# ENDANGERED SPECIES ACT
# BIOLOGICAL ASSESSMENT

## Planned Temporary Deviation


## Prepared by
## Department of the Army
## Jacksonville District Corps of Engineers



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# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

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# 1 INTRODUCTION

The purpose of a Biological Assessment is to evaluate the potential effects of a Federal action on both listed species and those proposed for listing, including designated and proposed critical habitat, and determine whether the continued existence of any such species or habitat is likely to be adversely affected by the Federal action. The Biological Assessment is also used in determining whether formal consultation or a conference is necessary [Federal Register 51 (106): Section 402.1 (f), pg. 19960, 3 June 1986]. This is achieved by:

- Reviewing the results of an on-site inspection of the area affected by the Federal action to determine if listed or proposed species are present or occur seasonally.
- Reviewing the views of recognized experts on the species at issue, along with relevant literature.
- Analyzing the effects of the Federal action on species and habitat, including consideration of cumulative effects and the results of any related studies.
- Analyzing alternative actions considered by the Federal agency for the proposed action.

# 2 CONSULTATION SUMMARY

On June 30, 2009, Everglades Restoration Transition Plan (ERTP) team members of U.S. Army Corps of Engineers (USACE) met with representatives of U.S. Fish and Wildlife Service (FWS) to discuss effects of the Interim Operational Plan for Protection of the Cape Sable Seaside Sparrow (IOP) from 2002 to 2009 on threatened and endangered species and their designated critical habitat and develop a scope for ERTP. USACE and FWS, along with members from Everglades National Park (ENP), South Florida Water Management District (SFWMD), and the Miccosukee Tribe of Indians of Florida conducted weekly or bi-weekly meetings from July 2009 through April 2010 to review empirical hydrological, meteorological, and ecological data from IOP operations, in order to define an array of water management actions to improve conditions for snail kite (*Rostrhamus sociabilis*) and wood stork (*Mycteria americana*), while maintaining protection of Cape Sable seaside sparrow (CSSS) (*Ammodramus maritimus mirabilis*). In addition, monthly meetings (September 2009-January 2010) were held with other governmental agencies, including Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Environmental Protection (FDEP), Florida Department of Agriculture, Consumer FWSs, and the Miami-Dade Department of Environmental Resources Management. After January 2010, these agencies were invited to participate in all ERTP team meetings. After April 2010, USACE continued to consult with FWS on proposed ERTP operations through October 2010.

USACE originally consulted with FWS by letter dated January 21, 2010 on federally listed threatened and endangered species that may be present in the ERTP action area. In a letter dated March 8, 2010, FWS provided partial concurrence with USACE finding of listed species that may be encountered or adjacent to the action area and provided a list of other federally threatened and endangered species, along with candidate species, potentially likely to occur within the action area. In 2010, federally threatened and endangered species that may occur within the ERTP action area included Florida panther (*Puma concolor coryi*), the Florida population of West Indian Manatee (Florida manatee) (*Trichechus manatus*), CSSS, snail kite, red-cockaded woodpecker (*Picoides borealis*), roseate tern (*Sterna dougallii dougallii*), wood stork, American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), Eastern indigo snake (*Drymarchon corais couperi*), crenulate lead-plant (*Amorpha crenulata*), deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), Garber's spurge (*Chamaesyce garberii*), Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeenis*), Small's milkpea (*Galactia smallii*), tiny polygala (*Polygala smallii*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), and Stock Island tree snail (*Orthalicus reses* [not incl. *nesodryas*]). In addition, the ERTP action area contains designated critical habitat for American crocodile, snail kite, CSSS, and Florida manatee.

On June 16, 2015, USACE consulted with FWS by letter to reconfirm listed species within the ERTP action area. By letter dated July 16, 2015, FWS amended the list of species to include those identified within **Table 5**. As a result of this reconfirmation, additional species were added to the list of species that have the potential to occur within the ERTP action area. These additional species include Florida bonneted bat (*Eumops floridanus*), Miami blue butterfly (*Cyclargus thomasi bethunebaker*), Bartram's hairstreak butterfly (*Strymon acis bartrami*) and its designated critical habitat, Florida leafwing butterfly (*Anaea troglodyta floridalis*) and its designated critical habitat, and Cape Sable thoroughwort (*Chromolaena frustrata*) and its designated critical habitat. In the same July 16, 2015 letter, FWS removed piping plover (*Charadrius melodus*), crenulate lead plant, deltoid spurge, Small's milkpea, tiny polygala, Big Pine partridge pea (*Chamaecrista lineata* var. *keyensis*), Carter's small-flowered flax (*Linum carteri* var. *carteri*), Florida brickell-bush (*Brickellia mosieri*), Florida prairie clover (*Dalea carthagenensis*), Florida semaphore cactus (*Opuntia corallicola*), and sand flax (*Linum arenicola*) from the USACE June 16, 2015 proposed list. Due to the fact that within the 2010 ERTP Biological Assessment USACE concluded that ERTP implementation may affect deltoid spurge, Garber's spurge, Small's milkpea, and tiny polygala, an effects determination for these species has also been included within this Supplemental Biological Assessment.

Federally listed species under the purview of National Marine Fisheries FWS (NMFS) include green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), and Johnson's seagrass (*Halophila johnsonii*). USACE coordinated with NMFS pertaining to potential action effects on listed species under their purview (March 2010, July 2015). In addition, the action study area contains designated critical habitat for green sea turtle, leatherback sea turtle, smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson's seagrass.

The USACE provided a Draft Biological Assessment to FWS in June 2010 and a Final Biological Assessment October 15, 2010. Based upon information contained within the USACE Biological Assessment, FWS provided a BO on November 17, 2010, concluding formal consultation on ERTP. A subsequent BO Amendment was provided March 2, 2012 to specifically address USACE concerns with wood stork incidental take triggers as expressed by USACE verbally and by email January 24, 2011. A full consultation history on water management activities to protect CSSS is contained within the 2010 ERTP Biological Assessment, 2010 ERTP BO, and 2011 ERTP Final Environmental Impact Statement (FEIS), and is hereby incorporated by reference.

In 2012, USACE implemented an accelerated planning process to improve conditions within the central Everglades. The Central Everglades Planning Project (CEPP), a component of the CERP, is designed to improve quantity, quality, timing, and distribution of water flow throughout the central Everglades to include WCA-3A, WCA-3B, and ENP. This project, once implemented, will restore the historical flow path to the extent practicable through WCA-3B and NESRS given other project constraints, e.g. flood mitigation. However, during CEPP ESA consultation, it was noted that restoration of historical flow into ENP could have potentially adverse impacts on CSSS due to rehydration of wetlands resulting in greater depths and longer periods of inundation. Adverse effects were noted for subpopulations A, C, D, and E; however, CEPP modeling also revealed areas in which habitat conditions would be suitable for future colonization by CSSS in areas adjacent to current subpopulation locations.

In addition, during ESA Consultation on CEPP, a number of actions were identified that could help improve the ability to estimate CSSS abundance, enhance CSSS habitat, and promote stability across CSSS subpopulations. As a result, the Department of the Interior, including FWS, ENP, and the United States Geological Survey, have implemented a CSSS Memorandum of Understanding (MOU). This MOU outlines steps that Department of the Interior agencies will undertake to better understand the biology of CSSS and to implement strategies to improve CSSS resiliency in the light of future hydrological conditions from implementation of CERP projects, as well as sea level rise. For additional information, please refer to 2013 CEPP BO (FWS 2013a).

USACE reinitiated ESA consultation on ERTP on November 17, 2014 as a result of an exceedance of an Incidental Take Reinitiation Trigger from the November 17, 2010 ERTP BO. The 2010 ERTP BO Incidental Take Reinitiation Trigger states "*If the annual CSSS population estimate falls below 2,915 sparrows [Mean population estimate 2001-2009 = 3,145 ± 230]), reinitiation of consultation must occur.*" Based upon preliminary data collected by ENP as part of the 2014 CSSS range-wide survey, it appears that the annual population estimate of CSSS has fallen below the reinitiation trigger defined within the November 17, 2010 ERTP BO. Therefore, pursuant to requirements of the 2010 ERTP BO, USACE formally requested reinitiation of consultation in a letter to FWS dated November 17, 2014.

In a letter dated December 12, 2014, FWS acknowledged receipt of the USACE reinitiation request and stated that "*it has become apparent to the FWS that further modifications to the current water management regime are needed to conserve and recover sparrows*". The December 12, 2014 letter also included comments from the Water Year 2013 ERTP Annual Assessment. On January 26, 2015, USACE responded to FWS December 12, 2014 letter stating that USACE is committed to looking for reasonable and prudent measures to further protect CSSS to the extent practicable through water management operations; but also clarifying that it is widely recognized that ERTP, and its predecessor, the 2002-2012 IOP, were not designed to recover CSSS, but instead, as measures to protect the subspecies during its breeding season from unfavorable water levels. The letter also addressed specific FWS comments on the Water Year 2013 ERTP Annual Assessment. On March 3, 2015, FWS responded with a list of potential conservation measures to explore, along with a request to increase the number of consecutive dry days from 60 to 90 or more consecutive dry days throughout a large portion of CSSS habitat in successive years, along with average annual hydroperiod of 90-210 days in CSSS habitat. USACE acknowledged during several informal meetings with FWS that it would use its operational flexibility under ERTP to promote conditions favorable for CSSS nesting and hydroperiod requirements. In addition, in light of FWS March 3, 2105 letter, USACE requested reaffirmation of FWS support for the MWD Increment 1 Field Test, as well as use of ERTP operational flexibility in a March 27, 2015 letter. FWS provided reaffirmation of support for the MWD Increment 1 Field Test as well as use of operational flexibility under ERTP in a letter dated May 22, 2015. Operational flexibility will be used to promote an increased number of consecutive dry days within CSSS habitat, as requested by FWS, to allow increased potential for breeding. In addition, this flexibility will be used to promote a 90-120 day discontinuous hydroperiod within CSSS habitat.

Once USACE reinitiated consultation, several technical team meetings were held with FWS and other DOI agencies including ENP, USGS, and BCNP. In addition, USACE also consulted with the Miccosukee Tribe of Indians of Florida, Seminole Tribe of Florida, SFWMD, and the local sponsor for the C&SF Project, along with other State agencies to address reasonable and prudent alternatives measures to protect CSSS. During the consultation process, several near-term (6-12 months), mid-term (2-5 years), and long-term (greater than 5 years) reasonable and prudent measures were identified that could potentially be undertaken by USACE and other Federal and state agencies that would protect and enhance CSSS populations. These reasonable and prudent measures require a concerted effort on behalf of state and Federal agencies to implement reasonable and prudent measures under their agency's authorities.

As part of the informal consultation process following USACE reinitiation request of November 17, 2014, FWS requested that USACE further restrict S-12A and S-12B operations to protect CSSS-A. In order to analyze the potential effects of the FWS request on water management operations and water elevations within WCA-3A in particular, USACE evaluated four different S-12A, S-343A, S-343B, S-344, and S-12B closure periods as illustrated in **Table 1**. The evaluations estimated the potential effect of each operational scenario on historical WCA-3A stages for each water year during historical IOP and ERTP operations; water years 2003-2015. The evaluations assumed the flow volumes that were historically released from the WCA-3A outlet structures (S-12A, S-12B, S-343A, S-343B, and S-344) during the extended closure periods identified for each scenario were instead retained within the WCA-3A storage volume. Although potential effects on WCA-3A stages varied in response to annual hydrologic conditions, all four scenarios demonstrated multiple years with WCA-3A stage increases greater than 0.2-0.3 feet; for relative comparison, it is critical to note that the WCA-3A stage reductions resulting from the WCA-3A Regulation Schedule changes during ERTP were also estimated at 0.2-0.3 feet during normal to wet conditions.

Based upon the results of this evaluation, it was concluded that due to potential high water concerns within WCA-3A and the fact that the BAMM WCA flood routing analysis has not been completed, USACE could not commit to additional mandated closure periods that may act to increase the peak stage, frequency, and duration of high water conditions within WCA-3A. Alternatively, USACE can use existing operational flexibility inherent within ERTP in order to minimize use of the S-12A, S-12B, S-343A, S-343B, and S-344 structures as conditions permit. A full evaluation of FWS-requested operational scenarios was provided to FWS on March 26, 2015, with further evaluation provided to FWS on April 29, 2015.

**TABLE 1: STRUCTURE CLOSURE PERIODS EVALUATED AT FWS REQUEST**

| Operational Scenario | Structural Changes |
|---|---|
| 1: Structures Close 1 month early | S-12A, S-343A, S-343A, S-344 close October 1; S-12B close December 1 |
| 2: Structures Open 1 month later | S-12A, S-12B, S-343A, S-343B, S-344 open August 15 |
| 3: Structures close 1 month early AND open 1 month late | S-12A, S-343A, S-343B, S-344 close October 1 AND open August 15; S-12B close December 1 AND open August 15 |
| 4: Structures closed all year | S-12A, S-12B, S-343A, S-343B and S-344 closed year round |

The USACE concluded ESA consultation with FWS on July 22, 2016, with FWS providing a revised BO for ERTP. The 2016 ERTP BO addresses the USACE' 2012 Water Control Plan, a document that guides how the USACE manages water for WCA 3A, ENP, and the SDCS to meet flood control, and other C&SF Project purposes, while avoiding and minimizing adverse effects to threatened and endangered species. Developed in formal ESA consultation with the USACE, the BO contains the FWS opinion that the USACE proposed continued operation of ERTP would jeopardize the endangered CSSS by reducing appreciably its likelihood of survival and recovery. The 2016 ERTP BO also transmits the FWS conclusion that ERTP, as proposed, will not destroy or adversely modify CSSS critical habitat, nor will it jeopardize the endangered Everglades snail kite (or its designated critical habitat), or the threatened wood stork.

For the CSSS, the 2016 ERTP BO presents a recommendation for a Reasonable and Prudent Alternative (RPA), with numerous elements, to the USACE proposed ERTP action. Main elements of the RPA are:

- Habitat Performance Targets
- Actions to Move Water East
- Surveys and Studies
- Adaptive Management

To summarize the discussion below, the USACE is taking specific actions to comply with the 2016 ERTP BO's terms and conditions and implementing its RPA.

**Habitat Performance Targets.** Among its several elements, the 2016 ERTP BO identifies a set of habitat performance targets in Section 7.1.1. that the FWS believes will improve conditions for the CSSS and contribute toward the survival and recovery of the species. These include targets for consecutive dry days during the CSSS nesting season and ranges for a discontinuous hydroperiod within the CSSS marl prairie habitat. Based on current model output, the FWS acknowledges in the BO that these targets are FWS goals for CSSS habitat to achieve over time, and are not technologically feasible for all subpopulations in every year at present (2016 ERTPBO at Table 34). These modeling results are based on implementation of Increment 2 stages within the L-29 with no seasonal stage constraints (BO target date is March 2018) and closure by ENP of the culvert within ENP along the old Tamiami Trail borrow canal at the junction with the ENP Tram Road, which was originally recommended as part of the USACE' 2011 ERTP Environmental Impact Statement.

As the 2016 ERTP BO also acknowledges, reaching the BO's "desired targets will require the work of various agencies and construction of additional infrastructure to accomplish." Additional habitat conservation actions by others identified in the BO include vegetation management and additional real estate and construction actions. The USACE will continue to work with FWS to identify non-hydrological habitat improvement initiatives that can be implemented by partners in concert with our water management actions. The specific actions that FWS believes USACE can take as a Federal water manager within southern Florida to help achieve these goals are discussed below.

**Actions to Move Water East.** In Section 7.1.2(1), the 2016 ERTP BO identifies several actions to reduce the amount of water that currently flows over CSSS-A and to shift those flows to the east while still maintaining the eastern subpopulations. First, the 2016 ERTP BO identifies an expanded closure period of October 1 through July 15 for the S-12A, S-12B, S-343A/B, and S-344 structures. Consistent with this action, the USACE conducted a National Environmental Policy Act (NEPA) assessment for MWD Increment 1 Plus to analyze a set of alternatives including the 2016 ERTP BO proposed operational changes for the WCA 3A water control structures and the expanded operational ranges within the SDCS. The MWD Increment 1 Plus Environmental Assessment and Finding of No Significant Impact (EA/FONSI) was signed February 16, 2017, implementing the 2016 ERTP BO closure periods on these structures.

The USACE also remains committed to close coordination with FWS and SFWMD to continue to implement operational flexibilities existing within our current water management operations to promote FWS's targets while maintaining other C&SF Project purposes. On a present basis, the USACE is maximizing and prioritizing flows from east to west to minimize flow through the S-12A and S-12B and, as appropriate, continuing to assess opportunities to utilize preemptive releases and additional existing flexibility. For example, flexibility provided in the 2016 Emergency Deviation Transitional Period allowed the USACE to delay opening the S-12A, S-12B, S-343A, and S-343B structures past July 15, 2016, as requested by the FWS. During the 2015-2016 seasonal closure period, the following closure periods were provided for these structures: S-12A was closed October 31, 2015 through August 11, 2016 (gates were partially opened to avoid gate overtopping from February 22 through March 10, in accordance with the current Water Control Plan); S-12B was closed January 1, 2016 through August 9, 2016; and S-343A and S-343B were closed October 30, 2015 through August 15, 2016. The FWS believes this delayed opening may have benefitted nesting sparrows in CSSS-A. This delayed opening was directly tied to the additional flexibility permitted by the 2016 Emergency Transition Period, given the current hydrologic conditions following the 2016 Emergency Deviation.

Second, Section 7.1.2(1) contains actions for increased water levels at the L-29 Canal. Consistent with this action, USACE completed an EA/FONSI on February 16, 2017 to incrementally raise water level stages in L-29 under MWD Increment 1 Plus (including consideration of raising L-29 Canal levels up to 7.8 feet NGVD), and is planning a NEPA analysis for MWD Increment 2 (including consideration of raising levels up to 8.5 feet NGVD). The MWD Increment 1 Plus EA/FONSI was signed February 16, 2017, allowing stages in the L-29 Canal to reach 7.8 feet NGVD. As identified within the MWD Increment 1 Plus EA/FONSI, raising of the L-29 Canal maximum operating limit above 7.5 feet NGVD up to 7.8 feet NGVD is contingent upon compliance with all of the following conditions: (1) acquisition of required real estate interest and any associated improvements for the private ownership along Tamiami Trail including receipt of Tamiami Trail Bridge and roadway channel and flowage easements from the Florida Department of Transportation; (2) completion of the C-358 Canal (Richmond Drive Seepage Collection Canal) and installation of S-357N (C-358 control structure); (3) completion of sufficient portions of Contracts 8 (construction of the C-111 NDA L-315 western levee and the L-357W Extension levee between Richmond Drive and the 8.5 SMA Detention Cell) and completion of the Contract 8A berms inside the 8.5 SMA Detention Cell.

Pending the completion of critical features necessary to operate the North Detention Area construction contracts and the acquisition of real estate interests, we expect to raise the L-29 Canal maximum operating limit to 7.8 feet NGVD by October 2017. On a present basis, construction within C-111 South Dade and 8.5 SMA project is still ongoing. In addition, USACE acquired a flowage easement from the Airboat Association in September 2016 and expects to have the required flowage easement from the Florida Department of Transportation by October 2017. The additional parcels along Tamiami Trail necessary to raise the L-29 stage constraint have been purchased by DOI, however, USACE still needs a real estate instrument to allow USACE to flow water across these properties. This instrument is anticipated to be acquired prior to October 2017. As FWS has acknowledged in the 2016 ERTP BO, eastern CSSS subpopulations, most notably CSSS-E, are likely to be negatively affected under MWD Increment 2 water management operations that shift more water east to the L-29 Canal and away from CSSS-A. The FWS further iterates that the eastern subpopulations will need to be monitored closely and adaptive operations, including seasonal limitations on water levels in the L-29 Canal, may need to be considered during the transitional period.

Third, Section 7.1.2(1) would have USACE utilize the S-333 structure for increased pre-emptive releases from WCA-3A, while continuing to operate the statutorily-constrained temporary features comprising the Decomp Physical Model (DPM) through FY 2018. With regard to S-333, the USACE is able to continue making preemptive releases consistent within the flexibilities of our current Water Control Plan.

With regard to the DPM, USACE agrees that additional testing would provide useful information to support future design efforts while providing incidental benefits to the CSSS.

The USACE has received SFWMD's agreement for supporting extended DPM testing for the next three years, and is working collaboratively with SFWMD, USGS, and a multiagency team to prepare for additional testing and complete any necessary permitting and NEPA requirements. This work will build upon recent testing efforts by the USACE. Since November 2013, USACE has operated the S-152 as documented in the 2010 EA and Design Test Documentation Report and the 2012 FDEP permit. Although the 2010 EA defines an operational window of October 1 through January 31, the FDEP permit truncated the testing window to November-December 2013 and November –January in 2014-2015 and 2015-2016 due to water quality concerns. In 2016, a temporary emergency deviation to the 2012 Water Control Plan enabled utilization of the S-152 structure for purposes of alleviating high water conditions within WCA 3A. During this time period, S-152 was operated from February 19 through February 23 and from March 9 through May 3 of 2016. Use of S-152 during the deviation provided opportunities to test dry season flows and USACE was able to convey 37,000 acre-feet from WCA-3A into WCA-3B during this time period.

The USACE has worked with partner agencies to better understand and investigate the ability to utilize this structure outside the defined testing period. However, additional NEPA and an FDEP permit modification will be required for these actions. A Draft EA and Proposed FONSI will be available in July 2017 for public review and comments. This EA examines alternative modes of operations for the DPM with the preferred alternative identified as year-round operations. The DPM is of a time-limited nature, and this effort will remain in full compliance with the Water Resources and Development Act of 2000, P.L. 106-541, Section 601(b)(2)(D)(iv), which specifically prohibits appropriations for construction of decompartmentalization projects until the completion of the Modified Waters Deliveries project.

**Surveys and Studies.** The 2016 ERTP BO RPA also contains the FWS's opinion on a number of surveys, studies, and monitoring reports that it believes the USACE should implement to aid the FWS's understanding of how hydrologic conditions relate to the CSSS and its habitat. Within Section 7.1.1 ("Targets"), this includes an analysis of daily water-level surfaces and ground elevations in certain Everglades transects (Section 7.1.1(3)), and an analysis of the S-332 Detention Areas to determine how operations of these facilities influence habitats for the eastern CSSS subpopulations during the nesting season (Section 7.1.1(3) (a)). The USACE is prepared to perform these studies and analysis using the technical methods identified in the 2016 ERTP BO. On a present basis, the USACE is working with USGS to refine the CSSS Sparrow Viewer to include the FWS metrics. The USACE continues to collect data as per the 2010 ERTP BO. Daily hydrologic information can be accessed at: http://w3.saj.usace.army.mil/h2o/inc1/reports.htm.

