#### FLORIDA WATER MANAGEMENT SOUTH DISTRICT

# **PERIOD-OF-RECORD PHOSPHORUS RETENTION IN THE EVERGLADES STORMWATER TREATMENT AREAS – 1994 TO 2016**

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# **1. INTRODUCTION**

The Everglades Stormwater Treatment Areas (STAs) are large constructed freshwater wetlands designed to reduce total phosphorus (TP) concentration in stormwater runoff primarily from the Everglades Agricultural Area (EAA) before this water enters the Everglades Protection Area (EPA). The STAs remove water-column TP through a combination of biological, chemical and physical mechanisms with the primary mechanism being P uptake by algae, microbes and plants and the eventual accretion of

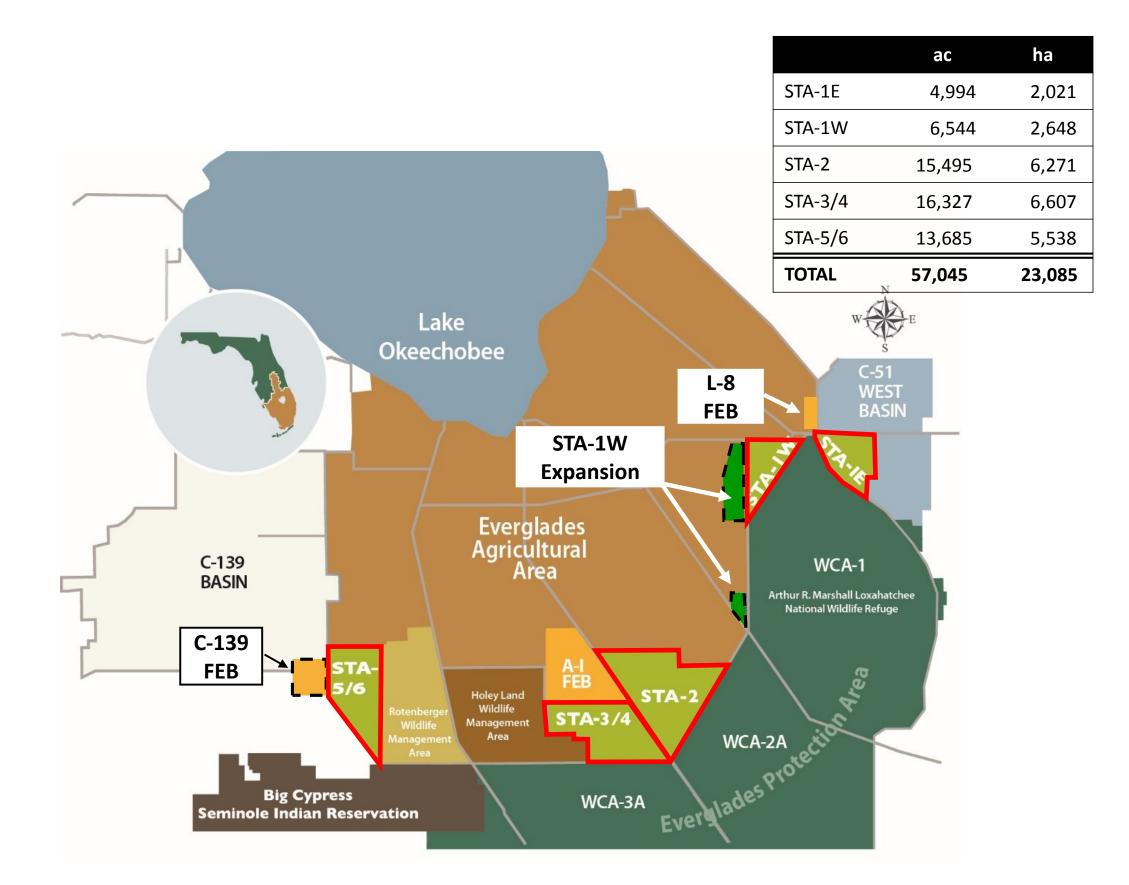
#### **5. SUMMARY**

- The STAs over their 22-year POR have treated 2.15 x 10<sup>4</sup> hm<sup>3</sup> (17.4M ac-ft) of runoff and retained 2,220 metric tons (t) of TP, or 76% of the inflow TP load that otherwise would have entered the EPA (Table 1).
- POR inflow TP concentration is not a strong predictor of outflow TP concentration (R<sup>2</sup> = 0.51; Fig 3A), while POR inflow TP load does predict the TP load retained ( $R^2 = 0.93$ ; Fig 3B).
- The cumulative double-mass curve for all STAs does not indicate any consistent decline in treatment performance over the POR (Fig. 3C).
- Annual TP load retained in individual STAs may approach an asymptote at inflow TP loads  $\geq \sim 3$  g m<sup>-2</sup> yr<sup>-1</sup> (Fig. 3D).
- Annual % TP load retained for all STAs achieved its highest level in WY2016 (86%). Conversely, outflow TP concentrations in the last six years have been among the lowest levels observed to date (~ 17 to 21  $\mu$ g L<sup>-1</sup>; Fig. 4A).

