WORKING *together* TO PROTECT OUR COASTAL WATERS

September 12, 2022

Colonel James Booth, District Commander
U.S. Army Corps of Engineers, Jacksonville District
Jacksonville, FL 32207
Letter submitted electronically

Subject: Lake Okeechobee System Operating Manual - Draft Environmental Impact Statement

Dear Colonel Booth,

On behalf of the Sanibel-Captiva Conservation Foundation and Conservancy of Southwest Florida, we thank the US Army Corp of Engineers for their commitment to making the Lake Okeechobee System Operating Manual (LOSOM) process as inclusive and transparent as possible. We recognize all of the hard work and dedication that the LOSOM team has invested in ensuring that the Lake Okeechobee System Operating Manual is equitable for the entire water management system and to the benefit of all stakeholders.

We acknowledge that there is no ideal scenario that will result in significant improvement to Caloosahatchee and St. Lucie Estuaries, Lake Okeechobee and the Everglades, while also serving the needs of water supply. The proposed plan provides a more equitable distribution from the current hold and dump practice that damages our waters and the ecosystems where we live, work and play.

Overall, LOSOM provides benefits to all downstream systems. We appreciate the flexibility in this plan that gives water managers the ability to react to changing real-world conditions while ensuring that permitted water users will be protected.

Sincerely,

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Technical comments

Overall, the Preferred Alternative has the potential to provide various levels of benefit to the northern estuaries (Caloosahatchee, St Lucie, and Lake Worth Lagoon), Everglades, and water supply. Our technical comments focus primarily on extreme discharges to the Caloosahatchee Estuary, Impacts on Lake Okeechobee, Red Tide, and climate change.

Discharges to the Northern Estuaries

The draft EIS acknowledges that the Preferred Alternative would result in greater extreme flow events for the Caloosahatchee River Estuary (i.e. 14-day moving average >6500 cfs at S79). Relative to each respective no-action alternative (NA22 and NA25) extreme flow events are expected to increase by 29.0% and 26.3%, respectively (Fig 1). The Draft EIS suggests that ***"once the C-43 Reservoir becomes operational in 2025, the number of extreme high flow events is expected to decrease slightly for both the No Action Alternative and the Preferred Alternative"*** with little quantitative information to support this statement. While the relative percent difference (and count) do vary between PA22 and PA25, these differences are relatively minor (<3%). Moreover, when evaluating the sources of extreme discharges, the vast majority (~80%) are from the Lake (Fig 2). Moreover, relative to each no-action alternative, lake derived extreme flow events increase by 36.2% and 35.6% for NA22 and NA25, respectively (Fig 2). This suggests very little benefit by the C-43 reservoir for lake-derived flows rather the benefit of the reservoir is realized in the basin-derived extreme flow events where PA25 shows a -8.3% difference relative to NA25 (Fig 2). Finally, the duration of daily flow >6500 cfs at S79, especially lake-derived events is of concern. The number of lake-derived extreme discharges increases relative to no-action baseline conditions ranging from <14 days to 30 - 60-day events (Fig 3). This is especially concerning for events lasting between 30 and 60 days (Fig 3).

Extreme flow events for the Caloosahatchee have the potential to affect conditions beyond the Caloosahatchee Estuary. Large discharge volumes can alter circulation patterns in the lower estuary and surrounding regions (i.e. Pine Island sound, San Carlos Bay, etc.) such that Gulf of Mexico water can be drawn into the estuary through inlets between the barrier islands. This dynamic can therefore transport and potentially concentrate *Karenia brevis* (i.e. red tide) from the nearshore environment (Dye et al 2020 & Olabarrieta et al *In Prep*). Additionally, prolonged extreme flow events have the potential to adversely affect indicator species such as oysters in all life stages but especially suspended larvae and attached oyster spat (Rumbold et al 2021). It has been recommended that extreme discharge events could be mitigated by implementing a pulsed discharge rate, while this management action could benefit the ecology it ultimately may not be reflected in the event counts of the RECOVER salinity envelope evaluation. Additionally, depending on how the pulse event is structured, it could increase the time needed to release the same volume of water to alleviate flood risk. The USACE should evaluate whether mitigation strategies such as the described pulsing, or other methods are appropriate to incorporate into their management of Lake Okeechobee.

