of desirable species. Freshwater inflows stabilize the water column and carry nutrients that  
667 stimulate phytoplankton and zooplankton, enhancing the recruitment, growth, and survival of fish and  
668 invertebrates (Fisher et al. 1988, Quinones and Montes 2001, Hoffman et al. 2007, Kostecki et al. 2010).

669 Studies have shown that the low salinity zones of estuaries (practical salinity of 0.5–17) are utilized  
670 by larvae and juveniles of estuarine-dependent faunal species (Wasserman and Strydom 2012, Day et al.  
671 1989) and flora. Some fauna require a low salinity zone to complete their development. For example,  
672 larvae of the inland silverside fish do not survive past the yolk-sac stage with a salinity of 17 but show no  
673 adverse effects with a salinity of 8 (Patillo et al. 1995). In general, however, estuaries are thought to be  
674 good nurseries because they provide an increased food supply, shelter, and lower predatory pressure.

675 There is an abundant literature describing the effects of altered freshwater inflows on estuarine  
676 systems (see reviews by Drinkwater and Frank 1994, Sklar and Browder 1998, Gillanders and Kingsford  
677 2002). Evidence supports the hypothesis that maintaining freshwater inflows and their natural variability  
678 is a key component of maintaining the ecological structure and function of an estuary (Estevez 2002).  
679 **Figure 4-1** presents a conceptual framework for evaluating the effects of freshwater inflow on estuaries  
680 (after Alber 2002 and Palmer et al. 2011). It is based on the proposition that freshwater inflow (quantity,  
681 quality, and timing) influences estuarine conditions (salinity, nutrient concentrations, etc.), and that these  
682 conditions in turn affect different resources (species, communities) or processes (productivity, nutrient  
683 cycling) in the estuarine ecosystem.



684

685

**Figure 4-1.** Conceptual model of the effects of freshwater inflow on estuaries.

686

687 The effects of freshwater inflow on an estuary are largely indirect and mediated through direct effects  
 688 on chemical and physical conditions. The freshwater-influenced estuarine condition considered to be most  
 689 strongly associated with the distribution and abundance of estuarine biota is salinity (Emery et al. 1957,  
 690 Gunter 1961, Kinne 1966, Remane and Schlieper 1971, Bulger et al. 1993, Whitfield et al. 2012). The  
 691 mechanisms underlying this correlation may be physiological, related to tolerance or specific  
 692 requirements for development (Bulger et al. 1993, Patillo et al. 1995), as well as ecological, related to  
 693 refugia from predation, food supply, or preferred habitat (Day et al. 1989, Peterson 2003). Whatever the  
 694 mechanism, the end result is that few estuarine organisms are found along the entire salinity gradient (0–  
 695 35). Typically, organisms are found only within certain salinity ranges along the gradient (Bulger et  
 696 al. 1993).

#### 697 **4.2 Environmental Problems in the Caloosahatchee River**

698 Many of the ecological problems in the target area downstream of the S-79 Structure stem from  
 699 widely fluctuating salinity resulting from high seasonal and inter-annual variation in discharge that occurs  
 700 at the Franklin Lock and Dam (S-79 Structure) combined with the channelization of the river. During the  
 701 wet season, runoff from the basins upstream of the S-79 Structure, supplemented by regulatory discharges  
 702 from Lake Okeechobee, drastically reduce salinity levels over most of the estuary, darken the water  
 703 restricting depth of light penetration, and disrupt nutrient balance and assimilation capabilities. In turn,  
 704 during dry periods, freshwater inflow can be so low that salt water migrates up to the S-79 Structure,  
 705 truncating the salinity gradient within the estuarine portion of the river. The PIR identified several  
 706 ecological problems arising from this high variance in freshwater inflow:

- 707 • Extreme changes in salinity
- 708 • Loss of freshwater and marine SAV due to salinity downstream of the S-79 Structure
- 709 • Truncation of the estuarine extent and function due to the physical constraint of the S-79  
 710 Structure (it effectively blocks tidal flows upstream of that point)
- 711 • Reduction of oyster reefs and adult blue crab habitat in the lower estuarine portions of the  
 712 river due to low salinity conditions

713 The PIR summarizes the scientific work that chronicles the deleterious ecological effects of extremes  
 714 in freshwater inflow to the Caloosahatchee River. Effects of high discharges were acknowledged even

715 before the S-79 Structure was built (University of Miami 1954, Phillips and Springer 1960, Gunter and  
716 Hall 1962). Subsequent research conducted by the SFWMD focused on the impacts of both high and low  
717 discharges on environmental factors such as salinity and a suite of estuarine indicator organisms including  
718 oysters, SAV, and other general biotic indicators such as plankton and benthic invertebrates (Chamberlain  
719 and Doering 1998a, Doering et al. 2002, Volety et al. 2009). This research confirmed that high discharges  
720 can lower salinity at the seaward end of the river to levels low enough to cause mortality of organisms  
721 that cannot escape (e.g., oysters, seagrass). Conversely, the lack of freshwater discharge allows salinity to  
722 increase downstream of the S-79 Structure to levels high enough to cause mortality to brackish water  
723 organisms (e.g., tape grass). Furthermore, this research has documented truncation of the salinity gradient  
724 at the S-79 Structure and the loss of the low salinity zone utilized as a nursery by many estuarine and  
725 estuarine-dependent species (USACE and SFWMD 2010).