#### this biomass to the wetland sediments.

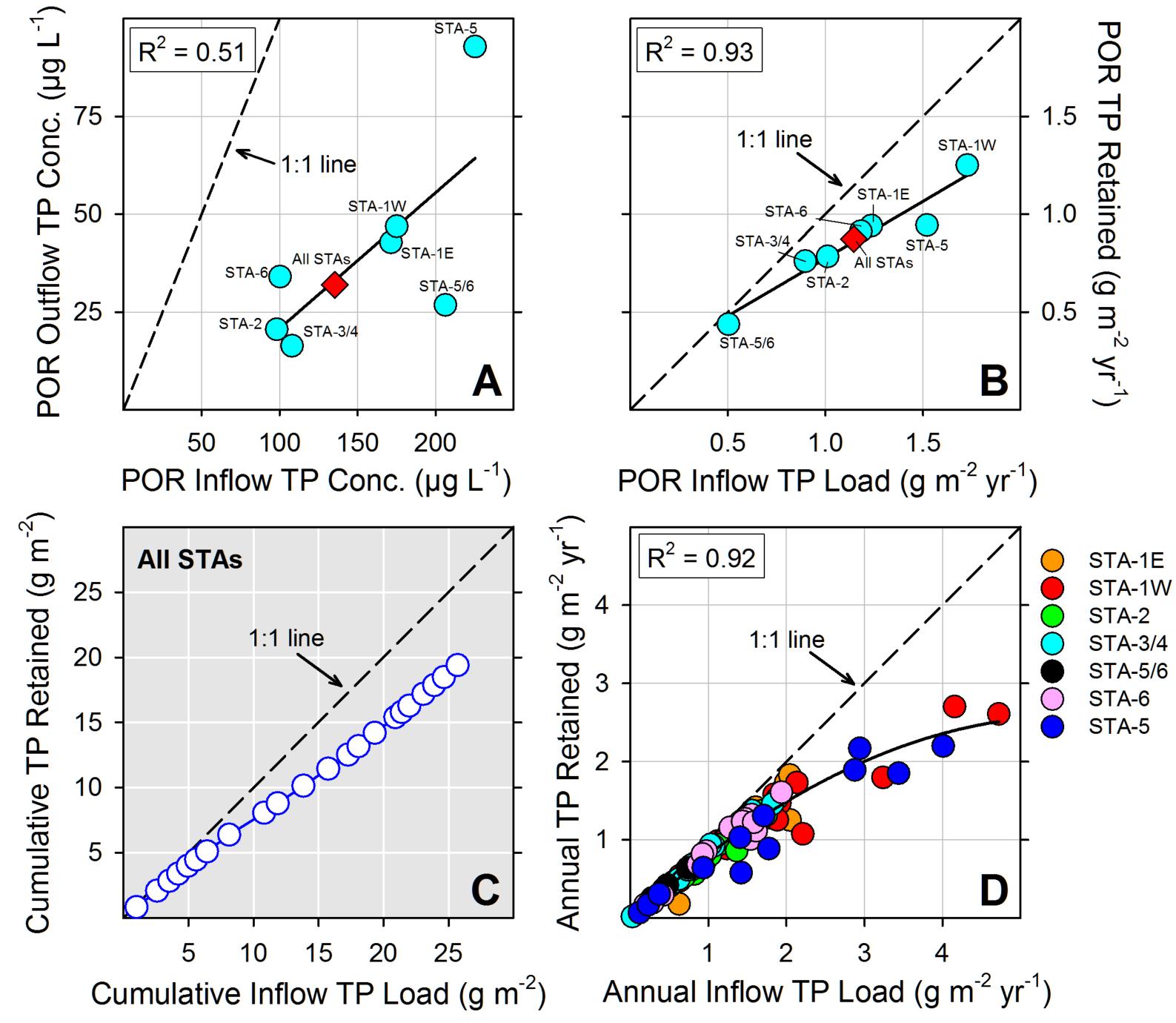
# **2. STUDY AREA**

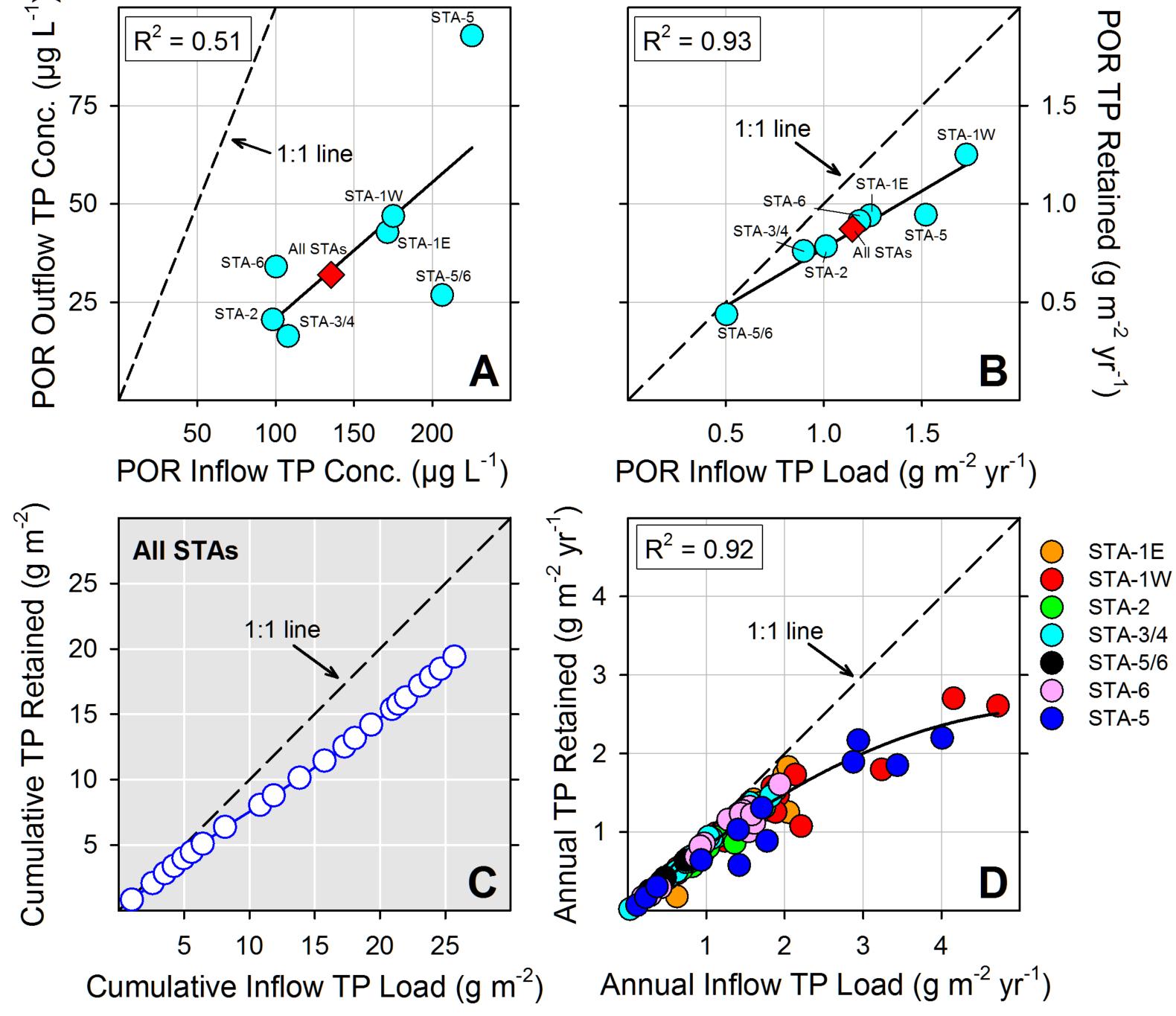
The Everglades STAs are located within the EAA (Fig. 1). They were built over a period of years and began operation in Water Year (WY) 1995 through WY2005 [WY = May to following April] (Table 1). These five wetlands currently encompass 23,085 ha (57,045 ac).