Further studies and analyses are identified in Section 7.1.2. These include an analysis of the potential effects of western flows on CSSS-A (Section 7.1.2(3) (i)) and, if necessary, a western flows seepage study analysis (Section 7.1.2(3) (i)). The USACE is in the early stages of working with ENP and FWS to identify survey methods in response, and is exploring potential procurement opportunities to leverage existing studies. We also intend to explore opportunities within the USACE' Western Everglades Restoration Project (WERP) to determine how WERP project features may assist in the effort of moving toward attaining the FWS's desired habitat targets. In addition, the Terms and Conditions Section of the Incidental Take Statements for the Everglades Snail Kite and Wood Stork also refer to a number of additional tests, surveys, and studies for the USACE to undertake on behalf of those latter two species. The USACE is currently implementing each of those items.

On August 16-17, and 23, 2016 the USACE held interagency meetings to discuss initial planning efforts for WERP. Presently, the USACE has contracts with University of Florida for both snail kite (Dr. Robert Fletcher) and wood stork (Dr. Peter Frederick) monitoring. The USACE has been actively monitoring snail kites range-wide since 1992 and wading birds since the late 1980's. The USACE also recently contracted with Dr. Ken Meyer (ARCI) and Dr. Phil Darby (University of West Florida) to implement an apple snail monitoring program and with Dr. Jay Sah (Florida International University) to complete the required vegetation analyses within CSSS habitat.

**Adaptive Management.** Finally, the USACE agrees with FWS that the 2016 ERTP BO RPA hinges upon a commitment to adaptive management. As outlined in Section 7.1.3(4), the BO's envisioned adaptive management process would serve as a way to keep the RPA on track to achieve its objectives while flexibly responding to new information. One attribute of this process would be to ensure that potential post-BO changes in USACE operations that may be necessary at a later date, and which are determined as unlikely to cause effects on the CSSS, wood stork, or snail kite different from or additional to those already considered in the BO, would not necessarily require a reinitiation of consultation for our agencies to address. In the interests of enabling this process, the USACE and FWS convened a January 26, 2017 ERTP Meeting in Vero Beach where USACE and FWS jointly decided that Leadership Group meetings would be held annually in mid-February and late September. At the January 26, 2017 meeting it was suggested that the 2017 meeting be held in March 2017. The ERTP Leadership Group Meeting was scheduled for March 2017 in South Florida, subsequently rescheduled until May 2017, and then finally June 2, 2017. Unfortunately on May 30, 2017, FWS requested that the June 2, 2017 ERTP Leadership Group meeting be cancelled due to other FWS priorities. The USACE remains committed to the actions outlined in the 2016 ERTP BO RPA and thus requested via letter on June 1, 2017 that FWS provide additional dates for the ERTP Leadership Group meeting. To date, FWS has not provided additional dates for this meeting.

As the 2016 ERTP BO acknowledges, implementing each of the actions of the RPA "is subject to various contingencies, including real estate acquisitions by DOI and the USACE, timely completion of several ongoing and planned construction projects, and complying with NEPA, some of which the USACE does not control (e.g., non-USACE land acquisition, tribal consultation, state CZMA evaluation)." The RPA actions are also subject "to the administrative and Congressional budget process, appropriations, the Federal Acquisition Regulations and Competition in Contracting Act, and the actions of third parties, which may delay or otherwise require changes to their execution." The USACE commits to coordinate with FWS as these contingencies are addressed and resolved in accordance with law. If, at a later date, processes such as NEPA result in any preferred alternative actions that may affect the CSSS in a manner, or to an extent not considered in the BO, the USACE will reinitiate formal consultation.

On June 22, 2017, USACE sent a letter requesting FWS concurrence to open the S-12A, S-12B, S-343A, S-343B, and S-344 structures at the earliest opportunity prior to July 15, 2017 to reduce stages in WCA 3A. In addition, USACE further requested to remove the 250 cubic feet per second (cfs) constraint on the S-332D pump station and allow pumping up to 500 cfs prior to July 15, 2017 to further facilitate reduction in stages in WCA 3A. On June 22, USACE requested emergency ESA consultation to further address high water concerns within WCA 3A. In our emergency ESA consultation, USACE made the following species effects determinations as related to the three species identified within the 2016 ERTP BO. Specifically, USACE determined that the proposed planned temporary deviation may affect, but is not likely to adversely affect, the endangered CSSS, endangered Everglade snail kite, or threatened wood stork. By letter dated June 27, 2017, the FWS concurred with USACE determinations for the Everglade snail kite and wood stork, but did not concur with the USACE determination for CSSS. Therefore, in accordance with the ESA, on July 6, 2017 USACE initiated formal ESA consultation and provided a Biological Assessment for the 2017 WCA 3A Planned Temporary Deviation. In the July 6, 2017, the USACE committed to providing an After Action Assessment to FWS assessing effects on CSSS-A within 90 days following conclusion of the deviation. On August 8, 2017, the FWS provided comments on the Biological Assessment and the USACE provided formal responses and a revised Biological Assessment on September 6, 2017.

Hurricane Irma developed on August 30, 2017 off the Cape Verde Islands and rapidly intensified as it moved west across the Caribbean. The storm caused catastrophic damage on several of the Leeward Islands, and made landfall in Florida on September 10, 2017. Significant precipitation across south Florida was associated with the storm. On September 15, 2017, to mitigate for high water stages within WCA 3A and the South Dade Conveyance System (SDCS), the USACE took emergency water management actions and communicated these actions to FWS by phone and email. The USACE made a no effect determination for threatened and endangered species associated with emergency water management actions within the SDCS. Due to the continued concern with regard to stages in WCA 3A on September 27, 2017, USACE sent a letter requesting FWS concurrence to delay closure of the S-12A, S-12B, S-343A, S-343B, and S-344 structures to reduce stages in WCA 3A. On September 28, 2017, the FWS communicated via email that FWS concluded that the action may adversely affect the endangered CSSS. On October 1, 2017 USACE requested emergency ESA consultation to further address high water concerns within WCA 3A. In our emergency ESA consultation, USACE made the following species effects determinations as related to the three species identified within the 2016 ERTP BO. Specifically, USACE determined that the proposed planned temporary deviation may affect, but is not likely to adversely affect, endangered Everglade snail kite, or threatened wood stork. The USACE also determined that if USACE did not delay closure of the S-12A and S-12B structures or reopen the S-343A, S-343B and S-344 structures then the proposed planned temporary deviation may affect, but is not likely to adversely affect, the endangered CSSS. However, USACE determined that if S-12A or S-12B closures was delayed or the S-343A, S-343B or S-344 structures were reopened, that the action may adversely affect CSSS. In an email dated October 5, 2017, the FWS acknowledged the necessity of keeping these structures open and indicated that FWS would provide the USACE with some conservation recommendations. On October 6, 2017, USACE received approval from the USACE South Atlantic Division to proceed with the 2017 S-12A, S-12B, S-343A, S-343B and S-344 Planned Temporary Deviation in order to alleviate risks to valuable natural resources, public health, safety or welfare (refer to 2017 WCA 3A Emergency and Planned Temporary Deviations Post Hurricane Irma Environmental Assessment and Finding of No Significant Impact). The Planned Temporary Deviation includes delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-343B and S-344 structures until stages within WCA 3A fall below the Modified Water Deliveries to Everglades National Park (MWD) Project Increment 1 Action Line or January 1, 2018, whichever comes first. As a result of this decision, USACE prepared this Biological Assessment to discuss potential effects on the CSSS.

At the September 29, 2017 ERTP Leadership Meeting, the USACE and FWS agreed that the USACE will provide an After Action Report to include all 2017 water management deviation activities approximately 90 days post conclusion of the deviations. The purpose of the After Action Report is to provide a hydrological analysis on how the 2017 emergency and planned water management deviations affected hydrological conditions within WCA 3A, the SDCS and ENP. **Neither this Biological Assessment (nor the July 2017 Biological Assessment) will be revised or supplemented.** As per emergency procedures outlined within the 1973 ESA, as amended, the USACE has used the best available scientific information available to develop both the October 2017 and the July 2017 Biological Assessments. The After Action Report is currently anticipated in summer 2018.

# 3 ACTION DESCRIPTION

## 3.1 ACTION AUTHORITY

The Central and Southern (C&SF) Project for Flood Control and Other Purposes was initially authorized by the Flood Control Act of 1948, Public Law 80-858, approved June 30, 1948. The remaining works of the Comprehensive Plan were authorized by the Flood Control Act of 1954, Public Law 83-780, approved September 3, 1954. There have been numerous modifications to the original C&SF Project authority. Examples of these modifications specific to this action include the 1992 Modified Water Deliveries to Everglades National Park General Design Memorandum and Environmental Impact Statement and the 1994 C&SF Project General Reevaluation Report and Environmental Impact Statement.

## 3.2 DESCRIPTION OF PROPOSED ACTION

The C&SF Project currently functions and was originally authorized to function as a multi-purpose water management system. The Congressionally-authorized purposes of the C&SF Project include flood control, agricultural irrigation, municipal and industrial water supply, preservation of fish and wildlife, water supply to Everglades National Park (ENP), preservation of ENP, prevention of saltwater intrusion, drainage and water control, groundwater recharge, recreation, and navigation. Operations in the project area are currently governed by the Modified Water Deliveries to Everglades National Park Project: G-3273 Constraint

Relaxation/S-356 Field Test and S-357N Revised Operational Strategy Increment 1 Plus (Increment 1.1 and 1.2); hereafter referred to as MWD Increment 1 Plus, which is a deviation to the 2012 Water Conservation Areas (WCAs), ENP and the ENP to SDCS Water Control Plan (hereafter referred to as the 2012 Water Control Plan). The EA and Finding of No significant Impact (FONSI) for MWD Increment 1 Plus is dated February 16, 2017.

The USACE implemented an Emergency Deviation from the 2012 Water Control Plan and the MWD Increment Plus Operational Strategy in order to provide relief from high water stages within WCA 3A and the SDCS on September 15, 2017 due to Hurricane Irma. Emergency water management activities that were implemented on September 15, 2017, upon approval of the USACE South Atlantic Division, include raising stages in the L-29 Canal up to 8.5 feet National Geodetic Vertical Datum (NGVD) of 1929, increased pumping at the S-356 to provide flood relief along L-31N Canal, increased pumping at S-357 structures to provide flood mitigation to the 8.5 SMA and associated operational changes within the SDCS (refer to 2017 WCA 3A Emergency and Planned Temporary Deviation Post Hurricane Irma Environmental Assessment and Finding of No Significant Impact, Appendix A). In addition to these emergency water management actions, the USACE also proposed to delay closure of the S-12A, S-12B, and reopen the S-343A, S-343B and S-344 structures as further risk reduction measures for WCA 3A natural resources, public health, safety or welfare as the wet season and hurricane season continue due to reduced flood storage. The delayed closures and reopening were approved in a Planned Temporary Deviation on October 6, 2017 by the USACE South Atlantic Division.

Due to the significant rainfall as a result of Hurricane Irma, relevant emergency orders (refer to 2017 WCA 3A Emergency and Planned Temporary Deviation Post Hurricane Irma Environmental Assessment and Finding of No Significant Impact, Appendix B) for flood relief and other measures were issued as outlined in **Table 2**. Total precipitation associated with Hurricane Irma is included within **Table 3.**

**TABLE 2: EMERGENCY ORDERS ISSUED FOR HURRICANE IRMA**

| Agency | Number | Date |
|---|---|---|
| Office of the Governor | Executive Order 17-235 | September 4, 2017 |
| Florida Department of Environmental Protection | OGC 17-0990 | September 5, 2017 |
| Florida Department of Environmental Protection | OGC 17-0989 | September 10, 2017 |
| Federal Emergency Management Agency | 82 FR 44196 | Declaration: September 5, 2017<br>Publication: September 21, 2017 |

**TABLE 3: TOTAL PRECIPITATION EXPERIENCED WITHIN C&SF PROJECT ACTION AREA BETWEEN SEPTEMBER 2, 2017 AND SEPTEMBER 23, 2017**

| Area | Precipitation | % of Average (September 2-25) |
|---|---|---|
| East EAA | 10.01 inches | 216%<br>(average 4.6 inches) |
| WCA-1 & WCA-2 | 9.79 inches | 205%<br>(average 4.78 inches) |
| WCA-3 | 10.71 inches | 220%<br>(average 4.87 inches) |
| Eastern Miami-Dade | 9.87 inches | 161%<br>(average 6.13 inches) |

All areas of South Florida continue to be inundated with water, restricting the ability to safely move water to mitigate the effects of flooding. Immediate action was necessary to deviate from permitted water management practices to move flood water out of the WCAs, and subsequently provide opportunities to move more water south out of the WCAs as well as within the SDCS. Therefore, the USACE initiated an emergency deviation from the approved Water Control Plan on September 15, 2017 for purposes of alleviating high water conditions within the project area. This action was taken to prevent risk to property. The proposed action includes a further planned temporary deviation to further mitigate for severe ecologic and economic losses that could result from prolonged high water levels. Loss of natural resources directly affects fisheries and fishing, seafood harvesting and ecotourism.

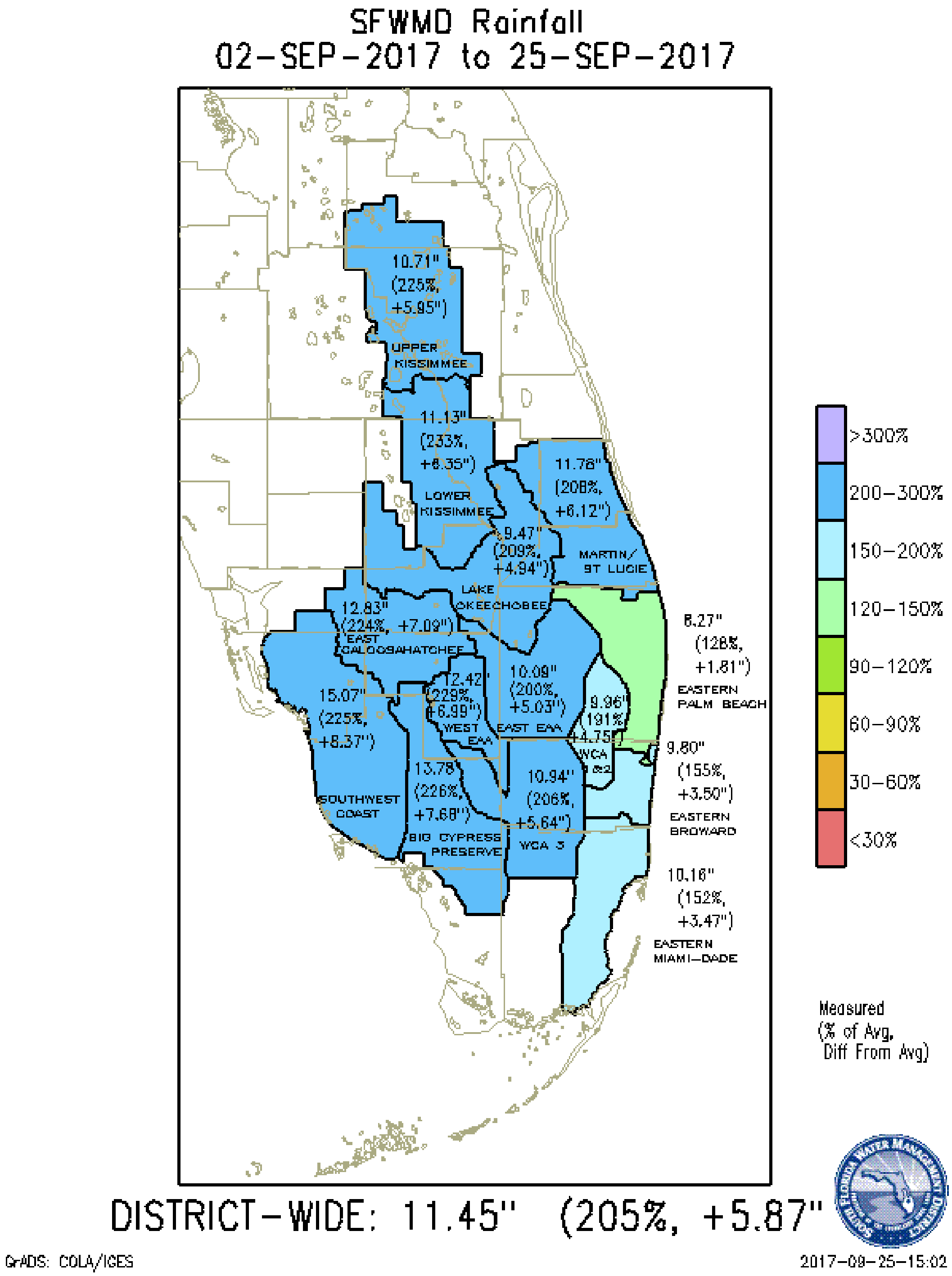



**FIGURE 1: PRECIPITATION MAP WITHIN THE PROJECT AREA BETWEEN SEPTEMBER 2 AND SEPTEMBER 25, 2017 (MAP COURTESY OF SOUTH FLORIDA WATER MANAGEMENT DISTRICT).**

Due to the unprecedented rainfall during the month of June 2017, as well as Hurricane Irma in September, WCA 2A and WCA 3A are above Zone A of their respective regulation schedules (**Table 4**). In addition, the Everglades Agricultural Area, which is located directly north of the

WCAs and sends excess water south into the WCAs, has also received a significant amount of rainfall, further exacerbating the rate of rise in the WCAs following Hurricane Irma.

**TABLE 4: WCA STAGES COMPARED TO REGULATION SCHEDULE (DATA REFLECTS STAGES ON SEPTEMBER 25, 2017).**

| Area | Current Stage (feet NGVD) | Regulation Schedule (feet NGVD) | Deviation from Regulation Schedule (feet) |
|---|---|---|---|
| WCA 1 | 17.07 | 17.50 | -0.43 |
| WCA 2A | 14.27 | 12.87 | 0.77 |
| WCA 3A | 12.11 | 9.76 | 2.35 |

The stages within WCA 3A are the most concerning because environmental constraints and current system capacity limit the volume of water that can be moved out of the system. The WCA 3A regulation schedule is currently above the maximum regulation schedule as shown in **Figure 2** and the maximum exceedance elevation for this time of the year, as shown in **Figure 3**.

Based on consideration of the current approved levee screening risk assessments for WCA 3A, the USACE recommends evaluating and implementing all available and appropriate water management options to immediately lower WCA 3A high water stages when the WCA 3A 3-station gage average (WCA 3AVG) is forecast to exceed 12.7 feet NGVD. The WCA 3A average stage of 12.7 feet National Geodetic Vertical Datum (NGVD) of 1929 corresponds to approximately 12.0 feet NGVD at the 3-65 gage location (3A-28), which triggers initiation of semi-weekly high water inspections by the South Florida Water Management District (SFWMD) along the L-28 and L-29 levee segments which border WCA 3A. The WCA 3A average stage of 12.7 feet NGVD also coincides with the period-of-record (1962-2017) high water stage in WCA 3A, and exceedance of this elevation will encroach into the required 2.5 feet of levee freeboard at the low point (elevation 14.3 feet NGVD) of the L-29 Levee along southern WCA 3A (L-29 Section 2) and increase potential for overwash/overtopping of the U.S. Highway 41 (Tamiami Trail) during storm events. As the stage increases in WCA 3A, there is also increased risk of seepage that could progress to movement of material, need for intervention, and inundation of populated areas east of the L-37 Levee segment of the East Coast Protective Levee. The USACE continues to assess risk to the WCA 3A levee system based on consideration of stage projections, direct field observations from the system-wide levee inspections, short-term and intermediate rainfall forecasts, and conditions and trends within the upstream basins.