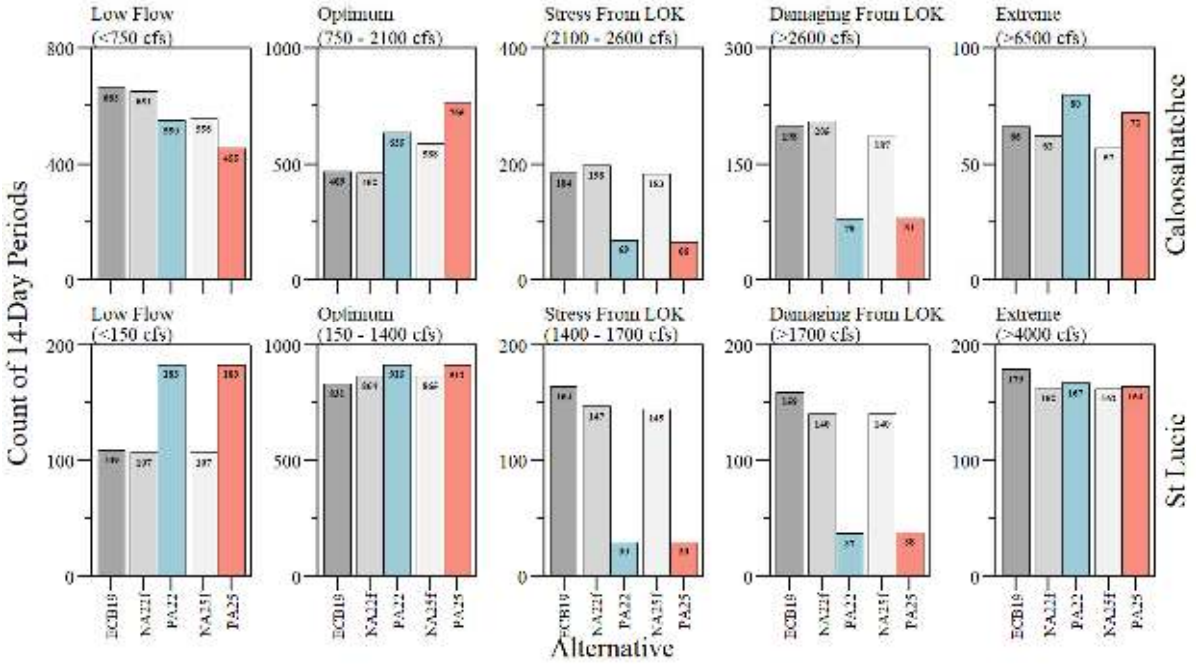

Figure 1. Count of 14-day periods within each respective RECOVER salinity envelope category during the simulation period of record for Caloosahatchee (top) and St Lucie (bottom) estuaries.

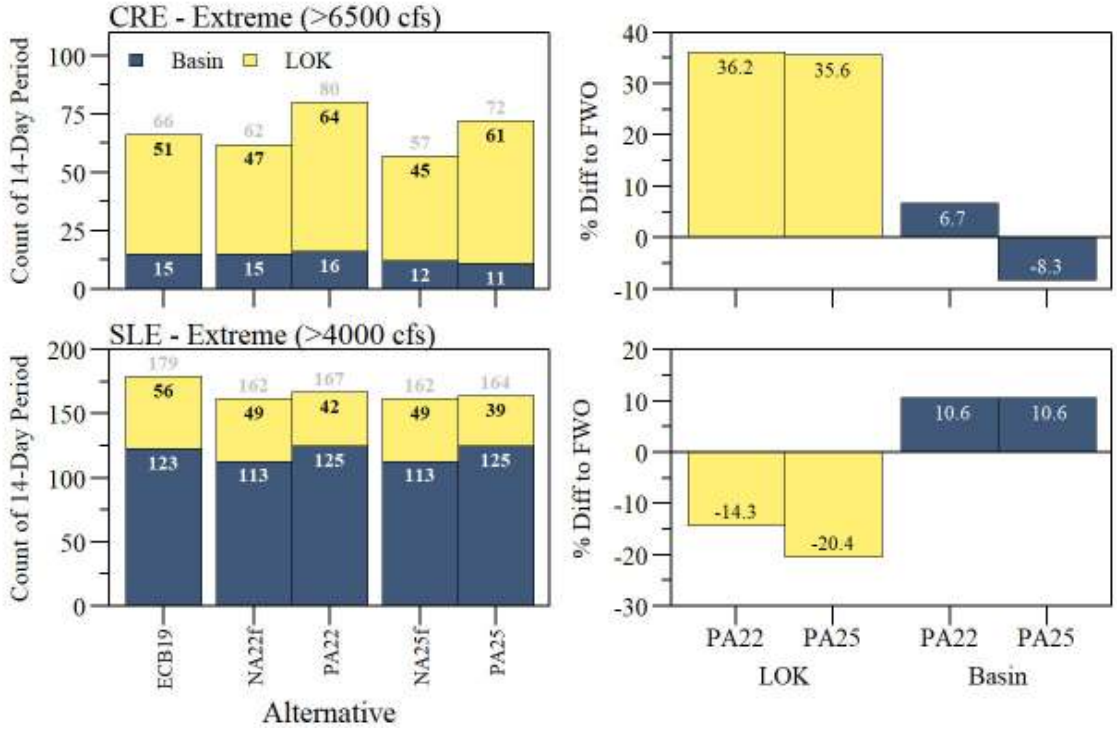

Figure 2. Count of 14-day events where discharges are >6500 cfs for the Caloosahatchee (top) and >4000 cfs for St Lucie (bottom) estuaries.