726 Research conducted since the PIR was completed has been summarized in the *Caloosahatchee River*  
727 *Watershed Protection Plan* (SFWMD et al. 2009) and the *Caloosahatchee River Watershed Protection*  
728 *Plan Update* (Balci and Bertolotti 2012). While providing new information and allowing a greater  
729 understanding of ecological problems in the Caloosahatchee River, results of these studies are in  
730 agreement with previous research. For example, a recent investigation by Tolley et al. (2010) focused on  
731 the relationship between freshwater inflow at the S-79 Structure and the geographic position of the  
732 density maxima (center of abundance) of larval fish and their prey in the downstream tidal portions of the  
733 river. At very low flows during the dry season, some species, notably juvenile bay anchovies and their  
734 mysid prey, became impinged on the S-79 Structure and are thus prevented from moving further  
735 upstream. These and other species became concentrated in the narrow portion of the river just  
736 downstream of the structure resulting in habitat compression and increased exposure to predation by  
737 jellyfish. The Tolley et al. (2010) study verified results of a SFWMD study conducted in the 1980s  
738 (SFWMD 2003): utilization of the tidally influenced portion of the river by larval fish was highest in the  
739 March–June period. These observations underscore the need for fresh water to provide a low salinity  
740 nursery zone during the dry season.

741 In contrast to some previously official opinions (USFWS 1957), the river and estuary are now  
742 considered valuable fisheries resources. Recent research and field studies have documented the use of the  
743 river and estuary as nursery habitat for several species of fish and invertebrates (Hunt and Doering 2013).  
744 These include blue crabs (*Callinectes sapidus*), the endangered bull shark (*Carcharhinus leucas*)  
745 (Simpfendorfer et al. 2005, Heupel and Simpfendorfer 2008, Ortega et al. 2009, Heupel et al. 2010), and  
746 the smalltooth sawfish (*Pristis pectinata*) (Simpfendorfer et al. 2008, Simpfendorfer et al. 2011). Portions  
747 of the Caloosahatchee River were designated as critical habitat for the smalltooth sawfish (NMFS 2009).  
748 In addition, the National Marine Fisheries (NMFS) website lists the Caloosahatchee River as essential  
749 habitat for juvenile brown shrimp (*Penaeus aztecus*), juvenile gray snapper (*Lutjanus griseus*), juvenile  
750 pink shrimp (*Penaeus duorarum*), adult and juvenile red drum (*Sciaenopsis ocellatus*), adult and juvenile  
751 Spanish mackerel (*Scomberomorus maculatus*), and juvenile stone crab (*Menippe mercenaria*) (USACE  
752 and SFWMD 2010).

753 Research conducted both before and after the PIR leads to the same conclusions: freshwater  
754 discharges during the wet season are too high and discharges during the dry season are too low. As the  
755 PIR concludes, “The estuary will remain at risk as long as the quantity and timing of freshwater flows  
756 into the estuary remains unchanged” (USACE and SFWMD 2010). A combination of reduced flows  
757 during the wet season and higher inflows during the dry season is necessary to protect fish and wildlife  
758 habitats in the estuarine portions of the Caloosahatchee River.

759 The PIR (USACE and SFWMD 2010) recognizes that this high variance in discharge results from  
760 a lack of storage in the regional water management system and proposes an aboveground reservoir as  
761 a solution:

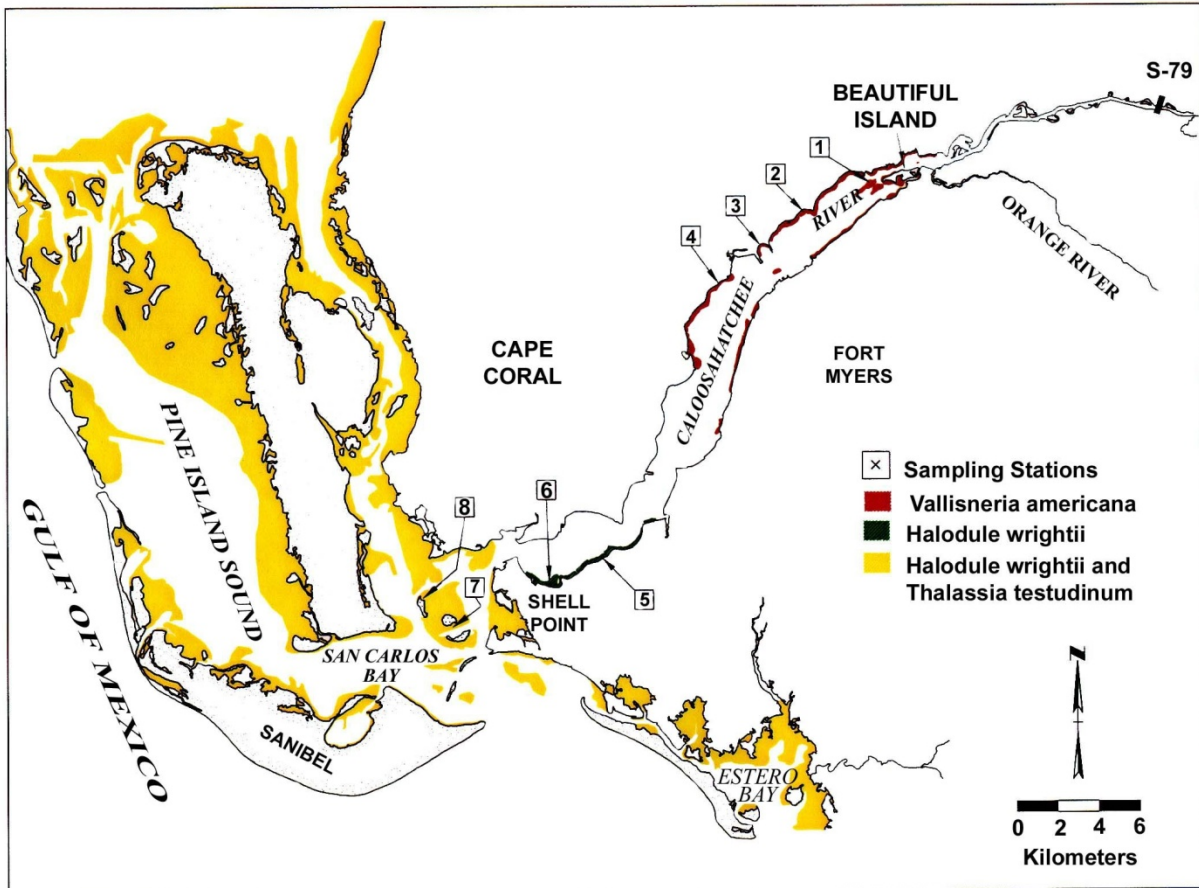
762 To restore ecological function and productivity in the Caloosahatchee Estuary, CERP,  
763 approved by Congress in the WRDA 2000 (US Congress 2000), included an above-  
764 ground reservoir along the Caloosahatchee River to capture and store basin runoff and  
765 excess freshwater released from Lake Okeechobee. By capturing this excess water the  
766 reservoir can also serve as a source of environmental water supply to the estuary during  
767 dry periods. The need for additional storage to restore, protect and preserve the  
768 Caloosahatchee Estuary, including Federal trust lands and other publically owned and  
769 managed areas in and around the Caloosahatchee Estuary has also been validated by  
770 other planning efforts, including the Caloosahatchee Water Management Plan (2000) and  
771 Lower West Coast Water Supply Plan (2005–2006) prepared by the SFWMD.

### 772 **4.3 Aquatic Habitat and Improvements Identified in the PIR**

773 To evaluate the water made available by the C-43 Reservoir, the PIR focused on existing habitat-  
774 forming species found throughout the length of the river downstream of the S-79 Structure: tape grass,  
775 *Vallisneria americana*, in the upper low salinity (oligohaline) region of the river; eastern oysters,  
776 *Crassostrea virginica*, in the lower mesohaline region of the river, and seagrasses (turtle grass, *Thalassia*  
777 *testudinum*, and shoal grass, *Halodule wrightii*) in the more marine portion of the system in San  
778 Carlos Bay.