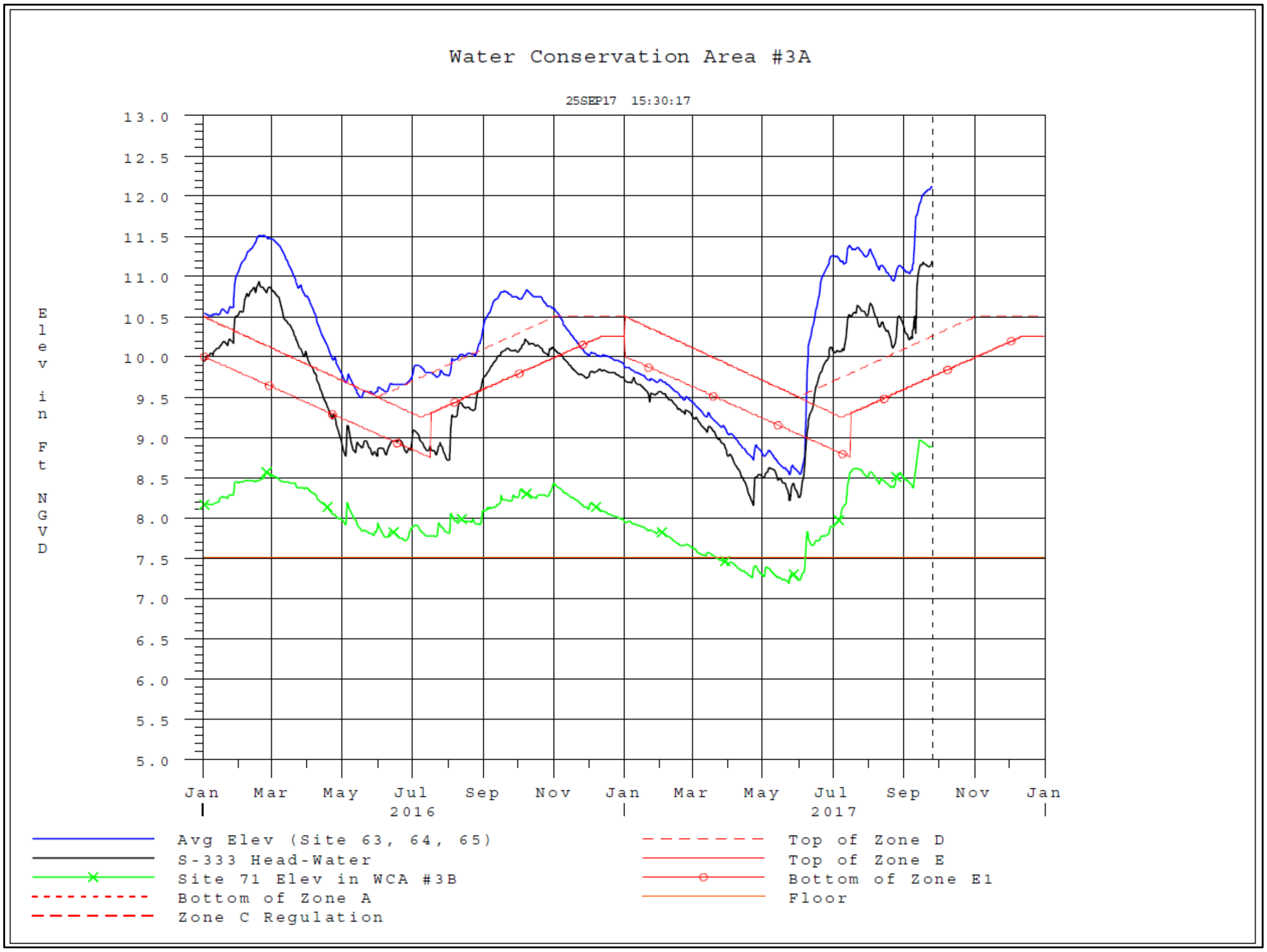



**FIGURE 2: WCA 3A STAGE HYDROGRAPH AND REGULATION SCHEDULE**

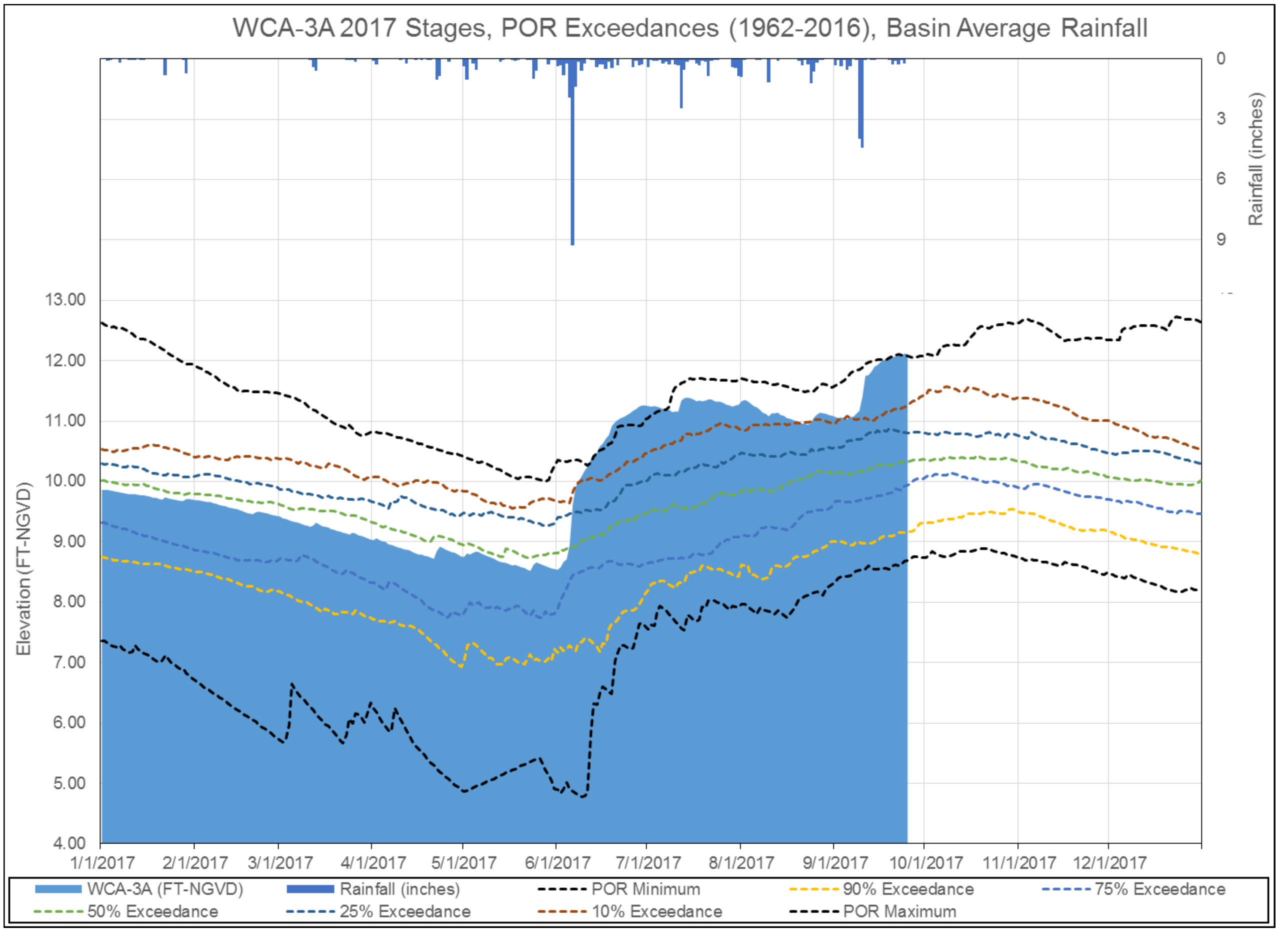



**FIGURE 3: WCA 3A COMPARED TO 1962-2016 EXCEEDANCE STATISTICS (SEPTEMBER 25, 2017)**

## 3.3 ACTION LOCATION

The water management operating criteria relating to the proposed action affects an area within the C&SF Project located in South Florida and includes Lake Okeechobee, the Caloosahatchee and St. Lucie Estuaries, WCA 3, ENP, and adjacent areas. Features of the proposed action are located in Broward and Miami-Dade Counties (**Figure 4**).

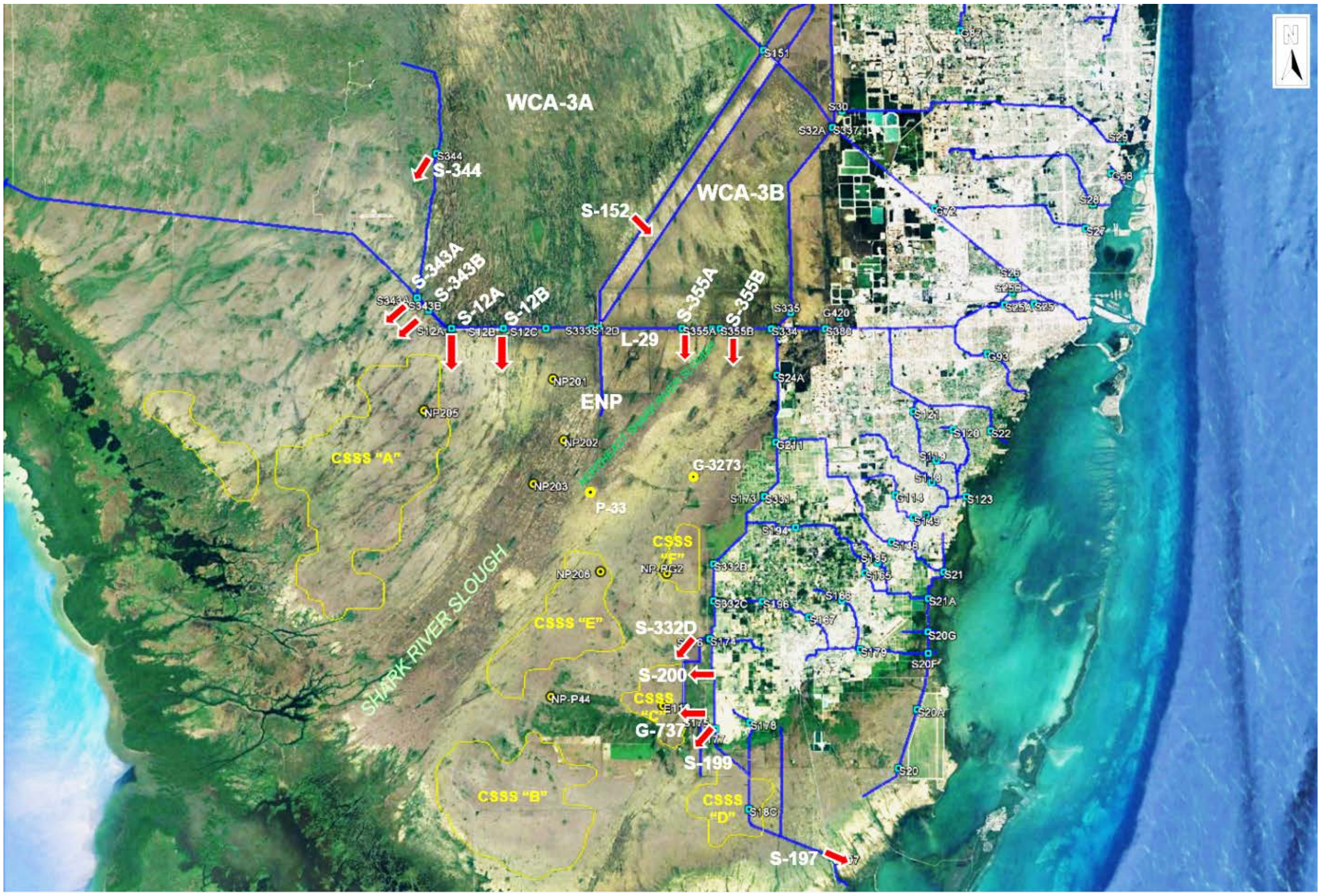



**FIGURE 4: PROJECT LOCATION AND RELEVANT C&SF PROJECT FEATURES OF THE MWD PROJECT AND C-111 PROJECTS**

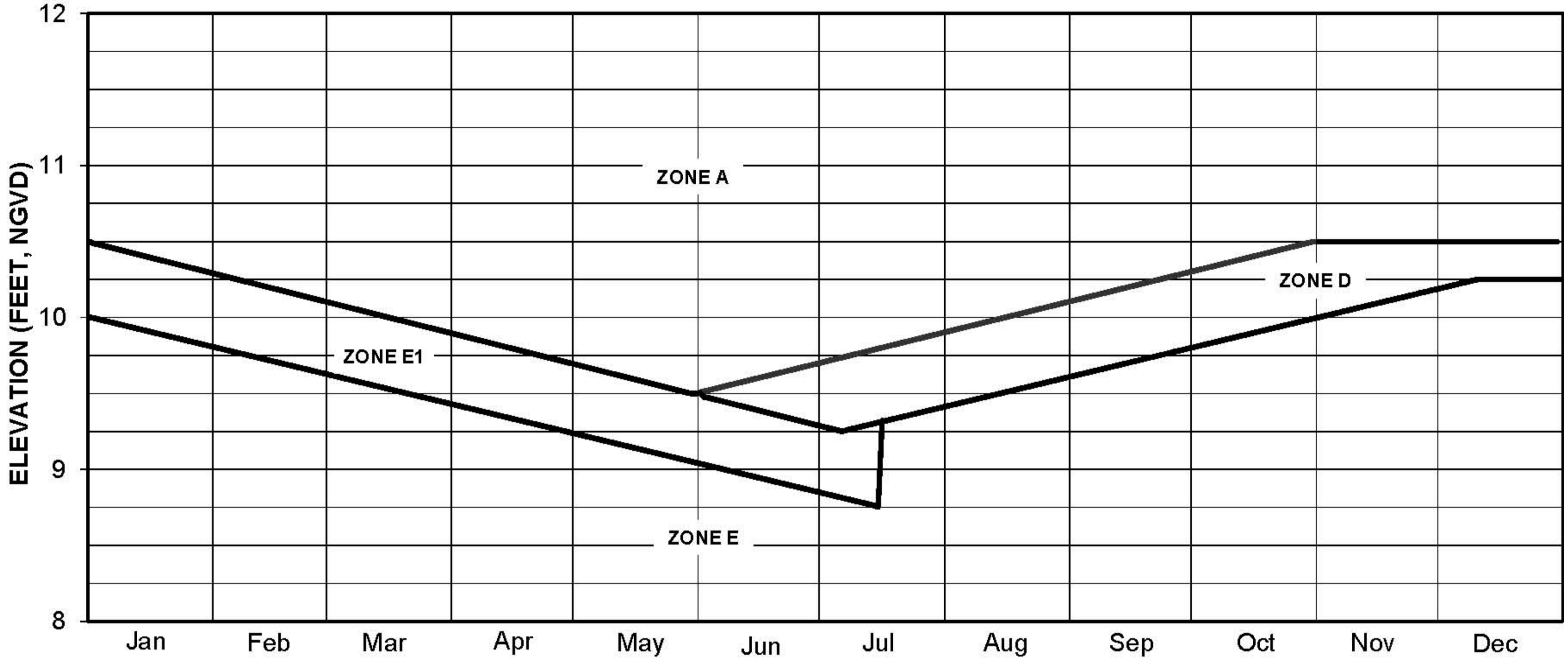
## 4 RECOMMENDED PLAN ELEMENTS

The USACE initiated an emergency deviation on September 15, 2017 from MWD Increment 1 Plus and the 2012 Water Control Plan in order to provide high water relief for WCA 3A and the SDCS in the wake of Hurricane Irma. These emergency deviation actions will be in effect until the WCA 3A 3 AVG reaches the bottom of Zone A of the WCA 3A Regulation Schedule (**Figure 5**).

Emergency water management actions implemented on September 15, 2017 include: 1) raising the maximum operating limit in the L-29 Canal up to 8.5 feet NGVD until the WCA 3 3AVG falls below Zone A of the WCA 3A Regulation Schedule; 2) use of the S-356 structure (up to 500 cubic feet per second (cfs)) to provide flood relief along L-31N Canal between structures S-335 and G-211 along the eastern side of Everglades National Park; and 3) use of S-357 (up to 575 cubic feet per second, cfs) to provide flood mitigation to the 8.5 Square Mile Area (SMA) due to excessive seepage from high water levels within Northeast Shark River Slough; 4) continued implementation of the June 2017 WCA 3A Planned

Temporary Deviation (on-going); and 5) continued implementation of July 2017 WCA 2A Planned Temporary Deviation (ongoing).

On October 6, 2017, USACE again received approval from its South Atlantic Division to implement a planned temporary deviation to further mitigate for stages within WCA 3A. The planned temporary deviation includes delayed closure of the S-12A and S-12B structures along with reopening of the S-343A, S-343B and S-344 structures until the WCA 3 three gage average falls below the MWD Increment 1 Action Line (10.75 feet NGVD) or January 1, 2018 (**Figure 5**).




**Notes: Zones B and C do not exist.** Use 3-gage average elevation (Sites 63, 64, and 65). If 3-gage average is in Zone D from 1 June through 14 July, Zone E1 operating criteria may be utilized.

**Zone A:** Up to maximum releases at S-12A, S-12B, S-12C, S-12D, S-333, S-334, S-343A, S-343B, S-344, and S-151 subject to attached Part C and WCA-3A, ENP, and ENP-SDCS Water Control Plan.

**Zones D, E:** Goal is to release 45% and 55% at S-12s and S-333, respectively, of the computed flow for Shark River Slough, subject to attached Part C and WCA-3A, ENP, and ENP-SDCS Water Control Plan.

**Zone E1:** Up to maximum releases at S-12C, S-12D, S-142, S-151, S-31, S-337, S-335, S-333, S-355A, S-355B and S-334 subject to attached Part C and WCA-3A, ENP, and ENP-SDCS Water Control Plan. The goal of Zone E1 is to address the reduction of WCA-3A releases due to CSSS-A structure closure periods.

CENTRAL AND SOUTHERN FLORIDA PROJECT

**WATER CONSERVATION AREA NO. 3A INTERIM REGULATION SCHEDULE**

PART A

DATED: March 2012
US ARMY ENGINEER DISTRICT
JACKSONVILLE, FLORIDA

**FIGURE 5: ERTP WATER CONSERVATION AREA 3A INTERIM REGULATION SCHEDULE**

# 5 DESCRIPTION OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

## 5.1 AFFECTED ENVIRONMENT

The action area includes NESRS, Western Shark River Slough, WCA-1, WCA-2 and WCA-3, Taylor Slough, the Lower East Coast area, 8.5 SMA, and Biscayne and Florida bays. The 2012 ERTP FEIS provides a full description of the affected environment within the action area and is incorporated into this document by reference. This information is available for review at: http://141.232.10.32/pm/program_docs/ertp.aspx. Additional information on existing conditions can be found within the 2017 Planned Temporary Deviation EA/FONSI (**Appendix A**).

### 5.1.1. VEGETATIVE COMMUNITIES

The Everglades landscape is dominated by a complex of freshwater wetland communities that includes open water sloughs and marshes, dense grass- and sedge-dominated marshes, forested islands, and wet marl prairies. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrological regime (FWS 1999). These communities generally occur along a hydrological gradient with the slough/open water marsh communities occupying the wettest areas (flooded more than nine months per year), followed by sawgrass marshes (flooded six to nine months per year), and wet marl prairie communities (flooded less than six months per year) (FWS 1999). The freshwater wetlands of the Everglades eventually grade into intertidal mangrove wetlands and subtidal seagrass beds in the estuarine waters of Florida Bay.

Development and drainage over the last century have dramatically reduced the overall spatial extent of freshwater wetlands within the Everglades, with approximately half of the pre-drainage 1.2 million hectares of wetlands being converted for development and agriculture (Davis and Ogden 1997). Alteration of the normal flow of freshwater through the Everglades has also contributed to conversions between community types, invasion by exotic species, and a general loss of community diversity and heterogeneity. Vegetative trends in ENP have included a substantial shift from the longer hydroperiod slough/open water marsh communities to shorter hydroperiod sawgrass marshes (Davis and Ogden 1997; Armentano et al. 2006). In addition, invasion of sawgrass marshes and wet prairies by exotic woody species has led to the conversion of some marsh communities to forested wetlands (Gunderson et al 1997).

Vegetative communities of the WCAs have suffered from both overdrainage and prolonged periods of inundation associated with the stabilization of water levels (USACE 1999a). Increased flooding and water depths in WCA-2A have resulted in the loss of wet prairie communities, drowning of tree islands, and loss of sawgrass marshes along slough edges. Major plant communities of WCA-2A now consist of remnant (drowned) tree islands, open water sloughs, and large expanses of sawgrass and sawgrass-cattail marshes. The increase in cattails in WCA-2A is attributed to increased nutrient loading associated with agricultural runoff. WCA-2B has suffered from lowered water levels resulting in heavy melaleuca (*Melaleuca quinquenervia*) infestations throughout the area. Increased deliveries of water to

WCA-2B, associated with drawdowns of WCA-2A in the 1980s, has helped somewhat to slow the advance of melaleuca.

Many areas of WCA-3A still contain relatively good wetland habitat consisting of a complex of tree islands, sawgrass marshes, wet prairies, and aquatic sloughs. Water lilies (*Nymphaea alba*) were originally widespread in sloughs throughout many areas of WCA-3A (McVoy et al. 2011). Reduced freshwater inflow and drainage by the Miami Canal have overdrained the northern portion of WCA-3A, resulting in increased fire frequency and the associated loss of tree islands, wet prairie, and aquatic slough habitat. Northern WCA-3A is currently dominated largely by mono-specific sawgrass stands with large areas of shrubs and monotypic cattail. In addition, northern WCA-3A lacks the diversity of communities that exists in southern WCA-3A. In southern WCA-3A, Wood and Tanner (1990) documented the trend toward deep water lily dominated sloughs due to impoundment. In approximately 1991, the hydrology of southern WCA-3A shifted to the deeper water and extended hydroperiods of the new, wet hydrologic era resulting in a northward shift in slough vegetation communities within the WCA-3A impoundment (Zweig and Kitchens 2008). Typical Everglades' vegetation, including tree islands, wet prairies, sawgrass marshes, and aquatic sloughs also occur throughout WCA-3B. However, within WCA-3B, the ridge and slough landscape has been severely degraded by the virtual elimination of overland sheetflow due to the L-67 Canal and levee system. WCA-3B experiences very little overland flow and has become primarily a rain-fed system predominated by shorter hydroperiod sawgrass marshes with relatively few sloughs or tree islands remaining. Water levels in WCA-3B are also too low and do not vary seasonally, contributing to poor ridge and slough patterning. Loss of sheetflow to WCA-3B has also accelerated soil loss, reducing elevations of the remaining tree islands in WCA-3B and making them vulnerable to high water stages.

Vegetative trends in ENP have included a substantial shift from the longer hydroperiod slough/open water marsh communities to shorter hydroperiod sawgrass marshes (Davis and Ogden 1997, Armentano et al. 2006). Flows through Shark River Slough under current system compartmentalization and water management practices are greatly reduced when compared with pre-drainage conditions. The result has been lower wet season depths and more frequent and severe dry downs in sloughs and reduction in extent of shallow water edges (McVoy et al. 2011). Overdrainage in the peripheral wetlands along the eastern flank of (NESRS) has resulted in shifts in community composition, invasion by exotic woody species, and increased susceptibility to fire. Areas within the eastern marl prairies along the boundary of ENP suffer from overdrainage, reduced water flow, exotic tree invasion, and frequent human-induced fires (Lockwood et al. 2003; Ross et al. 2006). In addition, invasion of sawgrass marshes and wet prairies by exotic woody species has led to the conversion of some marsh communities to forested wetlands (Gunderson et al. 1997).

The estuarine communities of Florida Bay have also been affected by upstream changes in freshwater flows through the Everglades. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (FWS 1999).

In contrast to the vast extent of wetland communities, upland communities comprise a relatively small component of the Everglades landscape and are largely restricted to Long Pine Key, the northern shores of Florida Bay, and the many tree islands scattered throughout the region. Vegetative communities of Long Pine Key include rockland pine forest and tropical hardwood forest. In addition, substantial areas of tropical hardwood hammock occur along the northern shores of Florida Bay and on elevated portions of some forested islands.

### 5.1.2. SLOUGH/OPEN WATER MARSH

The slough/open water marsh community occurs in the lowest, wettest areas of the Everglades. This community is a complex of open water marshes containing emergent, floating aquatic, and submerged aquatic vegetation components. The emergent marsh vegetation is typically dominated by spikerushes (*Eleocharis cellulosa* and *E. elongata*), beakrushes (*Rhynchospora tracyi* and *R. inundata*), and maidencane (*Panicum hemitomon*). Common floating aquatic dominants include fragrant water lily (*Nymphaea odorata*), floating hearts (*Nymphoides aquatica*), and spatterdock (*Nuphar lutea*); and the submerged aquatic community is typically dominated by bladderwort (*Utricularia foliosa*) and periphyton. As shown by Davis et al. (1997), vegetative trends in the ENP have included the conversion of slough/open water marsh communities to shorter hydroperiod sawgrass marshes.