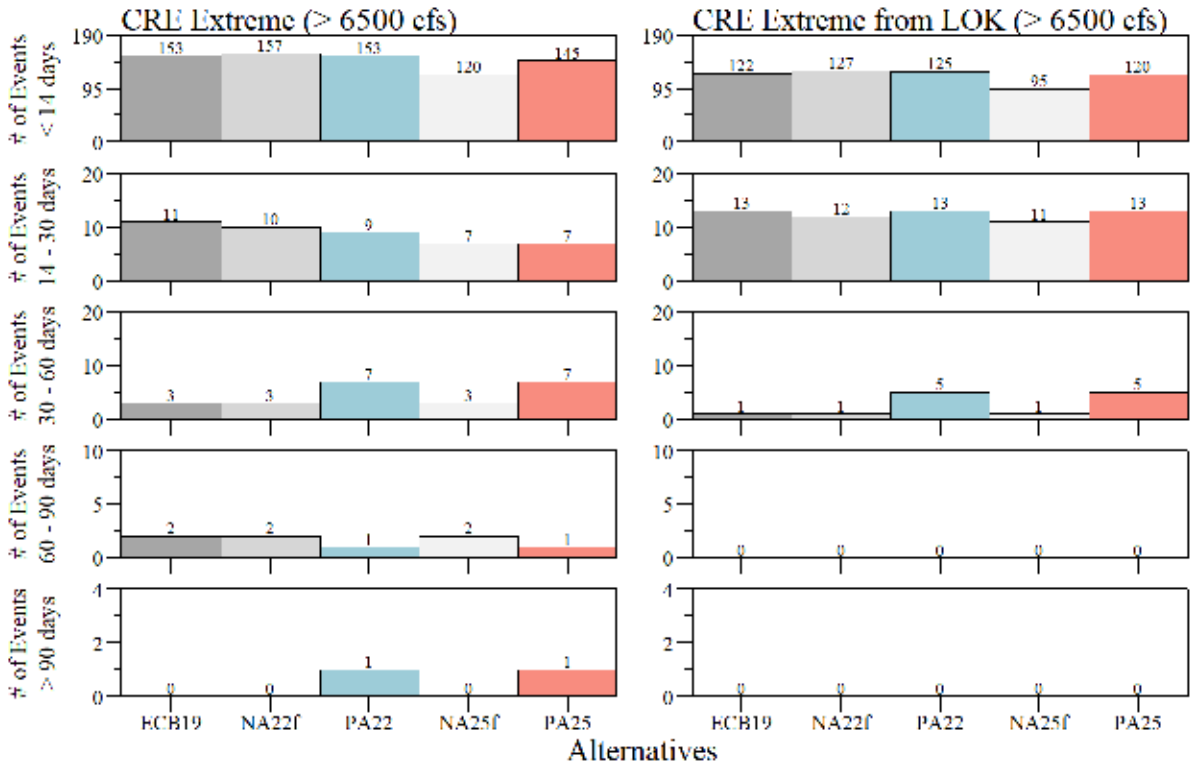

Figure 3. Total number of events and duration of extreme flow events for the Caloosahatchee River Estuary (left) and lake-derived extreme flow events (right).

Lake Impacts

An objective of the plan formulation for the current Preferred Alternative was to address the duration and number of events above 17 feet and to develop lake recovery mode in the operational guidance. The frequency of lake stage elevations above 17 Ft NGVD29 increased from 0.2% in the No Action Alternative to 1.3% in the Preferred Alternative. The frequency of stage elevations above 16 Ft NGVD29 also significantly increased between the No Action and Preferred Alternative (Fig 4). Meanwhile, the frequency of stage elevations less than 10 Ft NGVD29 is lower in the preferred alternative relative to the 'future without the project' indicating overall higher average stage elevations. These stage elevations are ecologically significant thresholds for Lake Okeechobee with the potential for higher lake water levels to result in damage to critical ecological zones of the lake including the nearshore and littoral zones of Lake Okeechobee (Havens 2002, Julian and Welch *In Press*).