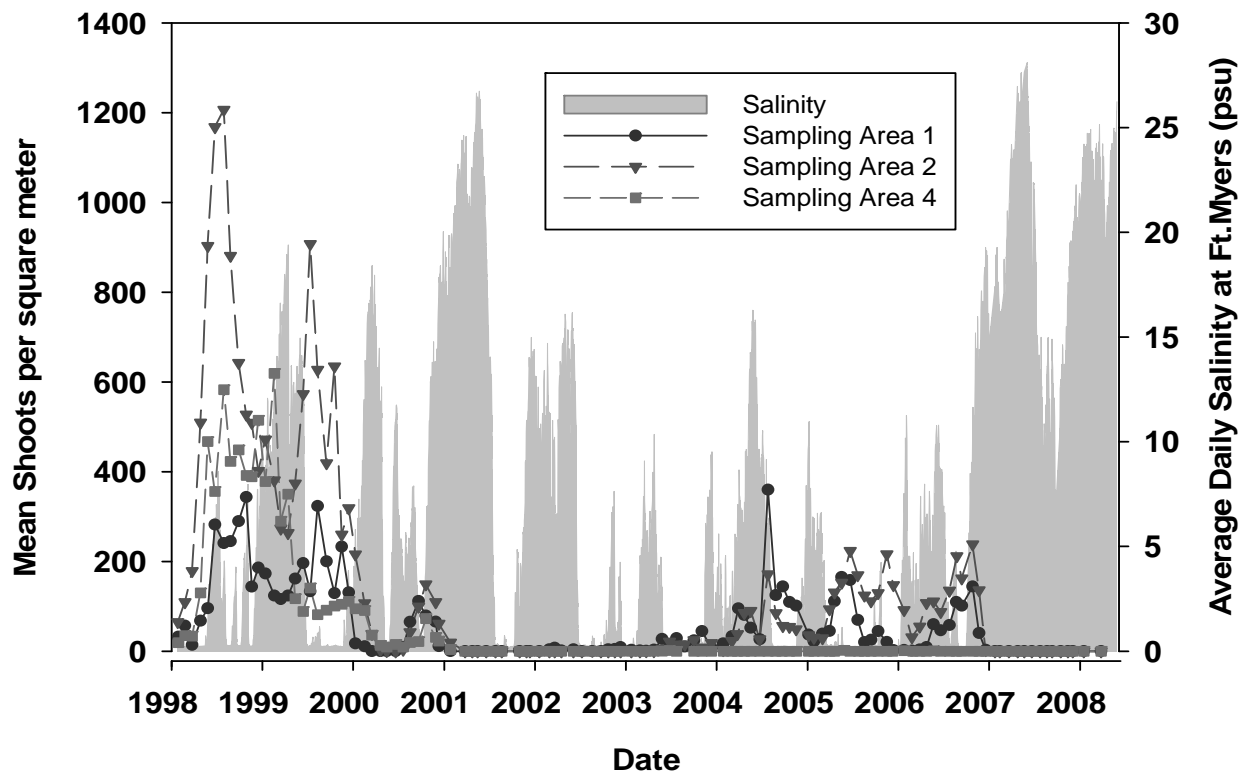
779 SAV beds are important to the ecology of shallow estuarine and marine environments. SAV provides  
780 habitat for many benthic and pelagic organisms, functions as nurseries for juveniles and other early life  
781 stages, stabilizes sediments, improves water quality, and forms the basis of a detrital food web (Kemp et  
782 al. 1984, Fonseca and Fisher 1986, Carter et al. 1988, Killgore et al. 1989, Lubbers et al. 1990). Because  
783 of the importance of SAV beds, estuarine restoration initiatives often focus on SAV (Batiuk et al. 1992,  
784 Johansson and Greening 2000, Virnstein and Morris 2000). SAV are commonly monitored to gauge the  
785 health of estuarine systems (Tomasko et al. 1996) and their environmental requirements can form the  
786 basis for water quality goals (Dennison et al. 1993, Stevenson et al. 1993). Although there are species-  
787 specific variations, SAV distributions in coastal areas are limited by four environmental factors: light,  
788 salinity, temperature, and nutrients (Dennison et al. 1993, Kemp et al. 2004).

789 Downstream of the S-79 Structure, the spatial distribution of SAV along the longitudinal axis of the  
790 estuary reflects their salinity tolerances (**Figure 4-2**). Sparse beds of the marine seagrass *Halodule*  
791 *wrightii* (shoal grass) extend up from San Carlos Bay almost to the Cape Coral Bridge (Hoffacker et al.  
792 1994, Chamberlain and Doering 1998b) and are restricted to the shoreline margins. Downstream of Shell  
793 Point, *Halodule* forms mixed beds with *Thalassia testudinum* and other less common species in San  
794 Carlos Bay and Pine Island Sound.  
795



796  
797 **Figure 4-2.** Historic distributions of *Vallisneria americana* and *Halodule wrightii*  
798 in the Caloosahatchee River (Hoffacker et al. 1994).  
799

800 The tape grass, *Vallisneria americana*, is an important upper estuarine SAV species (**Figure 4-2**) and  
801 is sensitive to saltwater intrusion. It is therefore a good indicator of the effects of varying freshwater  
802 inflow to the river, especially during periods of low flow in the dry season. When present, this species is  
803 located near the shoreline in the upper portions of the river to a depth of about 1.0 m. Tape grass is a salt-  
804 tolerant freshwater angiosperm that provides important nursery habitat for blue crabs, white shrimp, and  
805 other species in the oligohaline zone (see Rozas and Minello 2006). Downstream of the S-79 Structure, its  
806 greatest coverage occurs from Beautiful Island to the Ft. Myers Bridges (15 to 20 miles [24 to 32 km]  
807 upstream of Shell Point, Hoffacker et al. 1994, Chamberlain and Doering 1998b). In this portion of the  
808 river, salinity during the dry season routinely exceeds the accepted threshold of 10 for a sustainable  
809 population. Saltwater migration during the dry season is of sufficient magnitude to routinely cause  
810 mortality of tape grass in the upper river (Doering et al. 2001, **Figure 4-3**). Hunt and Doering (2005)  
811 examined the effects of salinity relative to other environmental drivers (light and temperature) using a  
812 numerical model and showed that in some years salinity intrusion in the upper portions of the river  
813 (downstream of the S-79 Structure) was a major driver of tapegrass decline. Supplemental flows at the S-  
814 79 Structure during the dry season would help alleviate mortality due to salinity intrusion.



815  
 816 **Figure 4-3.** *Vallisneria americana* downstream of the S-79 Structure (sampling areas  
 817 correspond to **Figure 4-2**). The years 1999–2001 and 2007–2008 were characterized  
 818 by drought conditions with daily dry season salinities in excess of 20.