### 5.1.3. SAWGRASS MARSH

Sawgrass marshes are dominated by dense to sparse stands of *Cladium jamaicense*. Sawgrass marshes occurring on deep organic soils (more than one meter) form tall, dense, nearly monospecific stands. Sawgrass marshes occurring on shallow organic soils (less than one meter) form sparse, short stands that contain additional herbaceous species such as spikerush, water hyssop (*Bacopa caroliniana*), and marsh mermaid weed (*Proserpinaca palustris*) (Gunderson et al. 1997). The adaptations of sawgrass to flooding, burning, and oligotrophic conditions contribute to its dominance of the Everglades vegetation. Sawgrass-dominated marshes once covered an estimated 300,000 acres of the Everglades. Approximately 70,000 acres of tall, monospecific sawgrass marshes have been converted to agriculture in the EAA. Urban encroachment from the east and development within other portions of the Everglades has consumed an additional 79,000 acres of sawgrass-dominated communities (Davis and Ogden 1997).

### 5.1.4. WET MARL PRAIRIE

Wet marl prairies occur on marl soils and exposed limestone and experience the shortest hydroperiods of the slough/marsh/prairie wetland complex. Marl prairie is a sparsely vegetated community that is typically dominated by muhly grass (*Muhlenbergia capillaris*) and short-stature sawgrass. Additional important constituents include black sedge (*Schoenus nigricans*), arrowfeather (*Aristida purpurascens*), Florida little bluestem (*Schizachyrium rhizomatum*), and Elliot's lovegrass (*Eragrostis elliottii*). Periphyton mats that grow loosely attached to the vegetation and exposed limestone also form an important component of this community. Marl prairies occur in the southern Everglades along the eastern and western periphery of SRS. Approximately 146,000 acres of the eastern marl prairie have been lost to urban and agricultural encroachment (Davis and Ogden 1997). Pollen data indicate that the marl prairies west of SRS are not a natural feature of the Everglades landscape, but developed after twentieth century hydrologic modification of the system reduced flow to the region (Bernhardt and Willard 2006). Prior to the modifications, plant communities at the sites analyzed by Bernhardt and Willard (2006) in western SRS consisted of sawgrass marshes. The authors concluded that "the current spatial distribution and community composition of marl prairies are a response to water management and land cover changes of the twentieth century; and further sampling of modern marl prairie communities and adjacent communities is necessary to document the pre- and post-drainage distribution of marl prairie" (Bernhardt and Willard 2006).

### 5.1.5. TREE ISLANDS

Tree islands occur within the freshwater marshes in areas of slightly higher elevation relative to the surrounding marsh. The lower portions of tree islands are dominated by hydrophytic, evergreen, broad-leaved hardwoods such as red bay (*Persea palustris*), sweetbay, dahoon holly (*Ilex cassine*), and pond apple (*Annona glabra*). Tree islands typically have a dense shrub layer that is dominated by coco-plum (*Chrysobalanus icaco*). Additional constituents of the shrub layer commonly include buttonbush and large leather fern (*Acrostichum danaeifolium*). Elevated areas on the upstream side of some tree islands may contain an upland tropical hardwood hammock community dominated by species of West Indian origin (Gunderson et al. 1997), with species composition shifting toward the north toward more temperate hardwood hammock species. Extended periods of flooding may result in tree mortality and conversion to a non-forested community. In the overdrained areas of WCA-3A, historic wildfires have consumed tree island vegetation and soils. Overall, the spatial extent of tree islands in WCA-3 declined by 61% between 1940 and 1995 (Patterson and Finck 1999). Portions of the WCAs have been flooded to the extent that many forested islands have lost all tropical hardwood hammock trees. Tree islands are considered an extremely important contributor to habitat heterogeneity and overall species diversity within the Everglades ecosystem because they provide nesting habitat and refugia for birds and upland species and serve as hotspots of plant species diversity within the Greater Everglades (Sklar and van der Valk 2002, FWS 1999). Tree islands also contain extraordinarily high levels of total phosphorus in their soil suggesting that they may play a major role in the biogeochemical cycles of nutrients in the Everglades (Troxler and Childers 2010; Wetzel et al. 2009, 2011). Wetzel et al. (2011) found that soil total phosphorus levels within WCA-3A and WCA-3B tree islands were approximately 4 times higher than the surrounding marsh total phosphorus levels. Tree islands within WCA-3B may help to capture and focus nutrients, assisting to minimize potential effects on sawgrass and wet prairie communities within this region (Wetzel et al. 2011).

### 5.1.6. MANGROVES

Mangrove communities are forested wetlands occurring in intertidal, low-wave-energy, estuarine, and marine environments. Within the action area, extensive mangrove communities occur in the intertidal zone of Florida Bay. Mangrove forests have a dense canopy dominated by four species: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). Mangrove communities occur within a range of salinities from 0 to 40 parts per thousand (ppt). Florida Bay experiences salinities in excess of 40 ppt on a seasonal basis. Declines in freshwater flow through the Everglades have altered the salinity balance and species composition of mangrove communities within Florida Bay. Changes in freshwater flow can lead to an invasion by exotic species such as Australian pine (*Casuarina equisetifolia*) and Brazilian pepper (*Schinus terebinthifolius*).

### 5.1.7. SEAGRASS BEDS

Seagrasses are submerged vascular plants that form dense rooted beds in shallow estuarine and marine environments. This community occurs in subtidal areas that experience moderate wave energy. Within the action area, extensive seagrass beds occur in Florida Bay. The most abundant seagrasses in south Florida are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Additional species include star grass (*Halophila engelmannii*), paddle grass (*Halophila decipiens*), and Johnson's seagrass (*Halophila johnsonii*). Widgeon grass may also occur in seagrass beds in areas of low salinity. Seagrasses have an optimum salinity range of 24 to 35 ppt, but can tolerate considerable short term salinity fluctuations. Large-scale seagrass die-off has occurred in Florida Bay since 1987, with over 18% of the total bay area affected. Suspected causes of seagrass mortality include high salinities and temperatures during the 1980s and long-term reductions of freshwater inflow to Florida Bay (RECOVER 2009).

### 5.1.8. ROCKLAND PINE FOREST

Pine rocklands within the action area occur on the Miami Rock Ridge and extend into the Everglades as Long Pine Key. Pine rocklands occur on relatively flat terrain with moderately to well-drained soils. Most sites are wet for only short periods following heavy rains (Florida Natural Areas Inventory 1990). Limestone bedrock is close to the surface and the soils are typically shallow accumulations of sand, marl, and organic material. Pine rockland is an open, savanna-like community with a canopy of scattered south Florida slash pine (*Pinus elliottii* var. *densa*) and an open, low-stature understory. This is a fire-maintained community that requires regular burns to maintain the open shrub/herbaceous stratum and to control hardwood encroachment (Gunderson 1997). The overstory is comprised of scattered South Florida slash pines. The shrub layer is comprised of a diverse assemblage of tropical and temperate species. Common shrubs include cabbage palm (*Sabal palmetto*), coco-plum (*Chrysobalanus icaco*), myrsine (*Rapanea punctata*), saw palmetto (*Serenoa repens*), southern sumac (*Rhus copallinum*), strangler fig (*Ficus aurea*), swamp bay (*Persea palustris*), wax myrtle (*Myrica cerifera*), white indigo berry (*Randia aculeata*), and willow-bustic (*Sideroxylon salicifolium*). The herbaceous stratum is comprised of a very diverse assemblage of grasses, sedges, and forbs. Common herbaceous species include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), hairy bluestem (*Andropogon longiberbis*), bushy bluestem (*Andropogon glomeratus* var. *pumilis*), candyweed (*Polygala grandiflora*), creeping morning-glory (*Evolvulus sericeus*), pineland heliotrope (*Heliotropium polyphyllum*), rabbit bells (*Crotolaria rotundifolia*), and thistle (*Cirsium horridulum*) (FWS 1999). This community occurs on areas of relatively high elevation and consequently, has been subject to intense development pressure. In addition, fragmentation, fire suppression, invasion by exotic species, and a lowered water table have negatively affected the remaining tracts of pine rockland (FWS 1999).

### 5.1.9. TROPICAL HARDWOOD HAMMOCK

Tropical hardwood hammocks occur on upland sites where limestone is near the surface. Tropical hardwood hammocks within the action area occur on the Miami Rock Ridge, along the northern shores of Florida Bay, and on elevated outcrops on the upstream side of tree islands. This community consists of a closed canopy forest dominated by a diverse assemblage of hardwood tree species, a relatively open shrub layer, and a sparse herbaceous stratum. This community is dominated by West Indian species and contains numerous species whose entire United States distribution is limited to tropical hammocks of South Florida. Common canopy species include gumbo-limbo (*Bursera simaruba*), paradise tree (*Simarouba glauca*), pigeon-plum (*Coccoloba diversifolia*), strangler fig, wild mastic (*Sideroxylon foetidissimum*), willow-bustic, live oak (*Quercus virginiana*), short-leaf fig (*Ficus citrifolia*), and wild tamarind (*Lysiloma bahamense*). Common understory species include black ironwood (*Krugiodendron ferreum*), inkwood (*Exothea paniculata*), lancewood (*Ocotea coriacea*), marlberry (*Ardisia escallonoides*), poisonwood (*Metopium toxiferum*), satinleaf (*Chrysophyllum oliviforme*), and white stopper (*Eugenia axillaris*). Common species of the sparse shrub/herbaceous layer include shiny-leaf wild-coffee (*Psychotria nervosa*), rouge plant (*Rivinia humilis*), false mint (*Dicliptera sexangularis*), bamboo grass (*Lasciacis divaricata*), and woods grass (*Oplismenus hirtellus*). This community occurs on areas of relatively high elevation and consequently, has been subject to intense development pressure. Fragmentation of remaining tracts, invasion by exotic species, and alterations of water table elevations have also had negative impacts on this community. Tropical hardwood hammocks on the Miami Rock Ridge have been affected by a lowered water table associated with the reduction of freshwater flow through the Everglades. In contrast, tree islands in the WCAs have been flooded to the extent that many have lost all tropical hardwood hammock trees.

## 5.2 FEDERALLY LISTED SPECIES

USACE has coordinated the existence of federally listed species with FWS and NMFS, as appropriate. Specifically, coordination with NMFS includes listed fish and sea turtles at sea. Coordination with FWS includes other listed plants and animals (FWS 2010). Twenty-nine federally listed threatened and endangered species are either known to exist or potentially exist within the action area and, subsequently, may be affected by the proposed action (**Table 5**). Many of these species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation.

Federally listed species that are known to exist or potentially exist within the action area are listed in **Table 5**. In addition, as also noted in **Table 5,** a number of candidate animal species are also known to exist or potentially exist within ERTP action area. Adverse effects to federally listed candidate species are not anticipated due to implementation of the 2017 Planned Temporary Deviation.

As noted in **Section 2**, this Biological Assessment is only being prepared for CSSS. On October 1, 2017, USACE requested emergency ESA consultation to address high water concerns within WCA 3A. In our emergency ESA consultation, USACE made the following species effects determinations as related to the three species identified within the

2016 ERTP BO. Specifically, USACE determined that the Planned Temporary Deviation may affect, but is not likely to adversely affect, endangered CSSS, endangered Everglade snail kite, or threatened wood stork. By email dated September 28, 2017 FWS concluded that the proposed water management actions of delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-343B and S-344 structures required formal consultation for CSSS. Therefore, in accordance with the ESA, USACE is initiating formal ESA consultation and assessing potential effects on CSSS via this Biological Assessment for the October 2017 Emergency and Planned Temporary Deviation Post Hurricane Irma.

## TABLE 5: STATUS OF THREATENED AND ENDANGERED SPECIES LIKELY TO BE AFFECTED BY 2017 PLANNED TEMPORARY DEVIATION AND USACE'S AFFECT DETERMINATION

| Common Name | Scientific Name | Status | May Affect | No Effect |
|---|---|---|---|---|
| **Mammals** | | | | |
| Florida panther | *Puma concolor coryi* | E | | X |
| Florida manatee | *Trichechus manatus latirostris* | E, CH | | X |
| Florida bonneted bat | *Eumops floridanus* | E | | X |
| **Birds** | | | | |
| Cape Sable seaside sparrow | *Ammodramus maritimus mirabilis* | E, CH | X | |
| Snail kite | *Rostrhamus sociabilis plumbeus* | E, CH | X | |
| Red-cockaded woodpecker | *Picoides borealis* | E | | X |
| Roseate tern | *Sterna dougallii* | T | | X |
| Wood stork | *Mycteria americana* | T | X | |
| **Reptiles** | | | | |
| American Alligator | *Alligator mississippiensis* | T, SA | | X |
| American crocodile | *Crocodylus acutus* | T, CH | | X |
| Eastern indigo snake | *Drymarchon corais couperi* | T | | X |
| Gopher tortoise | *Gopherus polyphemus* | C | | X |
| Green sea turtle* | *Chelonia mydas* | E | | X |
| Hawksbill sea turtle* | *Eretmochelys imbricata* | E | | X |
| Kemp's Ridley sea turtle* | *Lipodochelys kempii* | E | | X |
| Leatherback sea turtle* | *Dermochelys coriacea* | E | | X |
| Loggerhead sea turtle* | *Caretta* | E | | X |
| **Fish** | | | | |
| Smalltooth sawfish* | *Pristis pectinata* | E, CH | | X |
| **Invertebrates** | | | | |
| Bartram's hairstreak butterfly | *Strymon acis bartrami* | E, CH | | X |
| Elkhorn coral* | *Acropora palmata* | T, CH | | X |
| Florida leafwing butterfly | *Anaea troglodyta floridalis* | E, CH | | X |
| Miami blue butterfly | *Cyclargus thomasi bethunebakeri* | E | | X |
| Schaus swallowtail butterfly | *Heraclides aristodemus ponceanus* | E | | X |
| Staghorn coral* | *Acropora cervicornis* | T, CH | | X |
| Stock Island tree snail | *Orthalicus reses* (not incl. *nesodryas*) | T | | X |
| **Plants** | | | | |
| Deltoid spurge | *Chamaesyce deltoidea* spp. *Deltoidea* | E | | X |
| Garber's spurge | *Chamaesyce garberi* | T | | X |
| Johnson's seagrass* | *Halophila johnsonii* | E, CH | | X |
| Okeechobee gourd | *Cucurbita okeechobeensis* ssp. *okeechobeenis* | E | | X |
| Small's milkpea | *Galactia smallii* | E | | X |
| Tiny polygala | *Polygala smallii* | E | | X |
| Blodgett's silverbush | *Argythamnia blodgettii* | T | | X |
| Cape Sable thoroughwort | *Chromolaena frustrata* | E, CH | | X |
| Everglades bully | *Sideroxylon reclinatum* spp. *austrofloridense* | C | | X |
| Florida bristle fern | *Trichomanes punctatum* spp. *Floridanum* | E | | X |
| Florida pineland crabgrass | *Digitaria pauciflora* | C | | X |

| | | | | |
|---|---|---|---|---|
| Florida prairie clover | | E | | X |
| Crenulate Lead Plant | | C | | X |
| Carter’s small flowered flax | | E, CH | | X |
| Florida Brickell- bush | | E, CH | | X |
| Florida semaphore cactus | | E, CH | | X |
| Sand flax | | E | | X |
| Pineland sandmat | *Chamaesyce deltoidea* ssp. *Pinetorum* | C | | X |

*Marine species under the purview of NMFS
E=Endangered; T=Threatened; SA=Similarity of Appearance; CH=Critical Habitat; C=Candidate Species, PE: Proposed endangered

## 5.3 DESIGNATED CRITICAL HABITAT

In addition to threatened and endangered species, the action area also includes or is adjacent to designated critical habitat for Florida manatee, CSSS (**Figure 6**), snail kite, American crocodile, Bartram’s hairstreak butterfly, Florida leafwing butterfly, Cape Sable thoroughwort, Carter’s small flowered flax, Florida Brickell-bush. Florida semaphore cactus, smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson’s seagrass. Please note that smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson’s seagrass fall under the purview of NMFS.

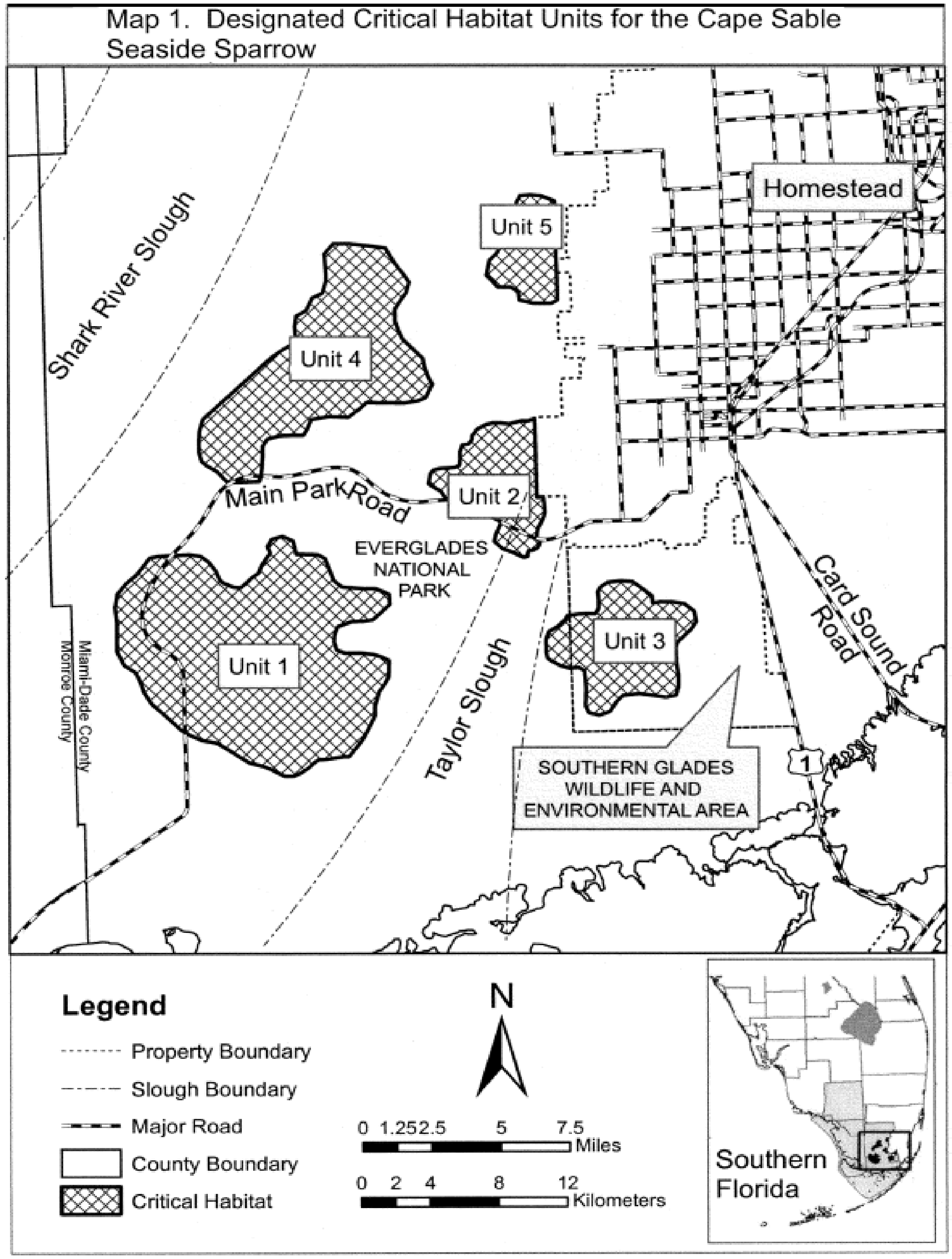



**FIGURE 6: CRITICAL HABITAT FOR THE CAPE SABLE SEASIDE SPARROW**

Designated critical habitat for the Cape Sable seaside sparrow include areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Dade, and Monroe counties, with the following components: those portions of ENP within T57S R36E, T57S R36E, T57S R37E, T58S R35E, T58S R36E, T58S R37E, T58S R35E, T58S R36E, T59S R35E, T59S R36E, T59S R37E. Areas outside of ENP within T55S R37E Sec. 36; T55S R38E Sec. 31, 32; T56S R37E Sec. 1, 2, 11-14, 23-26; T56S R38E Sec. 5-7, 18, 19; T57S R37E Sec. 5-8; T58S R38E

Sec. 27, 29-32; T59S R38E Sec. 4 (CFR Vol. 72, No. 214 / 11-6-07). All of the designated CSSS critical habitat lies within the ERTP action area.

## 5.4 "MAY AFFECT" DETERMINATION

Under provisions of emergency consultation on October 1, 2017 the USACE determined that the Proposed Action may affect, but is not likely to adversely affect, the endangered CSSS if delayed closure of S-12A, S-12B, and reopening of S-343A, S-343B and S-344 is not implemented. If the planned temporary deviation is implemented, the USACE concluded that the action may affect CSSS and will initiate formal consultation under the ESA of 1973, as amended. On October 6, 2017 delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-343B and S-344 structures was approved at the USACE South Atlantic Division. Therefore, USACE determined that the action may affect the CSSS and formal consultation is initiated with the delivery of this Biological Assessment.

## 5.5 CAPE SABLE SEASIDE SPARROW AND "MAY EFFECT" DETERMINATION

Measuring 13-14 centimeters in length, CSSS is one of nine subspecies of seaside sparrows (Werner 1975). CSSS are non-migratory residents of freshwater to brackish marshes and their range is restricted to the lower Florida peninsula. They were originally listed as endangered in 1969 due to their restricted range (FWS 1999). Subsequent changes in their habitat have further reduced their range and continue to threaten this subspecies with extinction.

CSSS appear to prefer mixed marl prairie communities that include muhly grass (*Muhlenbergia filipes*) for nesting (Stevenson and Anderson 1994). These short-hydroperiod (the period of time during which a wetland is covered by water) prairies contain a mosaic of moderately dense, clumped grasses, interspersed with open space that permit ground movements by the sparrows (FWS 1999). According to previous literature, (Werner 1975; Bass and Kushlan 1982), CSSS are generally not found in communities dominated by dense sawgrass, cattail (*Typha* spp.) monocultures, long-hydroperiod wetlands with tall, dense vegetative cover, spikerush marshes, and sites supporting woody vegetation. However, recent research has revealed that CSSS within the Dogleg North plot sub-population B (CSSS-B) were successfully nesting in "very thick, tall sawgrass" (Virzi and Davis 2013; Slater et al. 2014). Curnett and Pimm (1993) indicated that CSSS also avoid sites with permanent water cover; however, more recent evidence has shown that CSSS successfully nested in areas in which "water levels were extremely high…approaching knee-deep at times with 100% coverage the entire summer" (Virzi and Davis 2013). The combination of hydroperiod and periodic fire events are critical in the maintenance of suitable mixed marl prairie communities for the CSSS (Kushlan and Bass 1983).