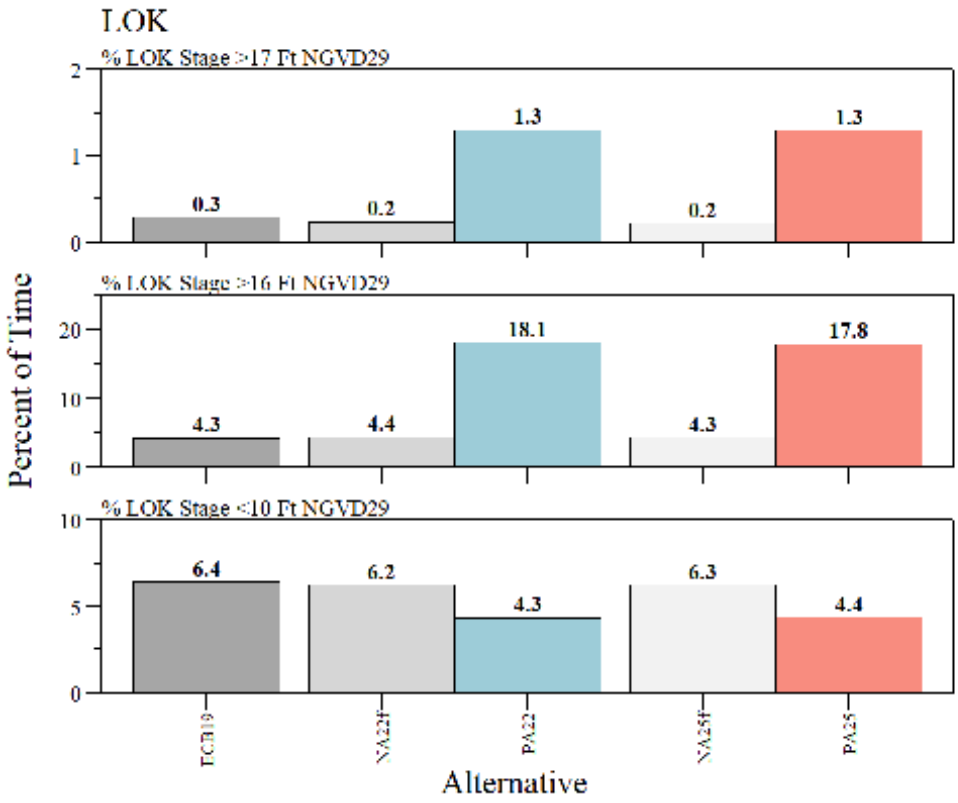

Figure 4. Percent of time LOK stage above 17 ft, 16 ft, and below 10 ft NGVD29 from the Regional Simulation Model - Basins model runs.

In the draft EIS, it is acknowledged that the Preferred Alternative is expected to have a long-term major adverse effect on the ecology of Lake Okeechobee due to high lake water levels directly impacting aquatic vegetation and indirectly impacting water quality and dependent species. As a part of LOSOM, the intent of the lake recovery mode is to reduce these effects to some degree. But it is the equivalent of a band-aid for a head wound. Based on the LOOPS modeling, the lake recovery model (Test 14 and 16) has the potential to reduce the frequency of >17 Ft NGVD29 by 0.2% and >16 Ft NGVD29 by 2.2% relative to the preferred alternative (Fig 5). Given these relatively small changes in the frequency of events, the change from major to moderate long-term adverse effects due to recovery mode seems arbitrary. Unfortunately, the potential cumulative effects on lake ecology will continue into the foreseeable future for any alternative even in light of future restoration as acknowledged in the draft EIS.

During the period of simulation, the lake was in the recovery envelope 30 times (out of 52; ~57%; RSMBN modeling), and implementation of the lake recovery mode reduced the frequency of being in the lake recovery (26 out of 52; 50%; LOOPS modeling). This slight change in operations has the potential to slightly improve lake conditions but regulatory discharges to the northern estuaries under lake recovery mode is expected to change. Based on the LOOPS modeling average regulatory discharges under lake recovery mode are expected to change slightly with a ~12 % increase for the St Lucie Estuary relative to the preferred alternative, however, it is still a 56% reduction relative to the no-action alternative. Meanwhile, regulatory discharges to the Caloosahatchee in recovery mode only decrease by <1.0% relative to the preferred alternative and

<3% relative to no-action (based on LOOPS modeling, 4% decrease based on RSMBN). This change in regulatory discharges is expected, as the Water Control Plan dictates that in recovery mode, discharge to the St Lucie Estuary can be up to 1400 cfs in Zone D including north and south Fork, and discharges to the Caloosahatchee remain up to 2100 cfs. It is our hope that water levels in the lake can be managed in such a way as to avoid high stages and not be in perpetual lake recovery mode given future climate change predictions. The USACE should explicitly state that it is their intention to manage the lake, to the extent viable, to avoid entering lake recovery mode. Managing the lake for sustainability and resiliency will improve not only the ecology of the lake but also downstream systems. Moreover, future CERP restoration efforts and storage options could alleviate the pressure on the lake to need recovery mode by properly managing water levels in an ecologically meaningful way.