819  
 820 Reefs formed by the eastern oyster are a prominent feature of estuarine landscapes in Florida (Barnes  
 821 et al. 2007) and historically were abundant in the Caloosahatchee River’s estuary (Sackett 1888). Oyster  
 822 reefs are important because they filter water, which can enhance water clarity, remove nutrients, protect  
 823 shorelines, and provide essential fish habitat (Coen et al. 1999, Wall et al. 2008, Beck et al. 2009).  
 824 Existing oyster reef habitat in the estuary has been estimated to cover approximately 18 acres (0.07 km<sup>2</sup>)  
 825 based on a survey conducted in 2004 (**Figure 4-4**, RECOVER 2007) and is much reduced relative to the  
 826 historical distribution (Sackett 1888). While oyster reef habitat in the Caloosahatchee is centered around  
 827 Shell Point, clumps of oysters may be found up to the Cape Coral Bridge (about 6 miles [10 km]  
 828 upstream of Shell Point, SFWMD 2003).

829



830  
831 **Figure 4-4.** Oyster reefs (in yellow) in the Caloosahatchee River in 2004 (RECOVER 2007).  
832

833 **4.4 Reservoir Freshwater Releases and Ecological Improvements**

834 The PIR assessed potential ecological improvements from operation of the C-43 Reservoir using  
835 Habitat Suitability Index models. Habitat Suitability Index models are typically driven by environmental  
836 variables such as temperature and salinity and measure how conducive conditions are for the survival and  
837 growth of the target species. The target species included in this analysis were the tape grass *V. americana*,  
838 oysters, and the seagrasses, *Halodule wrightii* and *Thalassia testudinum*. Enhanced conditions for these  
839 species in the Caloosahatchee River will also benefit resident fish and other wildlife. To achieve the  
840 habitat improvement shown in the PIR, all the water that the project made available was assumed to flow  
841 to the Caloosahatchee River downstream of the S-79 Structure. The analysis showed that construction and  
842 operation of the reservoir will improve conditions for fish and wildlife by improving conditions for their  
843 habitat. As described in the PIR, “Fish and wildlife habitat benefits of the Caloosahatchee River (C-43)  
844 West Basin Storage Reservoir project includes improving the timing of water deliveries to the estuary  
845 thereby providing a salinity range suitable for a healthy ecosystem and reestablishment of natural

846 hydropatterns within existing natural areas, improvement in seagrass beds in the estuary, and increase  
847 habitat for the eastern oyster, blue crab, and other fish and marine organisms” (USACE and  
848 SFWMD 2010).

849



851

## Section 5. Identification of Water to be Reserved

852 A component of establishing a water reservation pursuant to Chapter 373.223(4) F.S., is the  
853 identification of locations and seasonal quantities of water, which in the judgment of the District, may be  
854 required for the protection of fish and wildlife or the public health and safety. Rules which withhold such  
855 waters from allocation are drafted when there is a reasonable expectation that demands for waters from  
856 the identified sources will occur at a time of year and in an amount, singularly or cumulatively, to reduce  
857 the availability of water needed for the protection of fish and wildlife. This section identifies the water  
858 associated with the C-43 reservoir project which is needed for the protection of fish and wildlife.

859 The scope of this reservation rulemaking is the protection of water stored in and discharged from the  
860 C-43 Reservoir from allocation to consumptive use withdrawals. As described earlier, protection of  
861 project waters under state regulatory authority is a prerequisite of a Project Partnership Agreement which  
862 in turn, is needed for authorization and appropriations of a CERP project component. State regulatory  
863 rules allow for reservations to be adopted prospectively for water anticipated to be made available from a  
864 project to be constructed in the future. The water to be reserved prospectively for the C-43 West Basin  
865 Storage Reservoir shall be consistent with the fish and wildlife benefits outlined in the Project  
866 Implementation Report (PIR).

867  
868 Details regarding the volumes and timing of water needs for the protection of fish and wildlife that  
869 occur within the Caloosahatchee River downstream of S-79 as identified for the C-43 Reservoir project  
870 can be found in Volume 3; Annex C of the Caloosahatchee River (C-43) West Basin Storage Reservoir  
871 Project Implementation Report and Environmental Impact Statement Final, November 2010 (PIR). The  
872 PIR is a project scoping and alternative evaluation level document in which project alternatives are  
873 formulated and evaluated against a defined set of performance measured to identify a final preferred  
874 option. Final design, construction and operations are determined after the Project Partnership Agreement  
875 is executed and funding appropriations are made.

876  
877 A component of the PIR is the identification of water made available for the natural system and other  
878 water related needs of the Caloosahatchee River. Section 8.5.3.1 of the main report identifies that: “To  
879 achieve the project purpose, all water made available by the project is for the natural system to attain the  
880 benefits of the project. Therefore, there will be no water made available for other water-related needs of  
881 the region by the project.” The benefits identified in the Appendix C of the PIR assumed that all of the  
882 surface water discharged from the C-43 reservoir is required to provide 12,809 average annual habitat  
883 units (HU) to the estuary downstream of the S-79 Structure. The PIR went on to quantify the water made  
884 available by the project based on assumptions associated with reservoir operations and spreadsheet  
885 analysis (section C.2.1.2 of Volume 3; Annex C) and a hydrologic performance indicator for the natural  
886 system related to beneficial flows at the S-79 Structure.

887  
888 This quantification, in the form of a volume probability distribution, is presented in section C.3.2.3 of  
889 Volume 3; Annex C, with annual volumes identified at the 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> percentiles of 159,485,  
890 105,990 and 27,619 ac-ft/year.