CSSS nest in the spring when the marl prairies are dry. While the majority of nesting activities have been observed between March 1 and July 15 when Everglades marl prairies are dry, (Lockwood et al. 1997, 2001), nesting has been reported as early as late February (Werner 1975), and as late as early August (Dean and Morrison 2001). Males will establish breeding territories in early February (Balent et al. 1998) and defend these territories throughout the breeding season (FWS 1999). Male sparrows vocalize to attract females and this particular breeding activity has been shown to decrease with increased surface water conditions (Nott et al. 1998; Curnutt and Pimm 1993).

Successful CSSS breeding requires that breeding season water levels remain at or below ground level in the breeding habitat. Nott et al. (1998) cited a "10-centimeter (cm)" rule for maximum water depth over which the CSSS will initiate nesting. This conclusion was based upon observations within the ENP range-wide survey in which no singing males were heard when water depths exceeded that level. However, Dean and Morrison (1998) demonstrated that nesting may occur when average water depths exceed this rule. In addition, more recent evidence has shown that not only were CSSS able to successfully breed in areas with standing water that was "approaching knee deep at times"; but also that they were able to successfully produce multiple broods (3) in the Dogleg Plot of CSSS-B "despite heavy rains that began in early-May and deep water levels that persisted throughout the breeding season in the study plot" (Virzi and Davis 2013; Slater et al. 2014).

CSSS construct their nests relatively close to the ground in clumps of grasses composed primarily of muhly, beakrushes (*Rhynchospora* spp.), and Florida little bluestem (*Schizachyrium rhizomatum)* (Pimm et al. 2002). The average early season nest height is 17 centimeters (6.7 inches) above ground, while the average late season nest height is 21 centimeters (8.3 inches) above ground (Lockwood et al. 2001). The shift in average nest height after the onset of the wet season rainfall pattern, which typically begins in early June (Lockwood et al. 2001), appears to be an adaptive response to rising surface water conditions. In general, the CSSS will raise one or two broods within a season; however, if weather conditions permit, a third brood is possible (Kushlan et al. 1982; FWS 1983). A new nest is constructed for each successive brood. The end of the breeding season is triggered by the onset of the rainy season when ground water levels rise above the height of the nest off the ground (Lockwood et al. 1997).

CSSS will lay three to four eggs per clutch (Werner 1978; Pimm et al. 2002) with a hatching rate ranging between 0.66 and 1.00 (Boulton et al. 2009b). The nest cycle lasts between 34 and 44 days in length and includes a 12-13 day incubation period, 9-11 day nestling period and 10-20 days of post-fledgling care by both parents (Sprunt 1968; Trost 1968; Woolfenden 1956, 1968; Lockwood et al. 1997; Pimm et al. 2002). Nest success rate varies between 21 and 60 percent, depending upon timing of nest initiation within the breeding season (Baiser et al. 2008; Boulton et al. 2009a). Substantially higher nest success rates occur within the early portion of the breeding season (approximately 60% prior to June 1) followed by a decline in success as the breeding season progresses to a low of approximately 21% after June 1(Baiser et al. 2008; Boulton et al. 2009a; Virzi et al. 2009). In most years, June 1 is a good division between the early high success period and the later, lower success period (Dr. Julie Lockwood email correspondence to FWS, October 15, 2009). Nearly all nests that fail appear to fail due to predation, and predation rates appear to increase as water level increases (Lockwood et al. 1997, 2001; Baiser et al. 2008). A complete array of nest predators has not been determined.

However, raccoons *(Procyon lotor*), rice rats *(Oryzomys palustri*s), and snakes, including exotic pythons, may be the chief predators (Lockwood et al. 1997; Dean and Morrison 1998; Post 2007).

A dietary generalist, CSSS feed by gleaning food items from low-lying vegetation (Ehrlich et al. 1992; Pimm et al. 2002). Common components of their diet include soft-bodied insects such as grasshoppers, spiders, moths, caterpillars, beetles, dragonflies, wasps, marine worms, shrimp, grass, and sedge seeds (Stevenson and Anderson 1994). The importance of individual food items appears to shift in response to their availability (Pimm et al. 2002).

CSSS are non-migratory with males displaying high site fidelity, defending the same territory for two to three years (Werner 1975). CSSS are capable of both short-distance and longer-range movements, but appear to be restricted to short hydroperiod prairie habitat (Dean and Morrison 1998). Large expanses of deep water or wooded habitat act as barriers to long-range movements (Dean and Morrison 1998). Recent research by Julie Lockwood, Ph.D. of Rutgers University and her students have revealed substantial movements between subpopulations east of Shark River Slough (Lockwood et al. 2008; Virzi et al. 2009), suggesting that CSSS has considerable capacity to colonize unoccupied suitable habitat (Sustainable Ecosystems Institute 2007).

In the 1930s, Cape Sable was the only known breeding range for CSSS (Nicholson 1928). Areas on Cape Sable that were occupied by CSSS in the 1930s have experienced a shift in vegetative communities from freshwater vegetation to mangroves, bare mud flats, and salt-tolerant plants, such as turtleweed (*Batis maritima*) and bushy seaside tansy (*Borrichia frutescens*) (Kushlan and Bass 1983). As a result, CSSS no longer use this area. More recently, continued alterations of CSSS habitat have occurred as a result of changes in the distribution, timing, and quantity of water flows in South Florida. Water flow changes and associated shifts in vegetation appear to be the leading contributor to the decline in CSSS population, which subsequently threaten the subspecies with extinction. Competition and nest also threatens CSSS.

Presently, the known distribution of CSSS is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades region (within ENP and BCNP) and the edge of Taylor Slough in the Southern Glades Wildlife and Environmental Area in Miami-Dade County. ENP staff first undertook a comprehensive survey of CSSS in 1981 to identify all areas where sparrows were present. This survey, hereafter referred to as the range-wide survey, resulted in the first complete range map for CSSS (Bass and Kushlan 1982; Kushlan and Bass 1983). The survey design consisted of a one-kilometer survey grid over any suspected CSSS habitat. As much of CSSS habitat is inaccessible, a helicopter was employed and landed at the intersection of each grid line (*i.e.* every 1 kilometer). At each site, the researchers would record every CSSS seen or heard (singing males) within an approximate 200 meter radius of their landing location (Curnutt et al. 1998). From the resulting range map, Curnutt et al. (1998) divided CSSS into six separate subpopulations, labeled as A through F (**Figure 7**), with subpopulation A (CSSS-A) as the only subpopulation west of Shark River Slough.

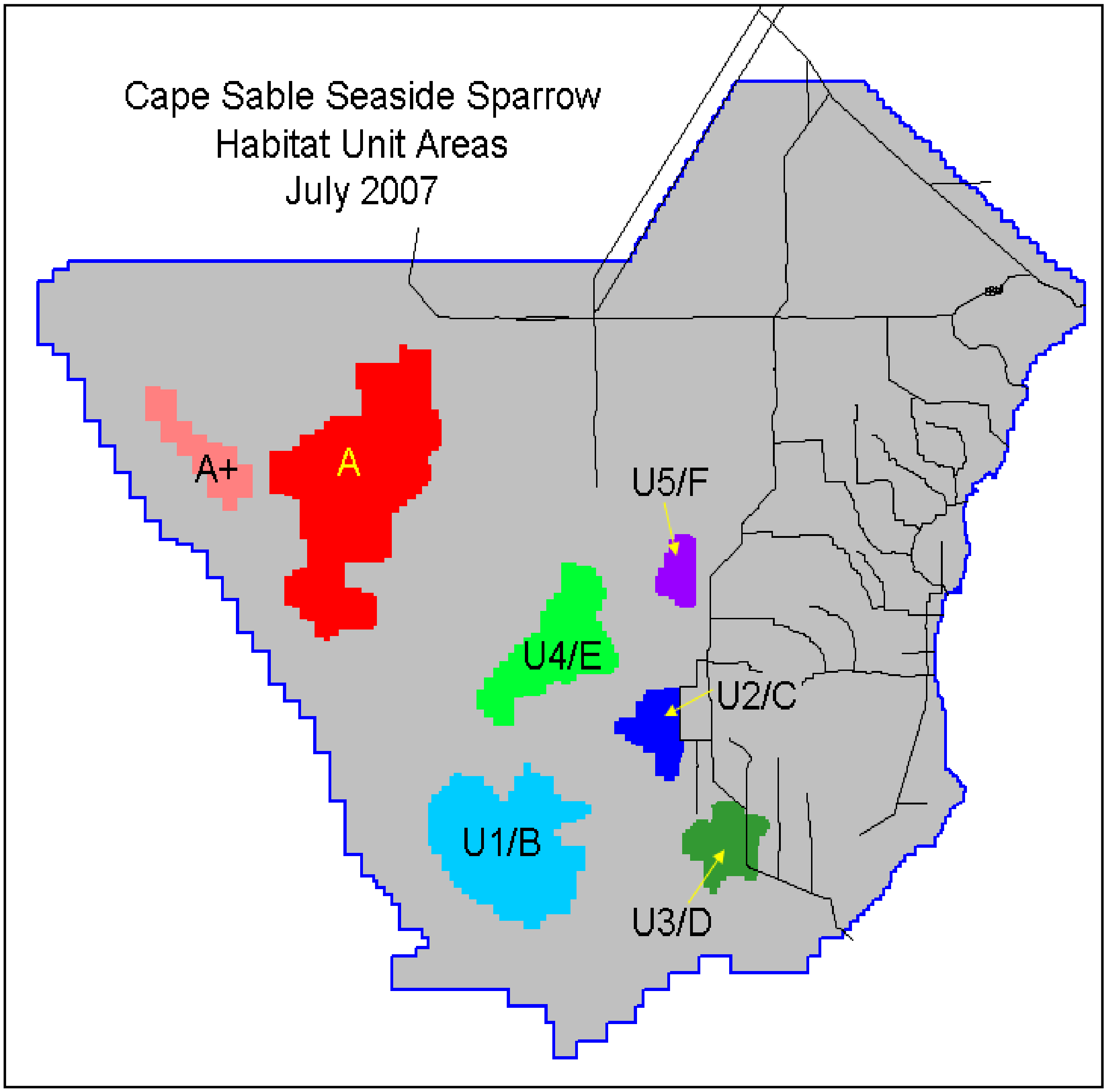



**FIGURE 7: CAPE SABLE SEASIDE SPARROW SUBPOPULATIONS (A-F) AND DESIGNATED CRITICAL HABITAT UNITS (U1-U5)**

After the 1981 survey, the population was not surveyed again until 1992. The range-wide survey has been performed annually since 1992, although the number of survey locations has changed from a high of over 850 sites in 1992 to a low of 250 sites in 1995 (Cassey et al. 2007).

Bass and Kushlan (1982) also devised a methodology of translating the range-wide survey results into an estimate of population size. To account for females (only males sing) and CSSS outside the audio detection range, the number of birds counted is multiplied by a factor of sixteen (15.87 rounded to 16). In order to confirm the validity of this estimation factor, Curnutt et al. (1998) compared the bird counts from the range-wide survey with actual mapped territories on intensive study plots and found it to be adequate given normal population fluctuations. More recent research indicates that this estimation factor may be overestimating population abundance within the smaller CSSS subpopulations (*i.e.* CSSS-A, C, D, F) due to the presence of floater males and a male-biased sex ratio (Boulton et al. 2009a). During CEPP ESA consultation, it was noted that a new population estimation methodology was necessary to more accurately assess small CSSS populations in light of this evidence. As a result, FWS has included within its CSSS MOU a provision for development of a new CSSS population estimation tool.

Based on the range-wide surveys, total CSSS populations have declined from approximately 6,600 individuals during the period from 1981-1992, to approximately 3,216 in 2015 (**Table 6**). Although populations decreased significantly during the early part of that time period, they have remained relatively constant since 1993 (**Figure 8**). Recognizing the limitations of the range-wide survey in detecting fine-scale changes in population abundance related to management actions (Walters et al. 2000; Lockwood et al. 2006), Cassey et al. (2007) translated the results of the range-wide survey into presence/absence data and then converted it into a measure of occupancy. In their study, occupancy was defined as the fraction of the area occupied by the species in any one year as employed by MacKenzie et al. (2002). Their results show that the proportion of CSSS range occupied decreased between 1981 and 1992, particularly in CSSS-C, CSSS-D, and CSSS-F; with a second period of decline between 1992 and 1996, most notably within CSSS-A. After 1996, overall occupancy has remained relatively constant (Cassey et al. 2007).

**TABLE 6: CAPE SABLE SEASIDE SPARROW BIRD COUNT AND POPULATION ESTIMATES BY YEAR AS RECORDED BY THE EVERGLADES NATIONAL PARK RANGE-WIDE SURVEY**

| Subpopulation | A | | B | | C | | D | | E | | F | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | BC | Pop Est* | BC | Pop Est* | BC | Pop Est* | BC | Pop Est* | BC | Pop Est* | BC | Pop Est* | BC | Pop Est* |
| 1981 | 168 | 2688 | 147 | 2352 | 27 | 432 | 25 | 400 | 42 | 672 | 7 | 112 | 416 | 6656 |
| 1992 | 163 | 2608 | 199 | 3184 | 3 | 48 | 7 | 112 | 37 | 592 | 2 | 32 | 411 | 6576 |
| 1993 | 27 | 432 | 154 | 2464 | 0 | 0 | 6 | 96 | 20 | 320 | 0 | 0 | 207 | 3312 |
| 1994 | 5 | 80 | 139 | 2224 | NS | NS | NS | NS | 7 | 112 | NS | NS | 151** | 2416** |
| 1995 | 15 | 240 | 133 | 2128 | 0 | 0 | 0 | 0 | 22 | 352 | 0 | 0 | 170 | 2720 |
| 1996 | 24 | 384 | 118 | 1888 | 3 | 48 | 5 | 80 | 13 | 208 | 1 | 16 | 164 | 2624 |
| 1997 | 17 | 272 | 177 | 2832 | 3 | 48 | 3 | 48 | 52 | 832 | 1 | 16 | 253 | 4048 |
| 1998 | 12 | 192 | 113 | 1808 | 5 | 80 | 3 | 48 | 57 | 912 | 1 | 16 | 191 | 3056 |
| 1999 | 25 | 400 | 128 | 2048 | 9 | 144 | 11 | 176 | 48 | 768 | 1 | 16 | 222 | 3552 |
| 1999b | 12 | 192 | 171 | 2736 | 4 | 64 | | 0 | 60 | 960 | 0 | 0 | 247 | 3952 |
| 2000 | 28 | 448 | 114 | 1824 | 7 | 112 | 4 | 64 | 65 | 1040 | 0 | 0 | 218 | 3488 |
| 2000b | 25 | 400 | 153 | 2448 | 4 | 64 | 1 | 16 | 44 | 704 | 7 | 112 | 234 | 3744 |
| 2001 | 8 | 128 | 133 | 2128 | 6 | 96 | 2 | 32 | 53 | 848 | 2 | 32 | 204 | 3264 |
| 2002 | 6 | 96 | 119 | 1904 | 7 | 112 | 0 | 0 | 36 | 576 | 1 | 16 | 169 | 2704 |
| 2003 | 8 | 128 | 148 | 2368 | 6 | 96 | 0 | 0 | 37 | 592 | 2 | 32 | 201 | 3216 |
| 2004 | 1 | 16 | 174 | 2784 | 8 | 128 | 0 | 0 | 40 | 640 | 1 | 16 | 224 | 3584 |
| 2005 | 5 | 80 | 142 | 2272 | 5 | 80 | 3 | 48 | 36 | 576 | 2 | 32 | 193 | 3088 |
| 2006 | 7 | 112 | 130 | 2080 | 10 | 160 | 0 | 0 | 44 | 704 | 2 | 32 | 193 | 3088 |
| 2007 | 4 | 64 | 157 | 2512 | 3 | 48 | 0 | 0 | 35 | 560 | 0 | 0 | 199 | 3184 |
| 2008 | 7 | 112 | NS | NS | 3 | 48 | 1 | 16 | 23 | 368 | 0 | 0 | 34** | 544** |
| 2009 | 6 | 96 | NS | NS | 3 | 48 | 2 | 32 | 27 | 432 | 0 | 0 | 38** | 608** |
| 2010 | 8 | 128 | 119 | 1904 | 2 | 32 | 4 | 64 | 57 | 912 | 1 | 16 | 191 | 3056 |
| 2011 | 11 | 176 | NS | NS | 11 | 176 | 1 | 16 | 37 | 592 | 2 | 32 | 62** | 992** |
| 2012 | 21 | 336 | NS | NS | 6 | 96 | 14 | 224 | 46 | 736 | 4 | 64 | 91** | 1456** |
| 2013 | 18 | 288 | 112 | 1792 | 8 | 128 | 1 | 16 | 45 | 720 | 1 | 16 | 185 | 2960 |
| 2014 | 4 | 64 | 114 | 1824 | 7 | 112 | 2 | 32 | 42 | 672 | 1 | 16 | 170 | 2720 |
| 2015 | 13 | 208 | 120 | 1920 | 7 | 112 | 4 | 64 | 55 | 880 | 2 | 32 | 201 | 3216 |
| 2016 | 3 | 48 | 114 | 1824 | 7 | 112 | 5 | 80 | 24 | 384 | 0 | 0 | 153 | 2448 |
| 2017 | 1 | 16 | 121 | 1936 | 3 | 48 | 4 | 64 | 75 | 1200 | 1 | 16 | 205 | 3280 |

BC: Bird Count; EST: Estimate; NS: Not Surveyed
* Population Estimate = Bird Count (BC) x 16
** Estimated totals in these years are not based on complete surveys of all subpopulations, and should not be directly compared with other years

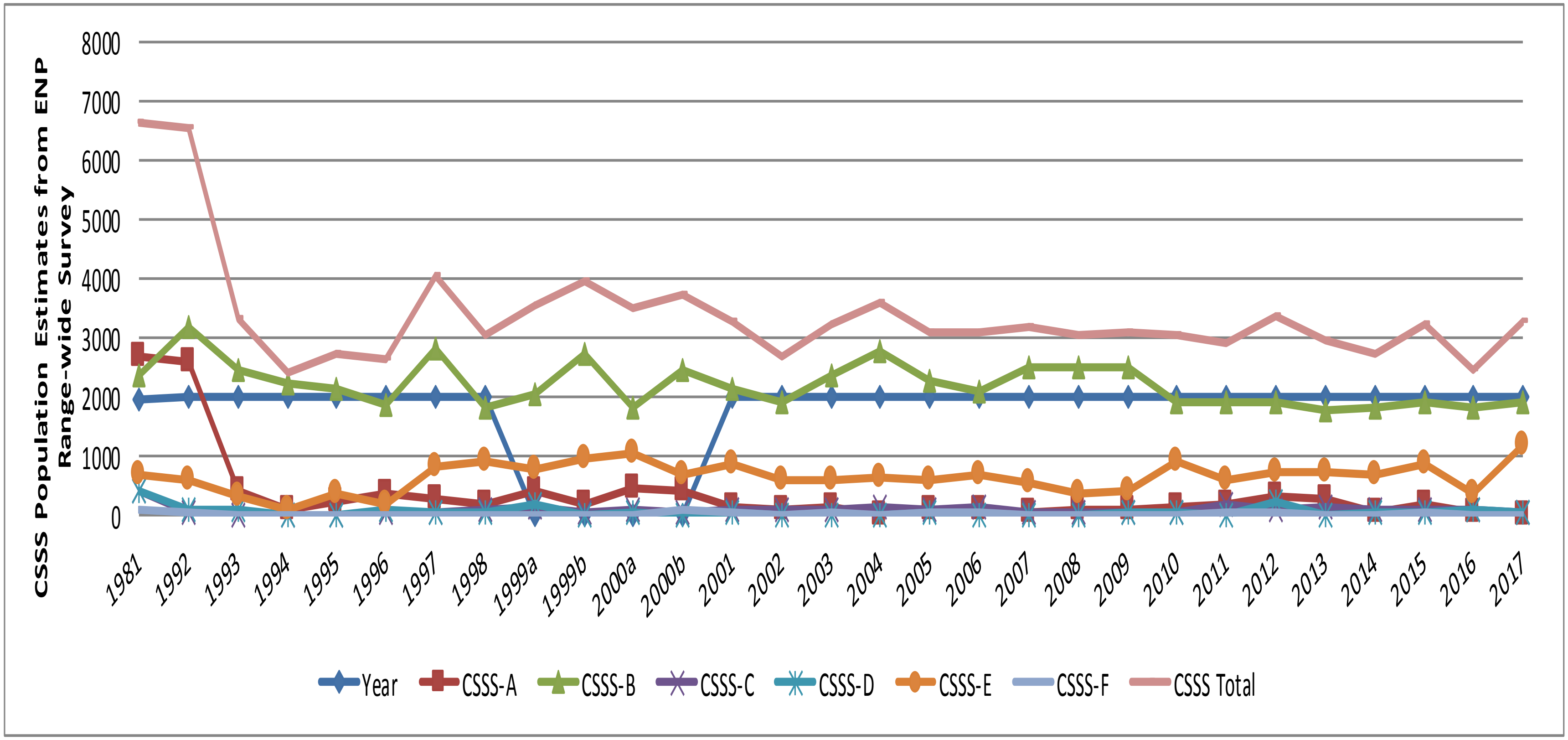



**FIGURE 8: CAPE SABLE SEASIDE SPARROW POPULATION ESTIMATES WITHIN EACH SUBPOPULATION AS REPORTED FROM THE EVERGLADES NATIONAL PARK RANGE-WIDE SURVEYS**

CSSS-A, once thought to be critical to the existence of CSSS, is located in western Shark River Slough, south of water discharges out of WCA-3A through the S-12 structures. Unusually intense and unseasonable rainy periods during the winter of 1992/93 and again in 1993/94 and 1994/95 caused prolonged flooding in CSSS-A, sufficient enough that the high water levels may have nearly precluded breeding in 1993 and 1995 (Walters et al. 2000). In addition, little or no breeding was possible during the 1994 and 1996 breeding seasons, due to the limited availability of suitable dry habitat. The flooding of the habitat by direct rainfall was compounded by discharges of water through the S-12 structures needed to meet the regulation schedule for WCA-3A. With an average life span of two to three years, several consecutive years with little or no reproduction could significantly affect population size. This is reflected in the reduction of sparrows detected in subsequent surveys in CSSS-A, in addition to the reduction in occupancy reported by Cassey et al. (2007) for the time period between 1992 and 1996. As a consequence, FWS issued a BO in 1999 providing recommendations to USACE on how water levels should be controlled within CSSS-A nesting habitat so that the existence of the CSSS would not be jeopardized. USACE responded by developing changes in water management operations through emergency deviations in 1998 and 1999, two iterations of ISOP in 2000 and 2001, culminating in IOP in 2002 and 2006, and then replaced in 2012 by ERTP, in order to address other endangered species concerns. ERTP has been in effect since October 2012. ISOP/IOP/ERTP goals were to keep subpopulations (particularly CSSS-A) dry during the breeding season and to also keep the habitat for subpopulations B, C, D, E, and F (CSSS-B, CSSS-C, CSSS-D, CSSS-E, and CSSS-F) from excessive drying in order to prevent adverse habitat change from unseasonable fire frequencies.