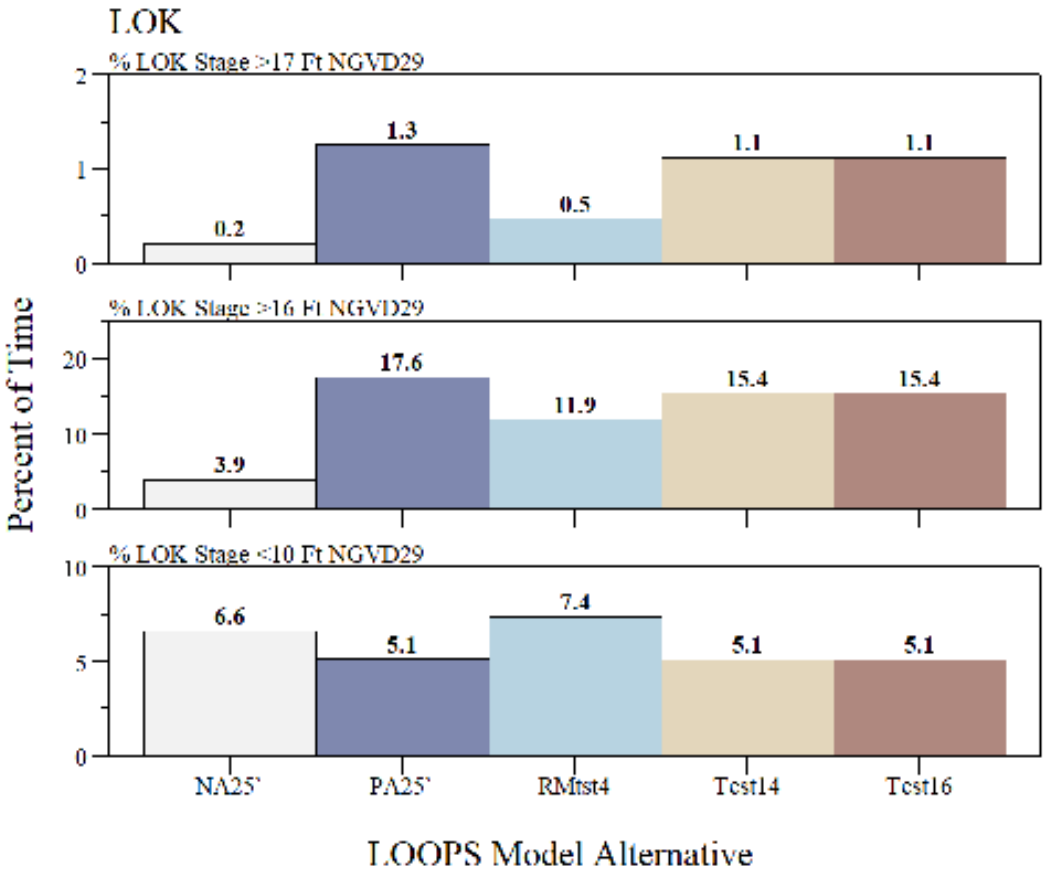

Figure 5. Percent of time LOK stage above 17 ft, 16 ft, and below 10 ft NGVD29 from the Lake Okeechobee Operational Planning Model runs.

Indirectly the Preferred Alternative could also affect the long-term water quality of the lake. The draft EIS acknowledges water quality for the preferred alternative within the lake will have a "*minor long-term adverse effect"*. This evaluation is based on the frequency of stage elevations above the ecological stage envelope and the associated detrimental effect on submerged aquatic vegetation and the potential mobilization of legacy sediments. Prior studies have demonstrated lake stage has an influence on spatial variability of TP concentration across Lake Okeechobee (Havens 1997; Havens and Walker 2002). Generally, TP concentrations increase with stage in the

near-shore and littoral regions of the Lake (Fig 6). This relationship could be explained by two mechanisms: (1) lake bathymetry may limit horizontal transport and mixing of nutrients under low-stage conditions between the pelagic and nearshore/littoral zones of the lake and; (2) at low-stage elevations and relatively high irradiance conditions (light penetration) uptake of phosphorus by vascular plants and periphyton can facilitate lower nutrient concentrations in this region. Given that the preferred alternative will result in higher water levels within Lake Okeechobee, to ensure that the plan does not further degrade the lake's water quality, mitigation strategies like the lake recovery mode and water quality restoration projects will be needed.