891  
892 Defining the water reservation using the volume probability distributions contained in the PIR has  
893 potential drawbacks due to changes in operations and assumptions which have occurred since the  
894 completion of the evaluations conducted in the PIR as described in Section 3. Based on these changes, it  
895 is possible that the volume probability curves identified under estimate the amounts of water that will be  
896 available in the C-43 reservoir and needed to meet the project salinity target identified in the PIR. As a  
897 result, basing the water reservation on the volume probability curve presented in the PIR may have the  
898 unintended consequence of protecting less water than may be available for restoration of the natural  
899 system. Therefore, staff recommends all C-43 reservoir project water should be reserved from allocation

900 for the protection of fish and wildlife rather than the specific volumes identified in the PIR. It is  
901 recognized that once constructed, the volume of water flowing from Lake Okeechobee and the upstream  
902 basins along with the operations of the reservoir will be refined. At that time it would be prudent to revisit  
903 the availability of the ‘as built’ project water to determine if this reservation needs to be updated.  
904

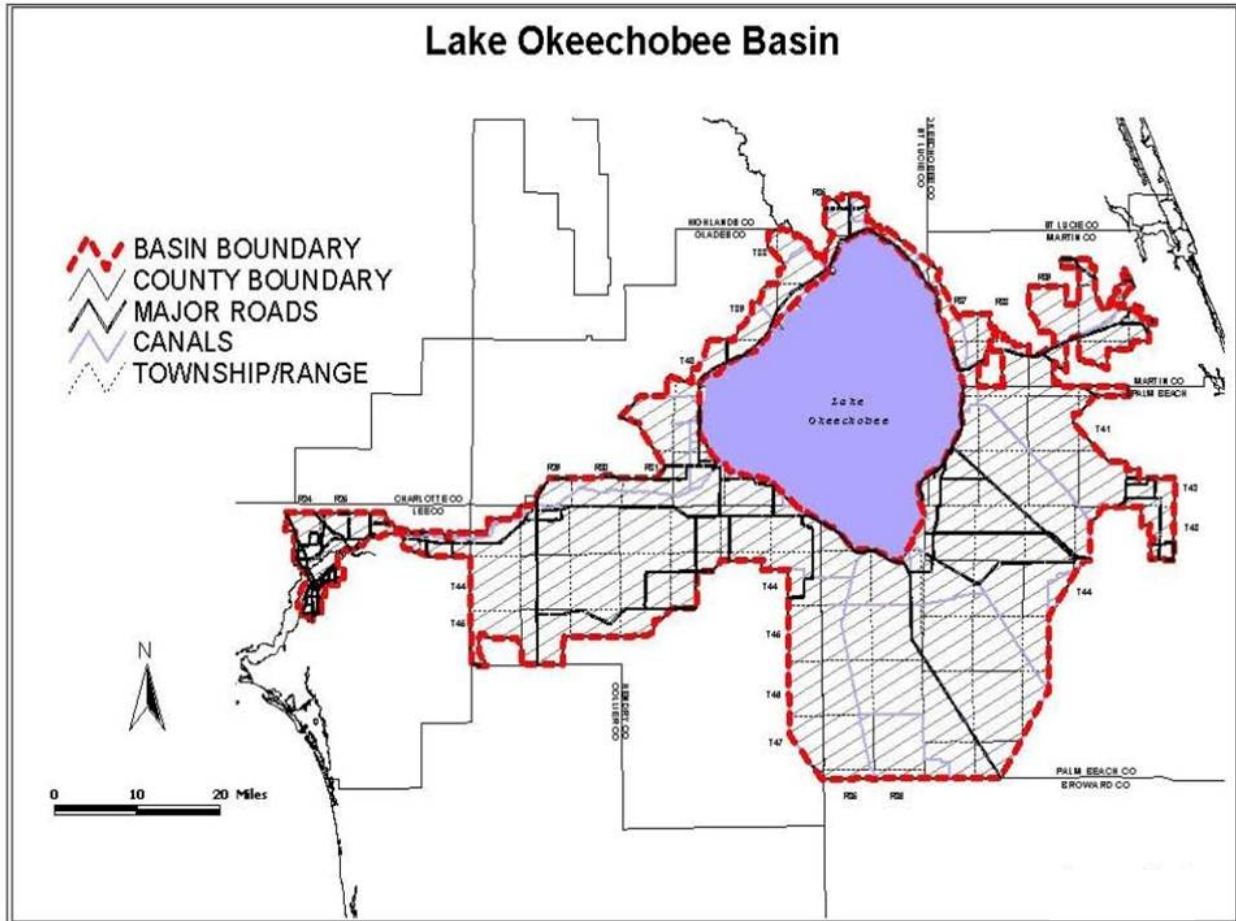
## 905 **5.1 Protection of Project Waters**

906 In order to determine where water reservation rules are needed to protect project water, four areas  
907 were evaluated to determine if there is a sufficient risk that future increases in consumptive use would  
908 occur to a degree that the project water would be otherwise diminished to a degree of affecting the C-43  
909 reservoir project objectives. These areas include the following; 1) the upstream watershed where Lake  
910 discharges and local runoff flows contribute waters for storage, 2) waters stored within the reservoir, 3)  
911 groundwater withdrawals in the vicinity of the project, and 4) C-43 canal water downstream from the  
912 discharge point of the reservoir to the S-79 Structure.