The primary objective in implementing IOP and maintaining CSSS water management operational restrictions under ERTP was to reduce high water levels within CSSS habitat west of Shark River Slough (*i.e.* CSSS-A). Water management operations designed to protect CSSS to the maximum extent possible during the nesting season in order to achieve FWS RPA to provide an improved opportunity for nesting by maintaining water levels below ground level for a minimum of 60 consecutive days between March 1 and July 15, corresponding to the CSSS breeding season. In addition, a secondary purpose of IOP was to allow CSSS habitat to recover from prolonged flooding during the mid-1990s. It is recognized in the 1999 FWS BO that there could be times when unseasonable rainfall events could overwhelm the ability of the water management system to provide the necessary dry conditions. Following implementation of IOP, the FWS recommendations for protection of the CSSS in CSSS-A were met in 2002, 2004, 2006, 2008, and 2009. Direct rainfall on CSSS-A prevented attainment of FWS RPA requirements for 2003, 2005 and 2007. Since 2010 FWS BO for ERTP, FWS recommendations for protection of CSSS-A were met in 2010, 2011, 2012, 2014, 2015, 2016 and 2017. Direct rainfall on CSSS-A in 2013 prevented meeting FWS RPA requirement of 60 consecutive dry days as measured at NP-205 between March 1 and July 15. As reported from the range-wide survey (**Table 6**), the estimated total CSSS population during IOP and ERTP has remained between 2,704 birds (2002) and 3,584 birds (2004). CSSS-A population estimates during IOP and ERTP ranged from a low of 16 (1 bird counted) in 2004 to a high of 336 (21 birds counted) in 2012. The population estimates for CSSS-A may be inflated due to the potential inaccuracy of the estimation factor in smaller subpopulations as suggested by recent research (Boulton et al. 2009a). In addition, it should also be noted that the estimates for a particular year have relevance for potential breeding that year, but this would not be reflected in the population estimates until the following year.

Another factor in lack of recovery is the change in vegetative structure resulting from physical alterations during the high water events of 1993 through 1995 and a shift in the vegetative community dominants away from previous species. This phenomenon was studied by Michael Ross, Ph.D. and Jay Sah, Ph.D. of Florida International University, along with James Synder of the United States Geological Survey (USGS) in a 2003-2009 monitoring study funded by USACE (Ross et al. 2003, 2004, 2006; Sah et al. 2007, 2008, 2009). Based upon several years of vegetation studies within CSSS habitat, the researchers concluded that the direction and magnitude of short-term vegetation change within marl prairie is dependent upon the position of the habitat within the landscape. Efforts to regulate operations of S-12 structures under ISOP/IOP/ERTP to protect CSSS-A and its habitat west of Shark River Slough have resulted in lower water depths during the sparrow breeding season as measured at Gauge NP-205. However, the persistence of wetter vegetation within the vicinity of gauge P-34 may have limited the recovery of CSSS-A within this part of its habitat. This suggests water flow from the northwest (*i.e.* western flows) and/or from changes in groundwater related to sea level rise may have resulted in deeper water levels and longer hydroperiods within this portion of CSSS-A habitat. This is one factor underlying the need for the Water Flow Analysis Test, as well as exploring options for the L-28 Borrow Canal. As shown in **Table 6,** CSSS-A has not recovered under IOP/ERTP operations, but has remained relatively stable since its implementation. Recent research suggests that sparrow populations are slow to recover, or cannot recover, once they reach very small population sizes, due to low adult and juvenile recruitment, many unmated males, biased sex ratios, lower hatch rates, and other adverse effects associated with small population size (*i.e.* the Allee effect) (Boulton et al. 2009a; Virzi et al. 2009). Virzi and Davis (2013) and Slater et al. (2014) have documented highly skewed sex ratios in favor of males within smaller CSSS populations studied (*i.e.* CSSS-A and CSSS-D) along with lower nest success rates. This, in addition to low return rate for males within CSSS-A, led Virzi and Davis (2013) to suggest that CSSS-A may be dropping below a critical threshold necessary to attract settling males due to lack of conspecific cues.

Vegetation change is mediated by the interaction of fire and hydrology. Studies by Sah et al. (2009) revealed that not only did post-fire flooding delay the vegetation recovery process, but also caused it to follow a different trajectory in terms of species composition. This in turn, could potentially impede recolonization by CSSS (Sah et al. 2009). The transition from one vegetation type to another (e.g. prairie to marsh) in response to hydrology may take place in as little as three to four years (Armentano et al. 2006), however, the transition from marsh to prairie may take longer (Ross et al. 2006, Sah et al. 2009). Vegetation studies within CSSS habitat (Ross et al. 2004) have shown that CSSS occupy prairies with a hydroperiod ranging between 90 and 240 days. ERTP ET 2 addresses this hydroperiod requirement. However, solely attaining this hydroperiod requirement may not be enough to promote a transition from marsh to prairie habitat, as this likely requires the process of fire (Ross et al. 2006, Sah et al. 2009). Recent research by Slater et al. (2014) noted the presence of apparently suitable sparrow habitat within the Lower Meadow of CSSS-A that had burned in 2009. This area had supported numerous breeding territories prior to the burn (La Puma et al. 2007); however in 2014 it remained unoccupied. Slater et al. (2014) speculate that there may not be enough surplus birds to recolonize this habitat, underscoring the hypothesis that CSSS-A may have reached a critical threshold due to small population size and may be unable to recover without intervention (e.g.. translocation).

## 5.6 POTENTIAL EFFECTS TO CAPE SABLE SEASIDE SPARROW

USACE recognizes that there are few opportunities within the current constraints of the C&SF system to completely avoid impacts to listed species. However, ERTP represents a transition from the single species management embodied within IOP to multi-species management to better meet the requirements of multiple species, including other endangered bird species. ERTP superseded IOP with the goal of providing favorable hydrological conditions for multiple wildlife species and the habitats upon which they depend, while continuing to provide a nesting window for the CSSS, particularly within CSSS-A. The purpose of the emergency and panned temporary deviation water management activities from MWD Increment 1 Plus and the 2012 Water Control Plan is to provide high water relief for WCA 3A until the WCA 3A 3 AVG falls below Zone A of the WCA 3A Regulation Schedule (**Figure 5**). The Planned Temporary Deviation includes delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-343B and S-344 structures until stages within WCA 3A fall below the Modified Water Deliveries to Everglades National Park (MWD) Project Increment 1 Action Line or January 1, 2018, whichever comes first. The WCAs are flooding in a manner that inundates tree islands and other wildlife habitat, and if sustained will negatively impact birds, including the endangered Everglade snail kite and threatened wood stork and mammals' dependent on that habitat. If the rate of rise is not mitigated to limit the prolonged duration of high water conditions, there is potential for these high water levels to pose greater risks to valuable natural resources, public health, safety or welfare as the wet season and hurricane season continue due to reduced flood storage.

### 5.6.1. DELAYED CLOSURE OF S-12A AND S-12B, AND REOPENING OF S-343A, S-343B, AND S-344

As per the July 2016 ERTP BO, the S-343A, S-343B and S-344 structures close October 1 independent of water stages in WCA 3A for protection of the endangered CSSS. The 2016 ERTP BO includes further closures of October 1 and November 1 for the S-12A and S-12B structures, respectively, if stages in WCA 3A are below the MWD Increment 1 Action Line (10.75 feet NGVD). If the WCA 3A stages are above 10.50 feet NGVD on September 30 or projected to rise above the MWD Increment 1 Action Line during October, S-12A and S-12B will not close on October 1. Under this WCA 3A high water condition, S-12A will close no later than November 1. If the WCA 3A stages are above 11.00 feet NGVD on October 31 or projected to rise above 11.25 feet NGVD during November, S-12B will not close on November 1 and will close no later than December 1. On October 6, 2017 when the 2017 Planned Temporary Deviation was approved, stages in WCA 3A were 12.56 feet, NGVD, which is 1.81 feet above the MWD Increment 1 Action Line. The USACE is still operating under the June 2017 WCA 3A Planned Temporary Deviation as well as the 2017 July WCA 2A Planned Temporary Deviation to help reduce stages in WCA 3A. Through these deviations, the USACE has currently maximized outflows from WCA 3A as well as limited inflows to the extent practicable given conditions within the upstream basins. Other steps the USACE is implementing to reduce stages in WCA 3A include raising the L-29 Canal constraint up to 8.5 feet NGVD, continuing maximizing discharge through S-12C, S-12D, S-333, S-334, and S-151, and maximizing discharges to tide from each of the WCAs. Despite implementation of these steps, headwater elevations at the S-12 structures are above 11.0 feet, NGVD. It is important to note that if headwater elevations at S-12A and S-12B are 11.0 feet NGVD or greater, the structures are opened to avoid overtopping (refer to 2016 ERTP BO).

Based upon the latest SFWMD October 2017 Dynamic Position Analysis WCA 3A is projected to fall below the MWD Increment 1 Action Line between early January 2018 (50% probability curve) and mid-April 2018 (90% probability curve) without implementation of the October 2017 Planned Temporary Deviation (**Figure 9**). In comparison, WCA 3A is projected to fall below the MWD Increment 1 Action Line between mid-December 2017 (50% probability curve) and late March 2018 with delayed closures (**Figure 10**).

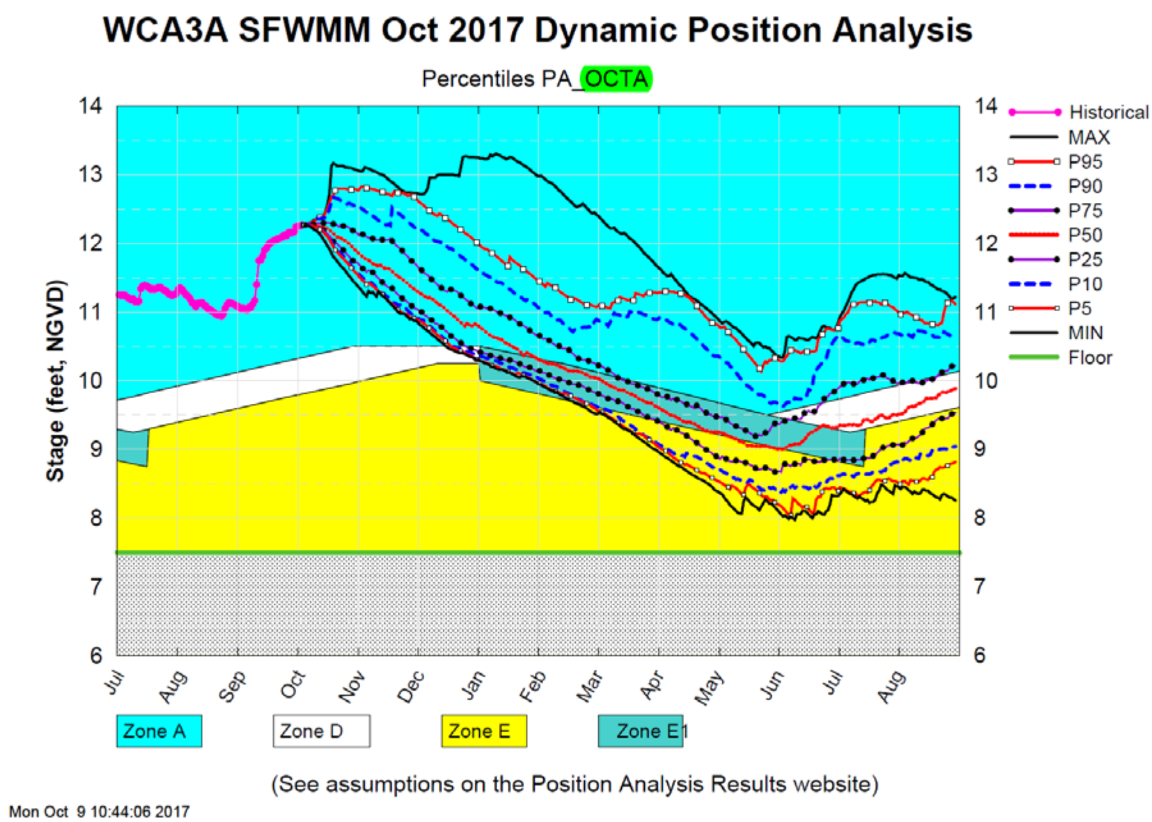



**FIGURE 9: OCTOBER 1, 2017 SFWMD POSITION ANALYSIS FOR WCA-3A WITHOUT THE DELAYED CLOSURE OF THE S-12A, S-12B AND REOPENING OF THE S-343A, S-343B AND S-344 STRUCTURES**

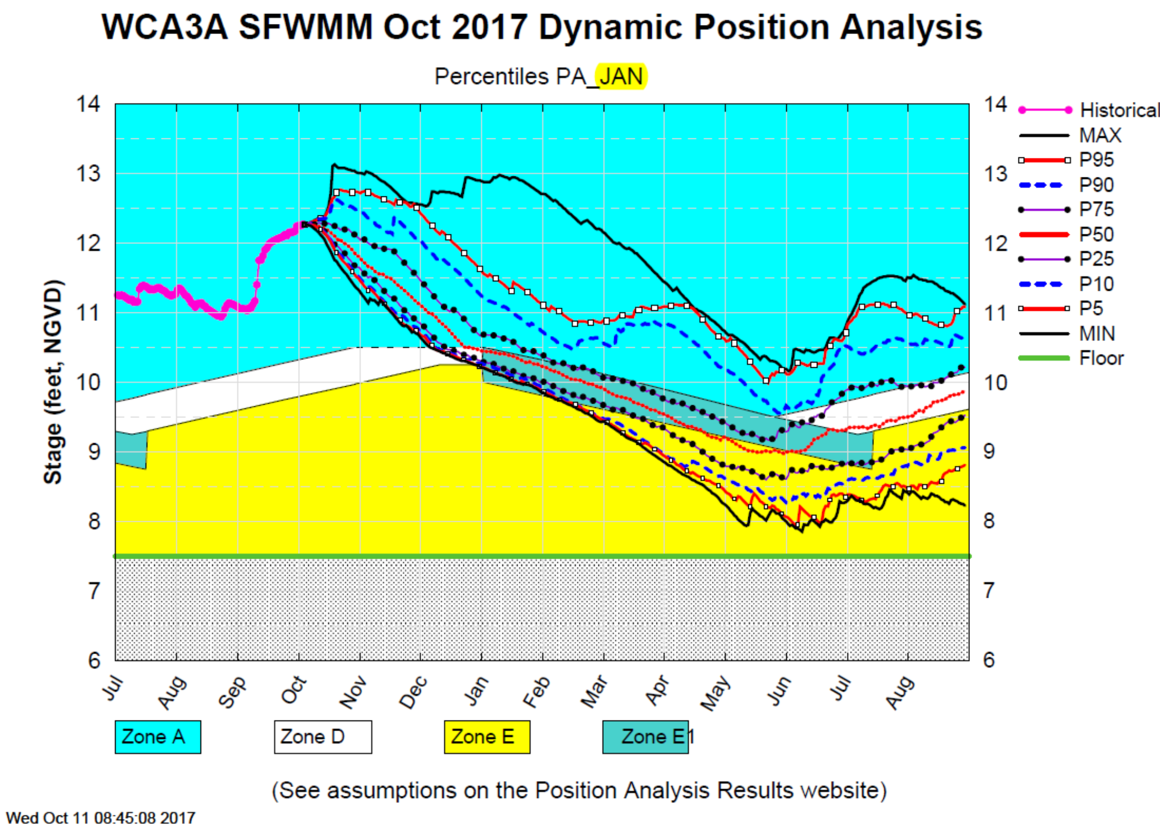



**FIGURE 10: OCTOBER 1, 2017 SFWMD POSITION ANALYSIS FOR WCA-3A WITH THE DELAYED CLOSURE OF THE S-12A, S-12B AND REOPENING OF THE S-343A, S-343B AND S-344 STRUCTURES**

The 2016 ERTP BO also included a discontinuous hydroperiod target for marl prairie habitat of 90-210 days "in order to restore a sufficient area of suitable marl prairie habitat for each CSSS subpopulation" (2016 ERTP BO, Section 7.1.1., page 205). The target states that USACE will manage water levels in a manner aimed at meeting the following:

a. *"Subpopulation A – At least 24,000 acres of suitable habitat within, and adjacent to, CSSS subpopulation A must show a 4-year running average discontinuous hydroperiod range of 90-210 days, with no 2 consecutive years failing to meet this tar Subpopulation A - At least 24,000 acres of suitable habitat within, and adjacent to, CSSS subpopulation A must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.*
b. *Subpopulations B through F – At least 40 percent of each designated CSSS critical habitat unit must have 90 consecutive dry days between March 1 and July 15 (CSSS breeding season) every year.*

The information presented in **Table 7** was obtained from the U.S. Geologic Survey (USGS) EDEN Sparrow Viewer. It is important to note that the data presented in **Table 7** reflects the annual discontinuous hydroperiod for 2016. Annual discontinuous hydroperiod statistics for 2017 will not be available until early 2018 and thus will be provided in the 2018 ERTP Biannual Assessment Report 2. 24,000 acres in CSSS-A represents approximately 40% of habitat available.

Based upon the information presented in **Table 7**, the FWS annual discontinuous hydroperiod target of 90-210 days was not met in any CSSS subpopulation in 2016. It is important to highlight that FWS at page 186 in the 2016 ERTP BO acknowledges that *"these targets are not technically feasible for all populations in every year at this time."* During the 2015 to 2016 dry season, South Florida experienced a very strong El Niño event. The first half of the dry season (November 2015-January 2016) was the wettest for this period since record keeping began in 1932. To protect natural resources within WCA 3A, in correspondence dated February 11, 2016, the Governor of Florida requested that USACE take immediate action to relieve flooding of the Everglades WCAs by raising the level of the L-29 Canal to 8.5 feet, NGVD so that substantial volumes of water could be moved from WCA 3A to ENP through Shark River Slough. The USACE initiated a temporary emergency deviation to the stage maximum operating limit of 7.5 feet, NGVD in the L-29 Canal on February 15, 2016 at the request of the Governor, for purposes of providing high water relief in WCA 3A.

**TABLE 7: PERCENTAGE OF HABITAT WITHIN EACH CSSS SUBPOPULATION THAT HAD AN ANNUAL DISCONTINUOUS HYDROPERIOD OF 90-210 DAYS. (NOTE: DATA COURTESY OF U.S. GEOLOGICAL SURVEY EDEN CSSS VIEWER).**

| Year | CSSS Subpopulation | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | Ax | B | C | D | E | F |
| 2016 | 1.5% | 2.4% | 17.6% | 7.6% | 3.3% | 6.9% | 29.8% |

The 2016 Temporary Emergency Deviation included the relaxation of the L-29 Canal stage maximum operating limit of 7.5 feet, NGVD up to 8.5 feet, NGVD for a period of 90 days. The Temporary Emergency Deviation also included a 60-day recovery period during which the water level would recede to stages typical of the recent hydrological conditions and the operational criteria under the then-current C&SF Project operations (MWD Increment 1), with the lowered operational ranges within the SDCS retained until this recovery period is completed. The 60 day recovery period was initiated on May 12, 2016 once the L-29 Canal constraint was returned to 7.5 feet NGVD. In June of 2016, the USACE anticipated the likelihood of above average conditions/flows through most of the wet season. With flora and fauna still recovering from the high water event during the typical dry season months, it was important to prevent, to the extent practicable, another high water event during the 2016 wet season. Therefore USACE proposed to extend the 60 day recovery period for purposes of maintaining lower canal levels along the L-31N and C-111 canals, as well as to maintain flexibility to address potential 8.5 Square Mile Area (SMA) flood mitigation issues identified during the Temporary Emergency Deviation. The lower L-31N Canal levels, increased pumping at S-331, and reduced pumping at S 357 into the 8.5 SMA Detention Cell were also necessary to facilitate the continued contractor progress with ongoing construction of the C-111 South Dade Project features following weather delays and site-related construction challenges throughout the 2015-2016 El Niño event. The 60 day recovery period was extended on July 11 and expired on November 30, 2016. A memorandum for the record documenting National Environmental Policy Act compliance for the extension of the recovery period was completed on July 8, 2016. A draft report which documents the first year of operations following the start of the MWD Increment 1 field test in October 2015, with principal emphasis on the system conditions through the 2016 Temporary Emergency Deviation and subsequent recovery period, is provided as Appendix A. The report provides an overview of water management operations and C&SF Project response for the October 2015 through September 2016 period, including comparisons of observed precipitation to historical norms, the system response summary for WCA 3A, monthly volumes delivered to the Northeast Shark River Slough compared to previous years under the 2012 ERTP, monthly volumes delivered to Northeast Shark River Slough using the S-356 pump station (91% of the annual total was delivered during October through January, prior to the 2016 Temporary Emergency Deviation), operational summary for the 8.5 SMA, and operational summaries for the SDCS Canal reaches between S-334/S-335 and S-197.

As a result of the record rainfall associated with the 2015/2016 El Niño event, and subsequent water management operations to alleviate high water concerns in WCA 3A, greater volumes of water entered the historic flow path through Northeast Shark River Slough into ENP. During the 2016 Temporary Emergency Deviation, the L-29 Canal stage reached 8.3 feet NGVD. Raising the stage in the L-29 Canal is included in the 2016 ERTP BO RPA (refer to Section 7.1.2.1.b, page 188, Actions to Move Water East). The increased volume of water entering NESRS through the S-333 structure under the 2016 Temporary Planned Deviation provided some insight into how hydroperiods within eastern CSSS subpopulations may be affected by future increments of Everglades' restoration. Despite that only 5.2% of CSSS-E experienced greater than 90 consecutive dry nesting days between March 1 and July 15, 2016 and only 6.9% of CSSS-E designated critical habitat unit experienced a discontinuous hydroperiod of 90-210 days, CSSS-E had the greatest number of singing males ever recorded by the ENP CSSS Range-wide survey since the annual surveys began in 1992. It is important to note that the estimates for a particular year have relevance for potential breeding that year, but this would not be reflected in the population estimates until the following year.