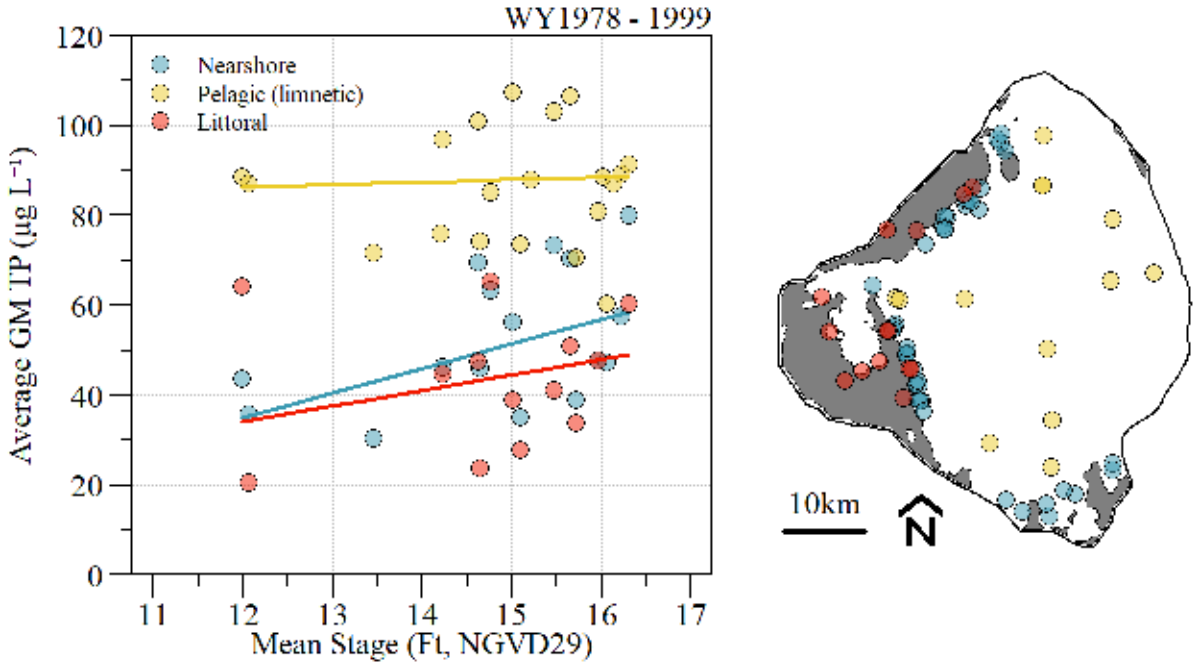

Figure 6. Average annual geometric mean total phosphorus concentration relative to annual mean stage elevation across Lake Okeechobee for the period of May 1977 to April 1999 consistent with Havens and Walker (2002). This time frame represents a period of higher lake stages relative to LORS08. This analysis was replicated using data available from the South Florida Water Management District online database (DBHYDRO; https://www.sfwmd.gov/dbhydro) from monitoring locations identified on the map (right).

Red Tide

The draft EIS acknowledges that Lake Okeechobee contributes approximately a third of the water and nutrient load to the Caloosahatchee Estuary based on the last five water year periods. Moreover, a total nitrogen (TN) total maximum daily load (TMDL) has been developed for the Caloosahatchee Estuary by the Florida Department of Environmental Protection with a load limit of 5,900 tons yr-1 including S79 and tidal basin loads. The draft EIS also discusses and provides some literature review of Red Tide (*Karenia brevis*) acknowledging that red tide predominately blooms off-shore and is transported on-shore (to the coast). The literature review is limited to literature up to 2021 and it states "***...there is no direct link between land-based nutrient pollution and land-based runoff to the frequency and severity of the red tide blooms.***" However, Medina et al (2022) concluded that nitrogen-enriched Caloosahatchee River discharges have consistently

intensified red tide blooms to varying degrees over time, are influential at the early stages of near-shore bloom development, and exerted the strongest influence during blooms' growth/maintenance stages. These results indicate that discharges and nitrogen inputs influence blooms through distinct yet synergistic causal mechanisms. The results of Medina et al (2022) indicate that watershed-scale nutrient management (not part of LOSOM) and modifications to Lake Okeechobee water management decisions (part of LOSOM) could mitigate coastal bloom development and maintenance.

Using annual nutrient load models developed by FDEP (link to presentation) changes in total nitrogen and total phosphorus (TN and TP) loading to the Caloosahatchee Estuary can be evaluated for the preferred alternative. Due to changes in discharges to the Caloosahatchee River Estuary loading is also affected with a 3% and <1% reduction in TP and TN loads, respectively for the preferred alternative relative to both no-action alternatives (i.e. NA22f vs PA22 and NA25f vs PA25). Meanwhile, relative to the no-action alternative, TP annual flow-weighted mean (FWM) concentrations decrease by 3% while TN FWM concentrations are expected to increase by <1%. While these models assume that water quality conditions during the period of simulation are stationary, the models do capture the relative contributions of load from the lake and watershed thereby evaluating potential changes in loading conditions to the estuary for the various alternatives. Additionally, an evaluation of the Caloosahatchee Estuary TMDL is not possible as the TMDL limit is based on S-79 and tidal basin (downstream of S-79) loading, these models only estimate annual S-79 loading. Based on the relative changes in TN and TP loads and FWM concentrations, the preferred alternative will have a marginal effect on annual nutrient loads and FWM concentrations. Therefore, significant actions are needed outside of LOSOM to address nutrient loading to the estuary.

The USACE has demonstrated that it has the capabilities to craft risk metrics associated with algal blooms, as this is precisely what it has done concerning the danger of transporting blue-green algae to the estuaries. By incorporating the presence of blooms, and the risk associated with the timing of a release, the USACE has taken tangible steps to limit the risk of blue-green algal blooms to the Caloosahatchee and St. Lucie estuaries. A similar metric should be established to evaluate the risk of exacerbating a red tide bloom. Factors such as the presence of *Karenia brevis* in the gulf, the TN and TP of the water released, the amount and duration of a planned release and the time of year could all be incorporated into the USACE decision-making process when determining the risk of a harmful algal bloom.