# **4. RESULTS**

	Op. Years	Surface Inflow	Surface Outflow			Outflow TP Load		Inflow TP	Outflow TP	Inflow TP Loading
	(WY)	(hm³)	(hm³)	Δ	(t)	(t)	Δ	(µg L <sup>-1</sup> )	(µg L <sup>-1</sup> )	$(g m^{-2} yr^{-1})$
STA-1E	05-16	1,515	1,446	4.6%	260	62	76%	171	43	1.236
STA-1W	95-16	4,867	5 <i>,</i> 015	-3.0%	852	235	72%	175	47	1.727
STA-2	02-16	5,420	5 <i>,</i> 840	-7.7%	532	120	77%	98	21	1.012
STA-3/4	04-16	6,866	6 <i>,</i> 930	-0.9%	742	113	85%	108	16	0.897
STA-5	00-12	1,513	1,391	8.0%	341	129	62%	225	93	1.521
STA-6	98-12	848	571	32.7%	85	19	77%	100	34	1.182
STA-5/6	13-16	481	482	-0.2%	99	13	87%	206	27	0.503
All STAs	95-16	21,511	21,675	-0.8%	2,912	692	76%	135	32	1.146





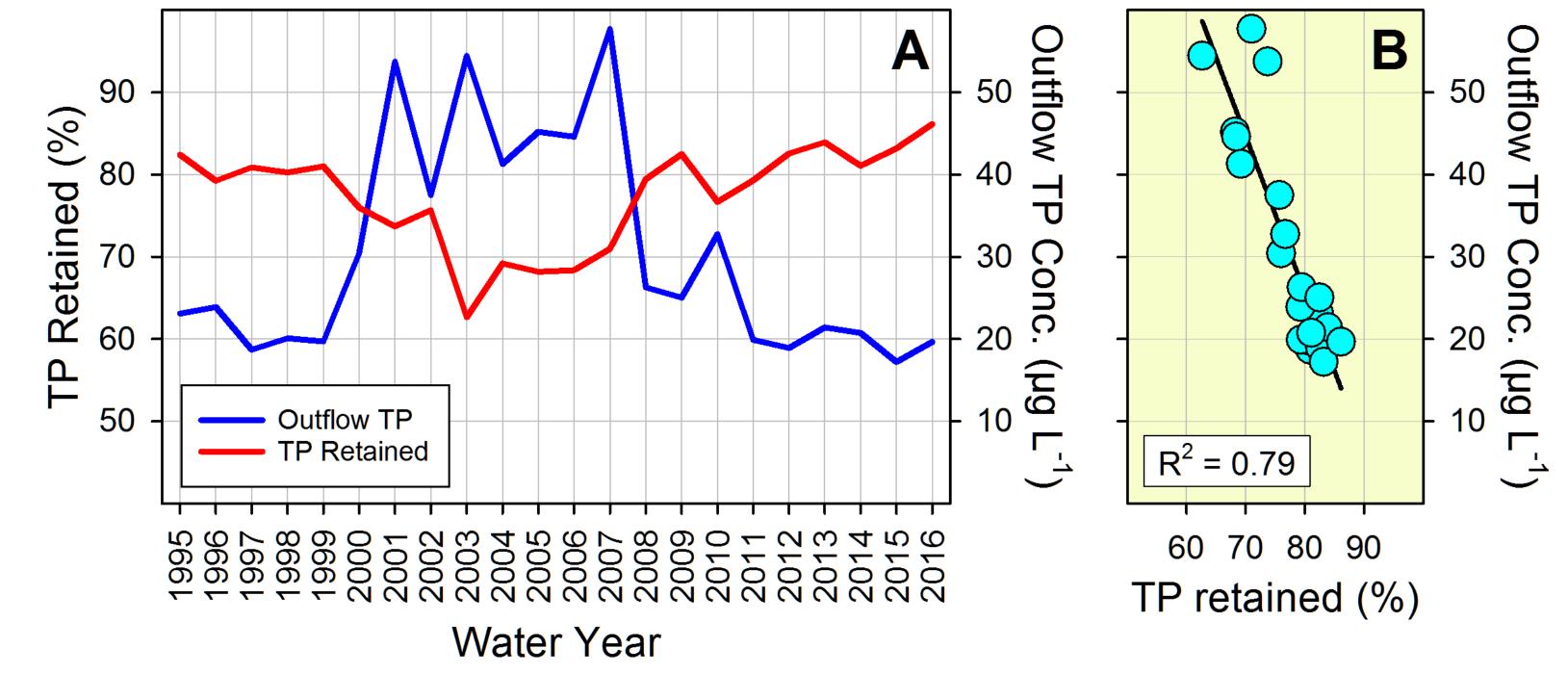
**Table 1.** Summary of STA operation and treatment performance over the POR.

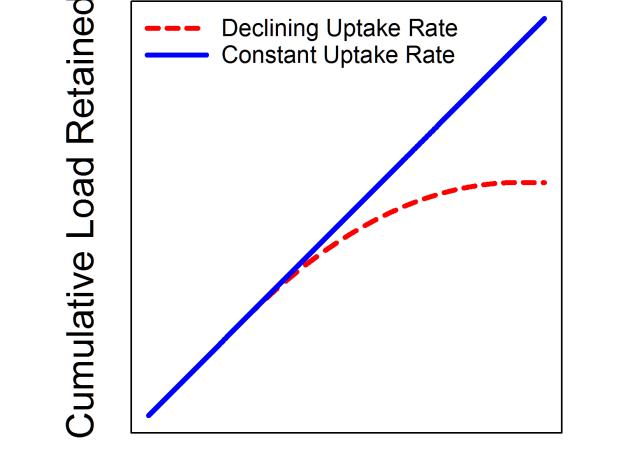
**Figure 1.** Location of the Everglades STAs in relation to the EAA, EPA, flow equalization basins (FEBs) and the future expansion of STA-1W.

### **3. METHODS**

Mass balance TP budgets and flow-weighted mean (FWM) TP concentrations were computed using surfacewater TP data collected from inflow and outflow sites in each STA. A cumulative double-mass curve (inflow load vs. load retained) was examined for any long-term trend in TP uptake over the period-of-record (POR) (Fig. 2). This poster includes analyses in which all the STAs are evaluated as a single system ("all STAs").

**Figure 3.** Evaluation of treatment performance in the STAs for A: inflow vs. outflow POR TP concentrations; **B**: POR inflow TP load vs. TP load retained; C: cumulative doublemass curve for inflow TP load vs. TP load retained ; **D**: annual TP load vs. TP load retained for each STA.





--- Declining Uptake Rate

Constant Uptake Rate

**Cumulative Inflow Load** 

**Figure 2.** Hypothetical cumulative double-mass curves illustrating constant and declining uptake rates.

Figure 4. Relationship of annual % TP load retained vs. outflow TP concentration for all STAs over the POR.

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