Based upon the information presented in **Table 8**, the mean four-year running hydroperiod target of 90-210 days was met in CSSS-C and CSSS-F. In contrast CSSS-A, CSSSS-Ax, CSSS-B, CSSS-D, and CSSS-E did not meet the FWS target. It is important to highlight that the FWS, in page 186 of the 2016 ERTP BO, acknowledges that "these targets are not technically feasible for all populations in every year at this time." It is also interesting to note that CSSS-B and CSSS-E, the two largest CSSS subpopulations with an estimated 2017 population size of 1,936 and 1,200 birds, respectively, both fell below the FWS 4 year target. In contrast, in CSSS-C, 83% of the designated critical habitat unit fell within the FWS 4 year target, however, only 3 males were heard during the 2017 ENP CSSS range-wide survey. Similarly, in CSSS-F, 75% of the designated critical habitat unit fell within the FWS 4 year target and only 1 male was heard singing during the 2017 ENP CSSS range-wide survey.

**TABLE 8: FOUR YEAR RUNNING AVERAGE DISCONTINUOUS HYDROPERIOD: CSSS SUBPOPULATIONS A-F AND THE PERCENTAGE WITHIN EACH SUBPOPULATION THAT MET THE FWS TARGET IN 2017. ALL DATA PROVIDED BY USGS EDEN CSSS VIEWER.**

| Year | CSSS Subpopulation | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | Ax | B | C | D | E | F |
| 2016 | 1.5% | 2.4% | 17.6% | 7.6% | 3.3% | 6.9% | 29.8% |

With respect to a correlation between structure closures, number of dry days at NP-205 within the nesting period, and CSSS population estimates for the following year, there does not appear to be a direct correlation. For example, as shown in **Table 9** during the 2007 breeding season, S-12A closed November 1, 2006 and remained closed until September 26, 2007 (72 days longer than FWS restricted opening date of July 15). However, during 2007, there were only 25 consecutive dry days measured at NP-205 during the FWS CSSS breeding window of March 1 through July 15. As previously stated, the number of dry days during the breeding season would be reflected in CSSS population estimates the following year, and in 2008, the population estimate for CSSS-A was 112 birds. During the 2008 CSSS breeding season, S-12A closed November 1, 2007 and remained closed until August 24, 2008 In contrast to 2007, in 2008 there were 160 consecutive dry days within FWS CSSS breeding window, but the 2009 CSSS-A population estimate was 96 birds. In contrast to the longer windows without flow through S-12A experienced during 2007 and 2008, during the 2009 CSSS breeding season S-12A closed November 2, 2008 and remained closed until July 16. Despite this shorter window without S-12A flow (as compared with 2007 and 2008), a total of 108 consecutive dry days were measured at NP-205 during FWS CSSS breeding window. The 2010 CSSS-A population estimate was 128 birds. As a final comparison underscoring this apparent lack of direct correlation, during the 2010 CSSS-A breeding season, S-12A closed October 29, 2009 and remained closed until July 15, 2010. During 2010, only 53 consecutive dry days were measured at NP-205 during FWS CSSS breeding window. Despite the shorter breeding window, the 2011 CSSS-A population estimate was 176 birds. Finally, in 2015 the S-12A and S-12B structures opened October 6, 2015, a total of 83 days past the CSSS July 15 opening period. The S-12A structure closed 24 days later on October 30, 2015 and the S-12B structured closed 34 days later on November 10, 2015, however, the 2016 CSSS-A population estimate was only 48 birds, representing an apparent reduction of 160 birds in comparison with the 2015 ENP range-wide estimate. Once again it is important to note that the 2015 ENP range-wide estimate reflects breeding effort during the previous year (*i.e.* 2014). This apparent lack of direct correlation underscores the need to investigate alternate sources of water flow within CSSS-A habitat (e.g. western flow, sea level rise), as well as the need to evaluate factors other than water management activities that may be preventing CSSS-A from successfully increasing in size.

Finally, it is imperative to underscore that completion of the Old Tamiami Trail borrow canal plug between S-12B and S-12C by ENP as identified in the February 8, 2017 MWD Increment 1 Plus EA, 2011 ERTP EIS and 2010 ERTP BO would prevent flows from S-12C into CSSS-A habitat. In addition, the analysis performed by ENP that is included within the 2011 ERTP

EIS along with modeling performed for the 2016 ERTP BO clearly highlights that the S-12A and S-12B closures are not effective without construction of this plug. Although the value of this plug has been demonstrated numerous times over the past several years, there does not appear to be any urgency to complete construction despite the dire predicament of jeopardy for CSSS that FWS outlined within the 2016 ERTP BO.

**TABLE 9: DATES OF S-12 OPENINGS AND DISCONTINUOUS HYDROPERIOD IN CSSS-A.**

| Calendar Year | S-12A | | | | S-12B | | | | NP-205 Discontinuous Hydroperiod (Days Wet) | Number of Dry Days with CSSS Nesting Window | CSSS-A Population Estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Open | Number of Days post FWS Restricted Opening Date (July 15) | Close | Number of Days post FWS Mandated Closure Date (November 1) | Open | Number of Days post FWS Restricted Opening Date (July 15) | Close | Number of Days prior to FWS Mandated Closure Date (January 1) | | | |
| 2002 | | --- | 1-Nov | 0 | | --- | 14-Nov | 48 | 273 | 68 | 96 |
| 2003 | 22-Jul | 7 | 1-Nov | 0 | 16-Jul | 1 | 1-Jan | 0 | 285 | 26 | 128 |
| 2004 | 26-Aug | 43 | 2-Nov | -1 | 27-Aug | 44 | 7-Dec | 25 | 275 | 79 | 16 |
| 2005 | 22-Jun | -23 | 16-Nov | -15 | 22-Jun | -23 | 30-Dec | 2 | 230 | 46 | 80 |
| 2006 | 24-Aug | 41 | 1-Nov | 0 | 2-Aug | 19 | 4-Nov | 58 | 246 | 112 | 112 |
| 2007 | 26-Sep | 72 | 1-Nov | 0 | 4-Oct | 80 | 8-Dec | 26 | 232 | 25 | 64 |
| 2008 | 24-Aug | 41 | 2-Nov | -1 | 17-Jul | 2 | 24-Dec | 8 | 183 | 160 | 112 |
| 2009 | 16-Jul | 1 | 29-Oct | 2 | 16-Jul | 1 | 31-Dec | 1 | 255 | 108 | 96 |
| 2010 | 15-Jul | 0 | 1-Nov | 0 | 11-Aug | 28 | 2-Dec | 30 | 260 | 53 | 128 |
| 2011 | 25-Oct | 101 | 1-Nov | 0 | 25-Oct | 101 | 23-Dec | 9 | 189 | 117 | 176 |
| 2012 | 15-Jul | 0 | 2-Nov | -1 | 15-Jul | 0 | 27-Dec | 5 | 255 | 66 | 336 |
| 2013 | 15-Jul | 0 | 2-Nov | -1 | 15-Jul | 0 | 14-Dec | 18 | 276 | 54 | 288 |
| 2014 | 13-Aug | 30 | 1-Nov | 0 | 12-Aug | 29 | 14-Nov | 48 | 248 | 83 | 64 |
| 2015 | 6-Oct | 83 | 30-Oct | 2 | 6-Oct | 83 | 10-Nov | 52 | 172 | 120 | 208 |
| 2016 | 12-Aug | 29 | 31-Oct | 1 | 10-Aug | 27 | 22-Nov | 40 | 294 | 72 | 48 |
| 2017 | 29-Jun | 16 | - | - | 29-Jun | 16 | - | - | - | 92 | 16 |

Based upon the apparent lack of correlation between structure closures, number of dry days at NP-205 within the nesting period, and CSSS population estimates, the USACE believes that effects on the CSSS-A nesting habitat downstream of S-12A and S-12B will be minimal as a result of the delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-343B and S-344 structures.

As shown in **Figure 11**, the SFWMD October 2017 Position Analysis reveals that stages at NP-205 will not recede below ground surface elevation until early April 2018 based upon the 50% probability curve. In comparison as shown in **Figure 12**, the SFWMD October 2017 Position Analysis reveals that stages at NP-205 will not recede below ground surface elevation until mid-March 2018 based upon the 50% probability curve; representing an approximate two-week difference, thereby allowing increased nesting opportunity within CSSS-A with implementation of the 2017 October Planned Temporary Deviation. This comparison reveals that retaining outlet capacity from WCA 3A through the S-12A, S-12B, S-343A, S-343B and S-344 structures actually benefits stages within CSSS-A. Both **Figure 11** and **Figure 12** reveal that stages at NP-205 will not recede below ground surface elevation during the 2018 CSSS nesting season based upon the 90% probability curve regardless of whether the S-12A, S-12B, S-343A, S-343B or S-344 structures are open or closed.

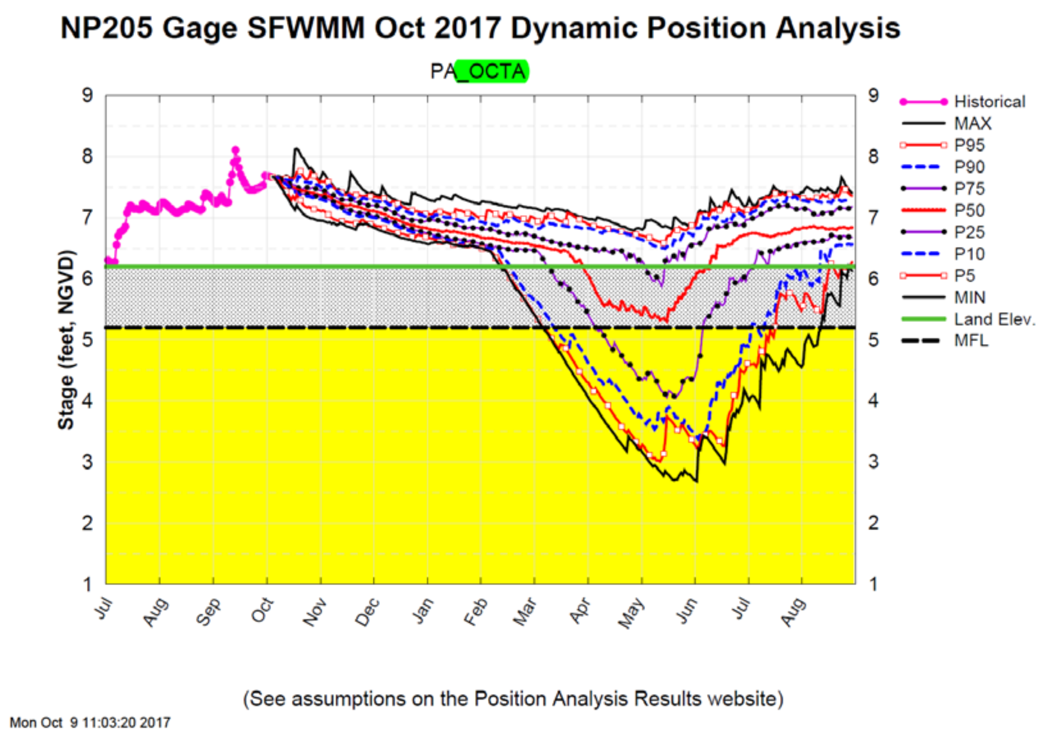



**FIGURE 3: OCTOBER 2017 SFWMD POSITION ANALYSIS FOR NP-205 WITHOUT THE DELAYED CLOSURE OF THE S-12A, S-12B AND REOPENING OF THE S-343A, S-343B AND S-344 STRUCTURES.**

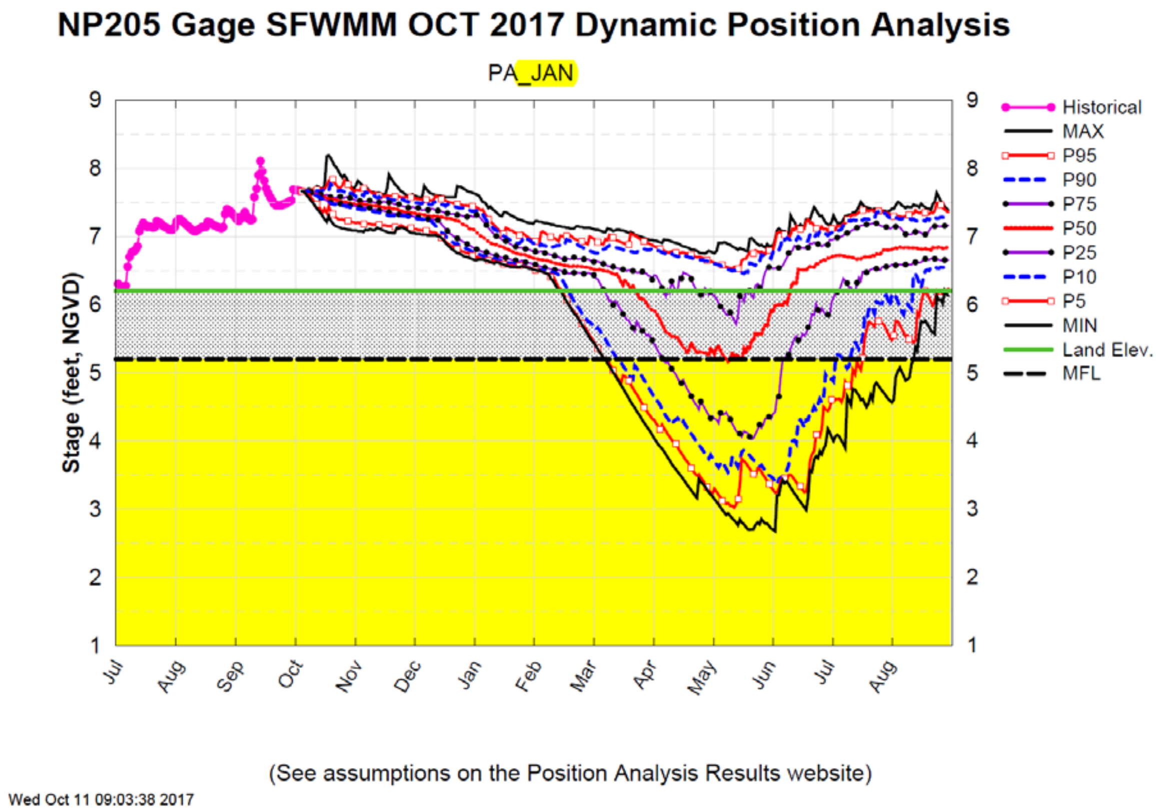



**FIGURE 4: OCTOBER 2017 SFWMD POSITION ANALYSIS FOR NP-205 WITH THE DELAYED CLOSURE OF THE S-12A, S-12B AND REOPENING OF THE S-343A, S-343B AND S-344 STRUCTURES**

Successful CSSS breeding requires that breeding season water levels remain at or below ground level in the breeding habitat. Nott et al. (1998) cited a "10-centimeter (cm)" rule for maximum water depth over which the CSSS will initiate nesting. This conclusion was based upon observations within the ENP range-wide survey in which no singing males were heard when water depths exceeded that level. However, Dean and Morrison (1998) demonstrated that nesting may occur when average water depths exceed this rule. In addition, more recent evidence has shown that not only were CSSS able to successfully breed in areas with standing water that was "approaching knee deep at times at times with 100% coverage the entire summer"; but also that they were able to successfully produce multiple broods (3) in the Dogleg Plot of CSSS-B "despite heavy rains that began in early-May and deep water levels that persisted throughout the breeding season in the study plot" (Virzi and Davis 2013; Slater et al. 2014). Based upon this evidence, USACE concludes that the amount of water that would reach CSSS-A between July 8, 2017 when the S-12A and S-12B are anticipated to overtop and July 15, 2017 when the gates no longer have CSSS restrictions, would not pose significant adverse effects even to the three active nests documented by FWS on June 27, 2017.

Furthermore, Lockwood et al. (2001) noted the average early season nest height is 17 centimeters (6.7 inches) above ground, while the average late season nest height is 21 centimeters (8.3 inches) above ground (Lockwood et al. 2001). The shift in average nest height after the onset of the wet season rainfall pattern, which typically begins in early June (Lockwood et al. 2001), appears to be an adaptive response to rising surface water conditions.

Published data and analyses by Baiser et al. (2008) and Virzi et al. (2009), along with input from Dr. Lockwood, (email correspondence to FWS, October 15, 2009) have identified April and May as the most critical time frames for successful CSSS breeding. Based upon intensive nest survey data from CSSS-B and CSSS-E, the CSSS breeding season can be divided into two segments corresponding to different levels of nest success. Prior to June 1, approximately 60% of CSSS nests are successful as compared with approximately 21% after June 1 (Baiser et al. 2008; Boulton et al. 2009a; Virzi 2009; FWS 2010). For the purposes of ERTP, it was assumed that sparrows within CSSS-A experience a similar pattern of nest success, with more successful nesting occurring earlier in the breeding season and a decline in nest success after June 1. Since 2008, intensive nest surveys have been conducted within CSSS-A (Boulton et al. 2009a; Virzi et al. 2009), representing the first time such intensive searching has been performed since 2000 within this subpopulation. Data obtained through their ongoing efforts will be incorporated in future management decisions. Operational changes under ERTP were designed to provide the appropriate hydrologic conditions earlier in the CSSS breeding season when CSSS experience the greatest nest success. Timing of nest initiation and nest success rates were used to better define the most critical portion of the CSSS nesting window on which to base water management decisions.

Timing of nest initiation is thought to be primarily dictated by an internal biological cue rather than habitat conditions, such as water depths (Dr. Lockwood email correspondence to FWS, October 15, 2009). Nott et al. (1998) cited a "10-cm" rule for maximum water depth over which the CSSS will initiate nesting. This conclusion was based upon observations within the range-wide survey in which no singing males were heard when water depths exceeded that level. However, Dean and Morrison (1998) demonstrated that nesting may occur when average water depths exceed this rule. In a 1997 paper, Lockwood et al. (1997) indicated that water depths delay the onset of breeding. However, more recently Dr. Lockwood (email correspondence to FWS, October 15, 2009) stated she believes the internal biological cue is the trigger for nest initiation and she does not think water is delaying the start of breeding. As nest initiation is most likely dictated by some internal cue (biological clock) rather than by habitat conditions (*e.g.* water depths), Dr. Lockwood indicated that "just making it drier earlier likely will not free them up to nest any earlier" (email correspondence to FWS, October 15, 2009).

The earliest nest initiation dates identified within the 14-year period between 1996 and 2009 were March 11 through March 15 (Baiser et al. 2008; Virzi 2009). These numbers are based upon intensive nest surveys, primarily in CSSS-B and CSSS-E (**Figure 13**). There is no nest initiation or nest survival data from CSSS-A during the IOP time period, with the exception of 2008 and 2009 (Boulton et al. 2009a; Virzi et al. 2009). Research by Dr. Lockwood and her students indicates that the greatest number of nests are initiated between March 25 and April 15, with fewer nests initiated in middle March and June as depicted in **Figure 14**.

Based upon the fact that water stages within CSSS-A in the vicinity of NP-205 are likely to be below ground surface prior to the height of the CSSS nesting season as well as the fact that nesting has been documented over standing water (Virzi and Davis 2013; Slater et al. 2014), the USACE believes that even with the delayed closure of the S-12A, S-12B and reopening of the S-343A, S-343B and S-344 structures there will not be a significant effect on the 2018 CSSS nesting season within CSSS-A and may in fact benefit nesting in CSSS-A by allowing an increase in the time period in which stages in the vicinity of NP-205 will have receded below ground surface elevation (**Figure 12**).