Climate Change

We recognize that the USACE has developed a set of standardized methods and tools for assessing the impacts of climate change used in planning projects and other efforts. The output from these tools in addition to other local sources of information is evidenced in the literature review provided in Appendix H of the draft EIS. However, we urge USACE to continue to follow the development of more locally relevant studies, tools, and models and also incorporate these into future climate assessments, including but not limited to the continuing work of the South Florida Water Management District (SFWMD) and its partners to refine regional rainfall projections. The capacity and availability of these tools are only likely to increase with the State's commitment to and funding for resilience.

In Appendix H of the draft EIS, sea level change was assessed using low, intermediate, and high future scenarios generated from the USACE sea level rise calculator for both the Fort Myers and Lake Worth Pier tidal gauge data. The values presented in Table H.1 differ slightly from what is presented in the USACE sea level change curve calculator (version 2022.60; https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html)(Fig 7A). Examining just Fort Myers, The USACE low and intermediate curves are very conservative - they trend lower than actual recent, observed sea level rise in the area, and lower than all of the scenarios represented in recently released 2022 curves from Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force (Table 1 and Fig 7B) which included the USACE among its partners. Extrapolations of observed data out to 2050 for Fort Myers, and the Eastern Gulf of Mexico, fall between the Task Force's intermediate high and high scenarios and below the USACE high curve (Fig 7B). A cursory look at Lake Worth Pier data appears to yield similar patterns. This would suggest that the USACE's high scenario should be given more weight within climate assessments of LOSOM and future iterations of the Lake Okeechobee regulation schedule. Additionally, it might be appropriate to include both USACE and some of the Task Force sea level rise curves within assessments.

Table 1. Changes in mean sea levels in units of feet compared to the year 2000 for the Fort Myers tidal gauge as calculated from Table H.1 of Appendix H of the draft EIS (USACE estimates) and as projected by the Interagency Sea Level Rise Scenario Tool (NOAA estimates).

	USACE			**Interagency Task Force**			
Year	Low	Int	High	Obs	Low	Int.	High
2030	0.33	0.46	0.85	0.67	0.51	0.59	0.64
2040	0.44	0.65	1.28	1.00	0.69	0.84	1.01
2050	0.55	0.85	1.78	1.39	0.87	1.13	1.55

In section H.1.2., the Corp describes current conditions at the Lake Okeechobee S-80 Outlet Structure on the St. Lucie River. The spillway is described as having a crest elevation of 2.04 ft NAVD88, the mean tailwater stage calculated between September 2013 and April 2021 was calculated as 2.17 ft NAVD88, and there is an acknowledgment that flows through the structure are constrained when tailwater stage is $\geq$ 1.5 feet NAVD88. This would seem to suggest that the average tailwater height at S-80 is above the crest height and the structure likely experiences impeded flows irrespective of additional sea level rise. If this is the case, then any amount of gradual sea level rise in addition to this mean tail water height seems problematic. If this is not the correct interpretation of the data presented, then perhaps further explanation would be warranted for an outside reader. Also, the way sea level rise seems to be presented in section H.1.3. is in isolation from the current mean tailwater heights at S-79 and S-80. It would be helpful to see

graphs that illustrate the compound, additive effect of both future SLR and mean tailwater height together in comparison to the critical tailwater threshold identified for both structures.