### 913 **5.1.1 Upstream Watershed Evaluation**

914 Inflows to the project reservoir will consist of regulatory discharges from Lake Okeechobee along  
915 with runoff from the upstream surface water basins. These flows occur primarily during the wet season  
916 but the C-43 Reservoir project operations will be capable of capturing runoff in the event of high rainfall  
917 events during the dry season. As discussed in **Section 3.4**, annual total flows at the S-79 Structure are  
918 expected to exceed the capacity of the reservoir (170,000 acre feet) 95 percent of the time under the  
919 LORS 2008 regulation schedule.

920  
921 Water use rules were used to assess the potential risk of future increases in consumptive uses. The use  
922 of surface water from Lake Okeechobee is capped at a 2008 baseline use rate within the Lake  
923 Okeechobee Basin (Water Use Basis of Review Section 3.2.1(G) - **Figure 5-1**). This Restricted  
924 Allocation Area rule prevents increases in water use from the Lake and therefore eliminates the risk of  
925 future water use impacting the volume of Lake water available for storage by the reservoir.  
926



927

928 **Figure 5-1.** Map Showing the Restricted Allocation Area Rule Boundary for Lake Okeechobee and Lake  
 929 Okeechobee Service Area.

930

931 There are no specific rules capping the use of surface water runoff from the upstream water use basins  
 932 between S-77 to S79. However, in considering if a proposed use is reasonable and beneficial the applicant  
 933 must demonstrate that the water supply is available during those times of demand up to a drought event  
 934 with a return probability of 1 in 10 years. Water use within the S-4, Caloosahatchee West and East basins  
 935 is predominately agriculture which requires supplemental irrigation water during the dry season months  
 936 when surface water runoff is mostly unavailable. Therefore new uses in the basin would not be able to be  
 937 permitted surface water runoff unless it was associated with a storage facility. The construction of onsite  
 938 storage facilities capable of supporting agriculture throughout the dry season has not been feasible or  
 939 permitted to date. Stormwater management facilities have on occasion been used to supply supplemental  
 940 irrigation for short times until stored water runs out but these facilities are not sized to meet water  
 941 demands throughout the dry season.

942

943 The 2012 Lower West Coast (LWC) Water Supply Plan (SFWMD 2012) indicates that agriculture  
 944 continues to be the LWC Planning Area's largest water user through the 2030 planning horizon. The  
 945 LWC Planning Area includes all of Lee County, most of Collier County and portions of Hendry,  
 946 Charlotte, Glades and mainland Monroe County. The Agriculture self-supply represents approximately  
 947 57-59 percent of the planning area's total gross demands by 2030. The annual gross water demands  
 948 Agricultural Self-Supply are estimated to be 630 MGD for 2010 while the projected demands are between

949 695.9-740.9 MGD for 2030. This is an increase of 10-18 percent throughout the entire LWC planning  
950 area. The percentage change within the Caloosahatchee watershed which encompasses four different  
951 counties was not evaluated as part of the 2012 water supply planning effort (SFWMD 2013).

952  
953 Due to regulatory limits on new uses for Lake Okeechobee and watershed surface water runoff,  
954 combined with the ample supply of wet season runoff available to recharge the reservoir on an annual  
955 basis, there is a low risk that new uses will be permitted to the degree sufficient to reduce the volumes of  
956 water available for storage in the C-43 Reservoir. It is concluded that additional water use rules which  
957 further limit the use of Lake Okeechobee surface water and basin runoff upstream of the reservoir for the  
958 protection of water to be captured and stored in the C-43 are not necessary.

### 959 **5.1.2 Water Stored Within the Reservoir**

960 Currently there are no existing rules that would prevent direct withdrawals of surface water from the  
961 reservoir once constructed. Such withdrawals will need to be prohibited by the reservation rule. This  
962 conclusion is consistent Section C.2.3., of Volume 3; Annex C, of the PIR which identifies there will be  
963 no water made available for other water related needs by the reservoir and all water made available by the  
964 project is provided to the natural system. Proposed rule 40E-10.041(3)(a) F.A.C., provides that all surface  
965 water contained within and released, via operation, from the Caloosahatchee River (C-43) West Basin  
966 Storage Reservoir is reserved from allocation.

### 967 **5.1.3 Groundwater Withdrawals in the Vicinity of the Project**

968 In addition to direct surface water withdrawals, staff evaluated the potential for well withdrawals  
969 removing significant volumes of reservoir water via seepage. Test well data from the reservoir site  
970 identify two freshwater aquifers occur beneath the site. The water table aquifer extends from land surface  
971 to depths of approximately 20 feet. The thin nature of the unit combined with the low permeability of the  
972 sediments limits the use of this aquifer to small withdrawals (generally less than 50 gallons per minute  
973 (gpm) per well). In addition, the design of the reservoir includes the construction of a fully penetrating  
974 seepage barrier constructed through the levee and into the naturally occurring clay confining unit beneath  
975 the water table aquifer to protect the efficacy of the surrounding dike and to prevent seepage impacts to  
976 adjacent lands. This design feature will effectively prevent seepage from the reservoir to any nearby water  
977 table well. As a result, no additional water use rules restricting water use from the water table aquifer will  
978 be needed.