**CSSS Earliest Nest Initiation Dates (1996 – 2009)**

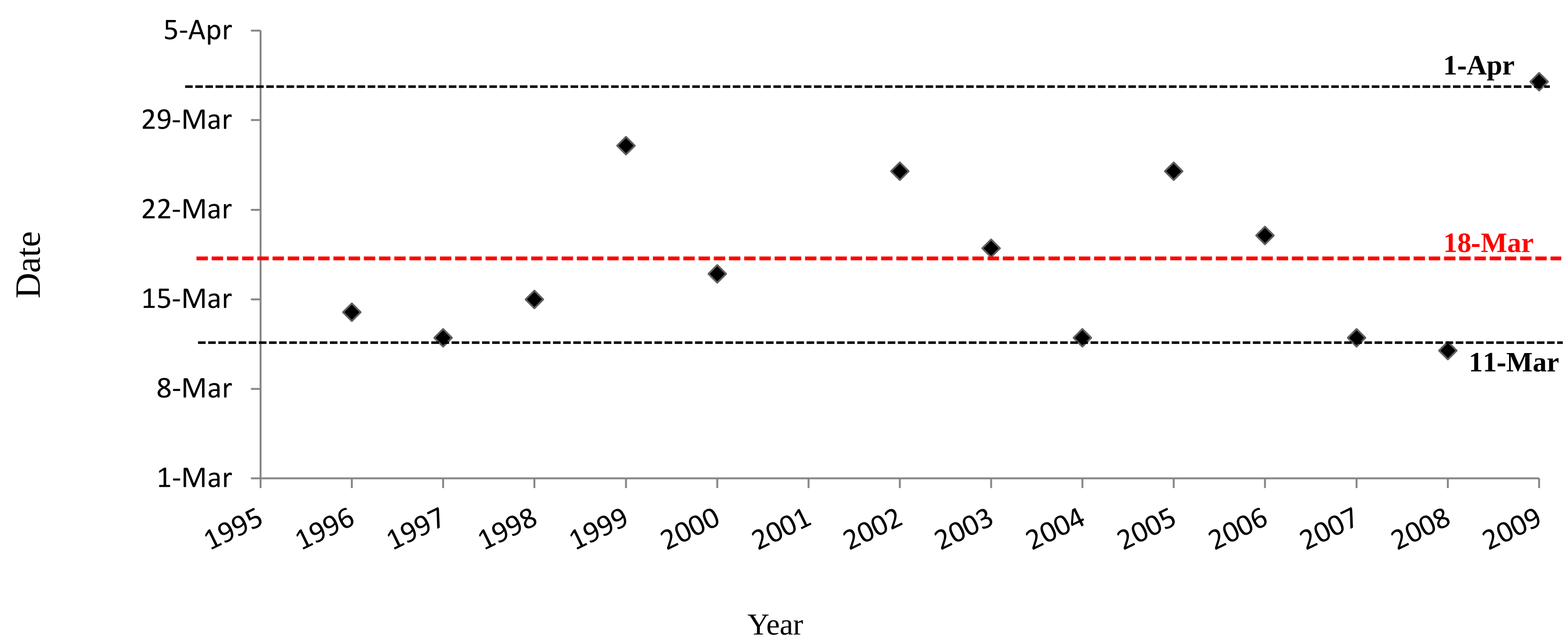



**FIGURE 5: EARLIEST CAPE SABLE SEASIDE SPARROW NEST INITIATION DATES BETWEEN 1996 AND 2009**

Source: Data and figure courtesy of Virzi (2009)
Note: March 18 represents the average date of nest initiation in March

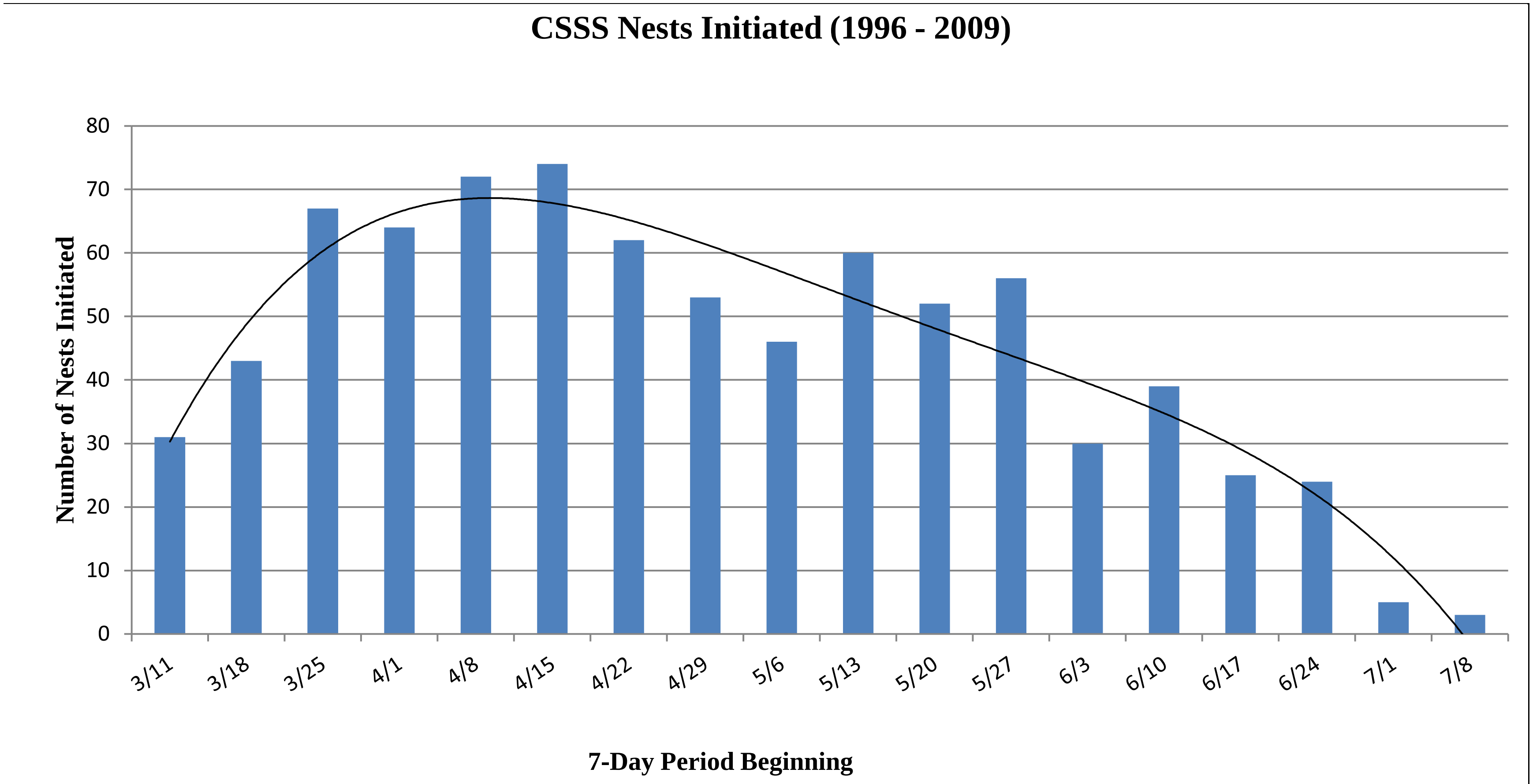



**FIGURE 14: NUMBER OF CAPE SABLE SEASIDE SPARROW NESTS INITIATED DURING EACH 7-DAY PERIOD BETWEEN 1996 AND 2009**

Source: Data and figure courtesy of Virzi (2009)

## 5.7 CAPE SABLE SEASIDE SPARROW SPECIES EFFECT DETERMINATION

Section 7(a) (2) of the Endangered Species Act provides as follows:

> Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.

Based upon the information presented within Section 5.6, USACE has determined that the October 2017 Planned Temporary Deviation may affect CSSS. Potential minor adverse effects on CSSS habitat may occur due to delayed closure of S-12A and S-12B structures and reopening of S-343A, S-343B and S-344 structures associated with hydroperiods that likely will be longer than the FWS preferred discontinuous hydroperiod of 90-210 days. The USACE does not anticipate any direct adverse effects on CSSS, but minor adverse effects on CSSS habitat in western Shark River Slough. The USACE commits to biweekly status updates on water management activities and development of an after action analysis report to demonstrate any effects on CSSS habitat and the ecosystem in general.

## 5.8 CAPE SABLE SEASIDE SPARROW CRITICAL HABITAT DETERMINATION

Critical habitat for the CSSS was designated on August 11, 1977 (42 FR 42840) and revised on November 6, 2007 (72 FR 62735 62766). Currently, the critical habitat includes areas of land, water, and airspace in the Taylor Slough vicinity of ENP in Miami-Dade and Monroe counties, Florida. Primary constituent elements include suitable soil, vegetation, hydrologic conditions, and forage base. The designated area encompasses approximately 156,350 acres (63,273 hectares) and includes portions of CSSS-B through CSSS-F (**Figure 7**). CSSS-A is the only area occupied by sparrows that does not have associated designated critical habitat.

As there is no designated critical habitat west of Shark River Slough, USACE has determined that delayed closure of the S-12A and S-12B and reopening of the S-343A, S-343B and S-344 structures will have no effect on designated CSSS critical habitat.

# 6 CONCLUSION

USACE recognizes the commitments made within the 2016 ERTP BO and remains committed to implementation of the RPA. As part of the September 2017 Emergency Deviation, the USACE raised the stage in the L-29 Canal up to 8.5 feet, NGVD which is a RPA within the 2016 ERTP BO. Elevated stages in the L-29 Canal will further assist to reduce stages in WCA 3A and will also help to reduce the duration that S-12A and S-12B would need to remain open. The USACE commits to continue to monitor the existing hydrologic gages downstream of these structures and include this information within an After Action Report. The USACE also commits to biweekly status updates with FWS on water management activities.

Finally, as agreed upon at the September 29, 2017 ERTP Leadership Meeting, the USACE will provide an After Action Report to include all 2017 water management deviation activities approximately 90 days post conclusion of the deviations. The purpose of the After Action Report is to provide a hydrological analysis on how the 2017 emergency and planned water management deviations affected hydrological conditions within WCA 3A, the SDCS and ENP. **Neither this Biological Assessment nor the July 2017 Biological Assessment will be revised or supplemented.** As per emergency procedures outlined within the 1973 ESA, as amended, the USACE has used the best available scientific information available to develop both the October 2017 and the July 2017 Biological Assessments. The After Action Report is currently anticipated in summer 2018.

# 7 LITERATURE CITED

Armentano, T.V., J.P. Sah, M.S. Ross, D.T. Jones, H.C. Cooley and C.S. Smith. 2006. Rapid responses of vegetation to hydrological changes in Taylor Sough, Everglades National Park, Florida, USA. Hydrobiologia 569: 293-309.

Baiser, B., R.L. Boulton, and J.L. Lockwood. 2008. The influence of water depths on nest success of the endangered Cape Sable seaside sparrow in the Florida Everglades. Animal Conservation 11: 190-197.

Balent, K. L., K. H. Fenn, and J. L. Lockwood. 1998. Wet season ecology of the Cape Sable Seaside Sparrow. Chapter 4 *in* Cape Sable Seaside-sparrow annual report: 1998 (S. L. Pimm, Ed.). Unpublished report submitted to Everglades National Park, Homestead.

Bass, O.L., Jr. and K.A. Kushlan. 1982. Status of the Cape Sable seaside sparrow. Report T-672, South Florida Research Center, Everglades National Park, Homestead, FL.

Bernhardt, C.E. and D.A. Willard. 2006. Marl Prairie Vegetation Response to 20th Century Hydrologic Change. U.S. Geological Survey Open-File Report 2006-U.S. Geological Survey, Eastern Earth Surface Processes Team, Reston, VA

Boulton, R.L., J.L. Lockwood, and M.J. Davis. 2009a. Recovering small Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) subpopulations: Breeding and dispersal of sparrows in the eastern Everglades 2008. Unpublished report to the United States Fish and Wildlife FWS (South Florida Ecological FWSs, Vero Beach) and the United States National Park FWS (Everglades National Park, Homestead).

Boulton, R.L., J.L. Lockwood, M.J., Davis, A. Pedziwilk, K.A., Boadway, J.J.T. Boadway, D. Okines, and S.L. Pimm. 2009b. Endangered Cape Sable seaside sparrow survival. Journal of Wildlife Management 73(4): 530-537.

Cassey, P., J.L. Lockwood, and K.H. Fenn. 2007. Using long-term occupancy information to inform the management of Cape Sable seaside sparrows in the Everglades. Biological Conservation 139:139-149.

Code of Federal Regulations [CFR] 50 Parts 1 to 199; 10-01-00

Curnutt, J.L., and S.L. Pimm. 1993. Status and ecology of the Cape Sable seaside sparrow. Unpublished report prepared for the U.S. Fish and Wildlife FWS and the National Park FWS; Vero Beach, Florida.

Curnutt, J.L., A.L. Mayer, T.M. Brooks, L., Manne, O.L., Bass Jr., D.M. Fleming, D.M., M.P. Nott, and S.L. Pimm, 1998. Population dynamics of the endangered Cape Sable seaside sparrow. Animal Conservation 1, 11–21.

Davis, S.M., L.H. Gunderson, W.A. Park, J.R. Richardson, and J.E. Mattson. 1997. Landscape dimension, composition, and functioning in a changing Everglades ecosystem. Pages 419-444. *In* S.M. Davis and J.C. Ogden (Eds). Everglades: the Ecosystem and its Restoration. St. Lucie Press, Delray Beach, Florida, USA.

Davis, S.M. and J.C. Ogden, 1997. Everglades: the Ecosystem and its Restoration. St. Lucie Press, Delray Beach, Florida, USA

Dean, T. F. and J.L. Morrison, 1998. Non-breeding season ecology of the Cape Sable seaside sparrow *(Ammodramus maritimus mirabilis}:* 1997-1998 field season final report. Unpublished report submitted to the U.S. Fish and Wildlife FWS.

Dean, T. F. and J.L. Morrison, 2001. Non-breeding season ecology of the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Final Report. Unpublished report to the Fish and Wildlife FWS, Vero Beach, Florida, USA

Lockwood, J.L., K. Fenn, J. Curnutt, D. Rosenthal, K.L. Balent, and A.L. Mayer. 1997. Life history of the endangered Cape Sable seaside sparrow. Wilson Bulletin 109: 720-731.

Lockwood, J.L., K. Fenn, K.H. Caudill, D. Okines, O.L. Bass Jr., J.R. Duncan, and S.L. Pimm. 2001. The implications of Cape Sable seaside sparrow demography for Everglades' restoration. Animal Conservation 4: 275-281.

Lockwood, J.L., M.S. Ross and J.P. Sah. 2003. Smoke on the water: the interplay of fire and water flow on Everglades restoration. Frontiers in Ecology and the Environment 1(9): 462-468.

Lockwood, J.L., B. Baiser, R.L. Boulton, and M.J. Davis, 2006. Detailed study of Cape Sable seaside sparrow nest success and causes of nest failure. 2006 Annual Report. US Fish and Wildlife FWS, Vero Beach, Florida, USA

Lockwood, J.L., R.L. Boulton, B. Baiser, M.J. Davis and D.A. La Puma, 2008. Detailed study of Cape Sable seaside sparrow nest success and causes of nest failure: Recovering small populations of Cape Sable seaside sparrows: 2007 Annual Report. Unpublished report to the USFWS, Vero Beach, FL and Everglades National Park, Homestead, Florida, USA

McVoy, C., W.P. Said, J. Obeysekera, J. VanArman, and T.W. Dreschel. 2011. Landscapes and Hydrology of the Predrainage Everglades. South Florida Water Management District, Gainesville, Florida: University Press of Florida.

Nicholson, D. J. 1928. Nesting habits of Seaside Sparrows in Florida. Wilson Bulletin 40:225-237.

Nott, M.P., O.L. Bass Jr., D.M. Fleming, S.E. Killefer, N. Fraley, L. Manne, J.L. Curnutt, T.M. Brooks, R. Powell, and S.L. Pimm, 1998. Water levels, rapid vegetational change, and the endangered Cape Sable seaside sparrow. Animal Conservation 1, 23–32.

Patterson, K., and R. Finck. 1999. Tree Islands of the WCA3 aerial photointerpretation and trend analysis project summary report. St. Petersburg, Florida: Geonex Corporation. Report to the South Florida Water Management District.

Pimm, S.L., J.L. Lockwood, C.N. Jenkins, J.L. Curnutt, M.P. Nott, R.D. Powell, and O.L. Bass Jr., 2002. Sparrow in the grass: a report on the first ten years of research on the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Report to Everglades National Park, Homestead, Florida.

Post, W. 2007. Practical ways of saving seaside sparrows. Presentation to the Sustainable Ecosystems Institute Avian Ecology Forum. August 13-15, 2007, Florida International University, Miami, Florida, USA.

Ross, M.S., J.P. Sah, J.R. Snyder, P.L. Ruiz, D.T. Jones, H. Cooley, and R. Travieso and 2003. Effect of hydrological restoration on the habitat of the Cape Sable seaside sparrow. Annual Report of 2002-2003. Report to Everglades National Park, Homestead, FL.

Ross, M.S., J.P. Sah, J.R. Snyder, P.L. Ruiz, D.T. Jones, H. Cooley, R. Travieso and S. Robinson. 2004. Effect of hydrological restoration on the habitat of the Cape Sable seaside sparrow. Annual Report of 2003-2004. Report to Everglades National Park, Homestead, FL.

Ross, M.S., J.P. Sah, J.R. Snyder, P.L. Ruiz, D.T. Jones, H. Cooley, R. Travieso and D. Hagayari. 2006. Effect of hydrology restoration on the habitat of the Cape Sable seaside sparrow. Annual Report of 2004-2005. Report to Everglades National Park, Homestead, FL.

Sah, J.P., M.S. Ross, J.R. Snyder, P.L. Ruiz, D.T. Jones, R. Travieso, S. Stoffella, N. Timilsina, H.C. Cooley and B. Barrios. 2007. Effect of hydrological restoration on the habitat of the Cape Sable seaside sparrow. Annual Report of 2005-2006. Report to Everglades National Park, Homestead, FL.

Sah, J.P., M.S. Ross, J.R. Snyder, P.L. Ruiz, S. Stoffella, M. Kline, B. Shamblin, E. Hanan, D. Ogurcak and B. Barrios. 2008. Effect of hydrological restoration on the habitat of the Cape Sable seaside sparrow. Annual Report of 2006-2007. Report to Everglades National Park, Homestead, FL.

Sah, J.P., M.S. Ross, J.R. Snyder, P.L. Ruiz, S. Stoffella, M. Kline, B. Shamblin, E. Hanan, L. Lopez and T.J. Hilton. 2009. Effect of hydrologic restoration on the habitat of the Cape Sable seaside sparrow. Final Report 2008. Report to U.S. Army Corps of Engineers, Jacksonville, FL.

Sklar, F. and A. van der Valk, Eds. 2002. Tree islands of the Everglades: an overview. Pages. 1-18 *in* Tree Islands of the Everglades. Kluwer Academic Publishers, Dordrecht, the Netherlands.

Slater, G, M.J. Davis, and T. Virzi. 2014. Recovery of the endangered Cape Sable seaside sparrow in Everglades National Park: monitoring and setting priorities. Final Report to the United States National Park FWS (Everglades National Park, Homestead, Florida).

Sustainable Ecosystems Institute, 2007. Everglades Multi-Species Avian Ecology and Restoration Review. Sustainable Ecosystems Institute, Portland Oregon.

Trost, C.H. 1968. Dusky seaside sparrow. Pages 859-868 *in* A.C. Bent, O.L. Austin, Jr., eds. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies. U.S. National Museum Bulletin; Washington, D.C.

Troxler, T.G., and D.L. Childers. 2010. Biogeochemical contributions of tree islands to Everglades wetland landscape nitrogen cycling during seasonal inundation. Ecosystems 13:75-89.

U.S. Army Corps of Engineers. 1995. Environmental Assessment and Finding of No Significant Fact, Test Iteration 7, Experimental Program of Water Deliveries to Everglades National Park, Central and Southern Florida Project for Flood Control and Other Purposes. Jacksonville District, Jacksonville, Florida, USA.

U.S. Army Corps of Engineers. 1999a. Central and Southern Florida Project Comprehensive Review Study: Final Integrated Feasibility Report and Programmatic Environmental Impact Statement. Jacksonville District, Jacksonville, Florida, USA.

U.S. Army Corps of Engineers. 1999b. 1998 Emergency Deviation From Test 7 of the Environmental Program of Water Deliveries to Everglades National Park to Protect the Cape Sable Seaside Sparrow, Central and Southern Florida Project For Flood Control and Other Purposes. Final Environmental Assessment. Jacksonville District, Jacksonville, Florida, USA.

U.S. Army Corps of Engineers. 2000. Final Environmental Assessment, Central and Southern Florida Project for Flood Control and Other Purposes, Interim Structural and Operational Plan (ISOP), Emergency Deviation from Test 7 of the Experimental Program of Water Deliveries to Everglades National Park for Protection of the Cape Sable Seaside Sparrow, Dade County, Florida. Jacksonville District, Jacksonville, Florida, USA.

U.S. Army Corps of Engineers. 2010. Water Resources Engineering Branch Position Statement on WCA-3A Regulation Schedule. Memorandum for SAJ Levee Safety Officer (Steve Duba). Jacksonville District, Jacksonville, Florida, USA.

U.S. Army Corps of Engineers. 2012. Everglades Restoration Transition Plan Final Environmental Impact Statement, Dade County, Florida. Jacksonville District, Jacksonville, Florida, USA.

U.S. Fish and Wildlife FWS. 2001. Final Coordination Act Report for the Interim Operating Plan for the Protection of the Cape Sable Seaside Sparrow. Vero Beach, Florida, USA.

U.S. Fish and Wildlife FWS. 1983. Cape Sable seaside sparrow recovery plan. U.S. Fish and Wildlife FWS; Atlanta, Georgia, USA.

U.S. Fish and Wildlife FWS. 1999. South Florida Multi-Species Recovery Plan. Southeast Region, Atlanta, Georgia, USA.

U.S. Fish and Wildlife FWS. 2006. Interim Operational Plan Biological Opinion. Prepared by the South Florida Ecological FWSs Office, Vero Beach, Florida, USA.

U.S. Fish and Wildlife FWS. 2010. Final Biological Opinion for the U.S. Army Corps of Engineers, Everglades Restoration Transition Plan. Vero Beach, Florida, USA.

U.S. Fish and Wildlife FWS. 2010. Eco-recommendations for the multi-species schedule. Presentation to the ERTP Team. January 15, 2010. Vero Beach, Florida, USA.

U.S. Fish and Wildlife FWS. 2013a. Central Everglades Planning Project Biological Opinion. Prepared by the South Florida Ecological FWSs Office, Vero Beach, Florida, USA.

U.S. Fish and Wildlife FWS. 2013b. Federal Register Volume 78, Number 158, August 15, 2013. Prepared by the South Florida Ecological FWSs Office, Vero Beach, Florida, USA.

Virzi, T. 2009. Recovering small Cape Sable seaside sparrow populations. Cape Sable Seaside Sparrow Fire Symposium. Everglades National Park, December 8, 2009.

Virzi, T., and M.J. Davis. 2013. Recovering small Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) subpopulations: breeding and dispersal of sparrows in the Everglades. Final Report to the United States National Park FWS ((Everglades National Park, Homestead, Florida).

Virzi, T., J.L. Lockwood, R.L. Boulton and M.J. Davis. 2009. Recovering small Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) subpopulations: Breeding and dispersal of sparrows in the Everglades. Report to: U.S. Fish and Wildlife FWS (Vero Beach, Florida) and the U.S. National Park FWS (Everglades National Park, Homestead, Florida).

Walters, J.R., S.R. Beissinger, J.W. Fitzpatrick, R. Greenberg, J.D. Nicholas, H.R. Pulliam, H.R., and D.W. Winkler. 2000. The AOU conservation committee review of the biology, status, and management of Cape Sable seaside sparrow: final report. The Auk 117(4): 1093-1115.

Werner, H., 1975. The biology of the Cape Sable seaside sparrow. Report to US Fish and Wildlife FWS. Everglades National Park, Homestead, FL.

Werner, H. W. 1978. Cape Sable Seaside Sparrow. Pages 19-20 *in* Rare and endangered biota or Florida, Vol. 2: Birds (H. w. Kale, Ed.). University Presses of Florida, Gainesville.

Wetzel, P.R., F.H. Sklar, C.A. Coronado, T.G. Troxler, S.L. Krupa, P.L. Sullivan, S. Ewe and S. Newman. 2011. Biogeochemical processes on tree islands in the Greater Everglades: Initiating a new paradigm. Critical Reviews in Environment and Technology 41:670-701.

Wood, J.M. and G.W. Tanner, 1990. Graminoid community composition and structure within four everglades management areas. Wetlands 10(2): 127-149.

Woolfenden, G.E. 1956. Comparative breeding behavior of *Ammospiza candacuta* and *A. maritima*. University of Kansas Publishing, Museum of Natural History; Lawrence, Kansas.

Woolfenden, G.E. 1968. Northern seaside sparrow. Pages 153-162 *in* A.C. Bent, O.L. Austin, Jr., eds. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies. U.S. National Museum Bulletin; Washington, D.C.

Zweig, C.L. and W.M. Kitchens, 2008. Effects of landscape gradients on wetland vegetation communities: information for large-scale restoration. 2008. Wetlands 28(4): 1086-1096.

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