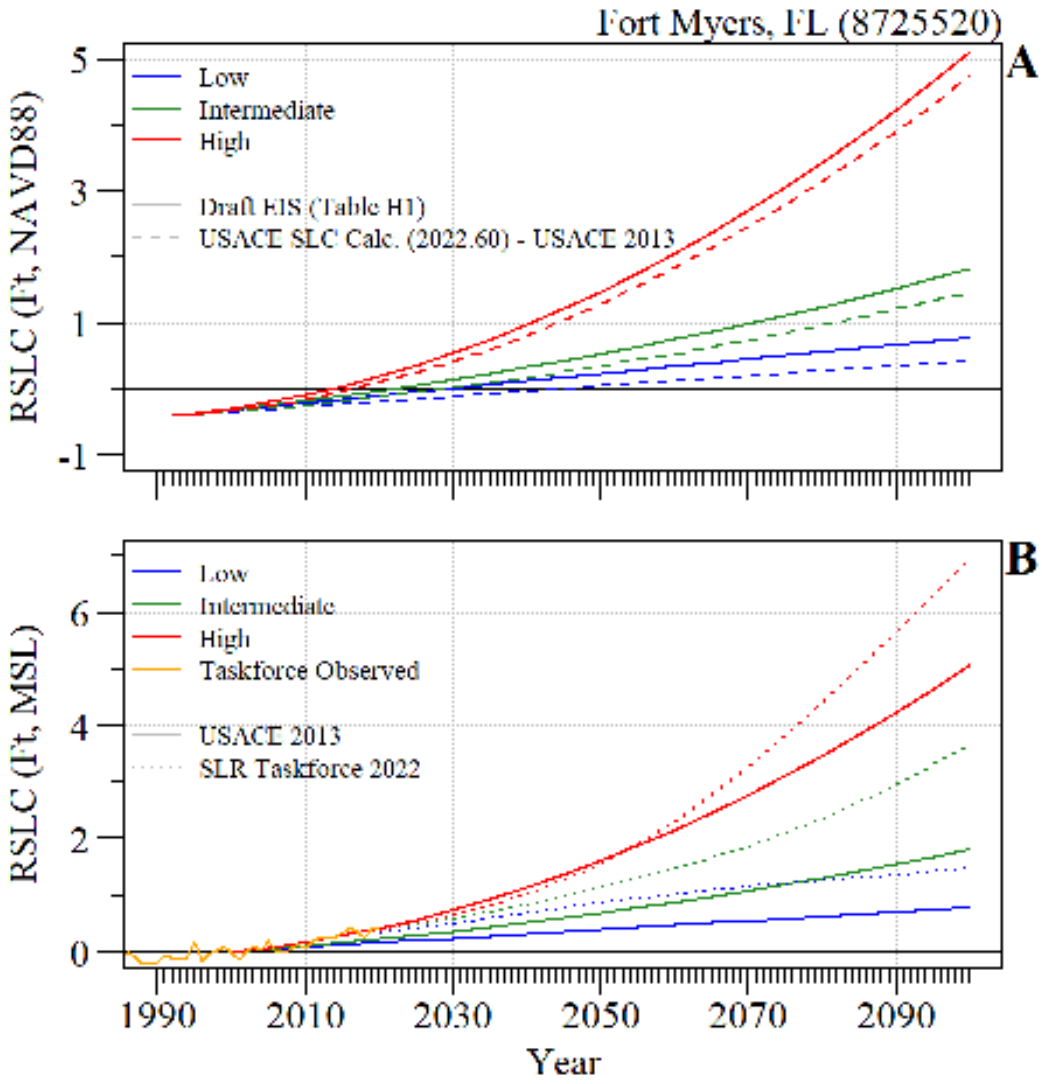

Figure 7. Relative sea level change for Fort Myers FL (8725520). A) presents low, intermediate, and high relative sea level change presented in the Table H1 of the Draft EIS and those presented in the USACE sea level curve calculator version 2022.60. B) presents observed, low, intermediate, and high relative sea level change curves for USACE 2013 (solid lines) and the Sea Level Rise Taskforce 2022 relative sea level change curves relative to 2000.

The literature review in Appendix H of the draft EIS includes results regarding the extent of current and future climate change impacts (Figure H.10 of the draft EIS), with one arrow denoting a small increase or decrease and two arrows denoting a large increase or decrease. This is in line with the USACE's bulletin on incorporating climate change impacts in hydrological analyses (USACE ECB 2018-14) which suggests the results should be primarily qualitative. However, it would be helpful for the LOSOM partners and stakeholders to include some level of quantitative information to better illustrate the magnitude and variability of the ranges of the results.

Appendix H of the draft EIS concludes that, even with the uncertainty associated with future climate conditions, the HUC 0309 watershed (south Florida) has vulnerabilities to climate change impacts (section H.3). These impacts include increases in extreme storm frequency and intensity, extreme temperatures, extreme precipitation, and sea level all of which affect the congressionally authorized purposes of the Central and Southern Flood Protection Project and future water management operations. There is an acknowledgment that the preferred alternative would benefit from considering climate conditions and resilience within operational planning and possibly developing adaptable operational protocols. However, no specificity was provided, therefore we would like to see USACE provide more information on how they could apply these recommendations.

Conclusion

We are appreciative of the time and effort that the USACE has put in to listen to the needs of all stakeholders throughout this process. The operational flexibility of the plan, coupled with the emphasis on maximizing optimal flows to the Caloosahatchee has resulted in a plan that we can support. The guidance within Zone D to provide minimum flows to the Caloosahatchee gives us confidence that the massive amount of work put into restoring the northern estuaries will not be casually and unnecessarily undone. However, the discussion that occurred during the SFWMD Governing Board meeting on September 8, 2022 is cause for concern. If the governing board were to have control over water distribution decisions above the water shortage band, without additional assurances made to protect flows to the estuaries (with emphasis on the Caloosahatchee), we would likely no longer be able to support the plan. With such an abdication by the USACE, it is entirely possible that the lake would be maintained higher than was modeled in the DEIS, necessary flows to the Caloosahatchee would be cut off earlier and we would see a sharp increase in stressful, damaging, and extreme flows, resulting in significantly more harm for the northern estuaries than was modeled by the current alternative. We urge the USACE to stick to the plan as it is contained within the DEIS and not risk the health of the environment for the desires of permitted users.

References

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