979  
980 The second aquifer, the sandstone aquifer occurs at depths between 45 and 160 below land surface in  
981 the vicinity of the site. These depths are based on the geologist log for the Caloosahatchee Aquifer  
982 Storage and Recovery (ASR) test core. The aquifer is separated from the water table aquifer by  
983 approximately 30 feet of low permeable clays that restrict the vertical movement from the overlying  
984 aquifer into the sandstone aquifer. The sandstone in this area produces significant yields of freshwater  
985 (upwards of 500 gpm per well) and is used for irrigation supply and self supplied potable water. Staff  
986 evaluated the potential impacts of hypothetical well located at progressively closer distances to the  
987 reservoir. In addition, model runs were made using different pumping rates and varying aquifer  
988 characteristics in order to assess the amounts of seepage that could result from nearby well operations.

989  
990 Minor amounts of seepage could occur from high yielding wells(e.g. 500,000 Gallons per day (gpd)  
991 located 1,000 feet from the reservoir. The amount of seepage from the reservoir is expected to be  
992 negligible given the maximum storage capacity of the reservoir. The rate of seepage declines quickly with  
993 greater distance from the reservoir. It would take many such wells located adjacent to cause a measurable  
994 change in reservoir storage. This is unlikely as all existing demands for irrigation in the lower west coast  
995 planning area are already being met from surface water which is a lower cost option. Further, farming  
996 irrigation practices require wells be distributed across the irrigated area making it unlikely that even if the

997 existing surface water sources of irrigation water were shifted to groundwater, that the wells would be  
998 clustered adjacent to the reservoir.

999 It is concluded that there is a low risk of a large number of high yielding sandstone wells being  
1000 proposed adjacent to the reservoir sufficient to cause significant seepage based reductions in reservoir  
1001 storage. Therefore, additional water use rules which would limit the use of the sandstone aquifer in the  
1002 vicinity of the C-43 reservoir are not necessary. A more detailed description of the site conditions and  
1003 model simulations are provided in **Appendix A**.

#### 1004 **5.1.4 Downstream Watershed Evaluation (C-43 Canal Water between S-79 Structure and** 1005 **the Reservoir)**

1006 A segment of the C-43 Canal, occurring between the S-79 Structure and the C-43 Reservoir, will  
1007 serve as the conveyance path for reserved water being delivered to the Caloosahatchee River. As such, it  
1008 is possible that new direct withdrawals from the C-43 Canal within this reach of the C-43 Canal could  
1009 intercept reserved water from reaching the estuarine portion of the Caloosahatchee River. Accordingly,  
1010 additional consumptive use permit rules will be needed by the time the reservoir is operational that will be  
1011 applied to applicants for new or increased C-43 surface water supplies within this reach of the canal. Such  
1012 rules should include criteria which when met, will demonstrate that such withdrawals will not divert and  
1013 use water reserved from allocation originating from the C-43 Reservoir. Proposed rule 40E-10.041(3)  
1014 F.A.C., requires the “Basis of Review for Water Use Permit Applications within the South Florida Water  
1015 Management District,” incorporated by reference in Rule 40E-2.091, F.A.C., shall be revised pursuant to  
1016 Section 373.223(4), F.S., in light of changed conditions or new information and prior to the reservoir  
1017 becoming operational. Specific permit criteria identifying how an applicant for withdrawal of C-43  
1018 surface water from a location downstream of the reservoir can demonstrate that reserved water will not be  
1019 withdrawn will be determined and incorporated by rule once the final operation plan for the C-43  
1020 reservoir is completed.

#### 1021 **5.2 Existing Legal Uses/Existing Legal Sources**

1022 Chapter 373.223(4) Florida Statutes states that when establishing a water reservation, all presently  
1023 existing legal uses of water shall be protected so long as such use is not contrary to the public interest.  
1024 Section 385.36 of the federal Programmatic Regulations requires that project implementation reports  
1025 determine if existing legal sources of water are to be eliminated or transferred as a result of project  
1026 implementation. If a project is expected to result in an elimination or transfer of an existing legal source  
1027 of water, the PIR shall include an implementation plan that ensures a new source of water of comparable  
1028 quantity and quality is available to replace the source that is being transferred or eliminated.  
1029

1030 In determining the water made available by the project, the PIR found that sources of water to meet  
1031 agricultural and urban demand in the Caloosahatchee River (C-43 Canal) Basin will remain the same as  
1032 before the project and therefore, there will be no elimination or transfer as a result of this project on  
1033 existing legal sources of supply. Since the project design does not depend on water supplies being utilized  
1034 by area uses, there is no basis upon which to conclude that the reservation of water made available by the  
1035 project will compete against existing legal uses. Therefore, it is concluded that all presently existing legal  
1036 uses of water as they relate to the proposed water reservation for this project, are not contrary to the  
1037 public interest.

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## **Appendix A. Evaluation of Groundwater Seepage Potential**

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To Be Finalized

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