

# Status of Long Term Trends for the Arthur R. Marshall Loxahatchee National Wildlife Refuge and Everglades National Park TP Compliance

Stuart Van Horn, P.E.  
Water Resources Division

Technical Oversight Committee Meeting  
*July 19, 2016 (slide revisions September 23, 2016)*



[sfwmd.gov](http://sfwmd.gov)

## Long Term Trend Goals

### A.R.M. Loxahatchee NWR

**Consent Decree - long term concentration expectation** (Appendix B, page B-3)

- “The long term concentration levels will apply to all 14 stations.”
- “Compliance with these concentration levels is expected to provide a long term average 14 station interior marsh concentration of approximately 7 ppb.”

**Consent Decree - long term compliance to be met by December 31, 2006**

(Appendix B, page B-4)

### Everglades National Park

**Consent Decree - long term concentration expectation** (Appendix A, page A-2)

- “Phosphorus limits apply to flow-weighted mean concentrations computed on an annual Water Year basis.”
- “Compliance with these limits is expected to provide a long term average flow-weighted mean inflow concentration of approximately 8 ppb for Shark River Slough Basin and 6 ppb for the Taylor Slough and Coastal Basins.”

**Consent Decree - long term inflow limits effective December 31, 2006**

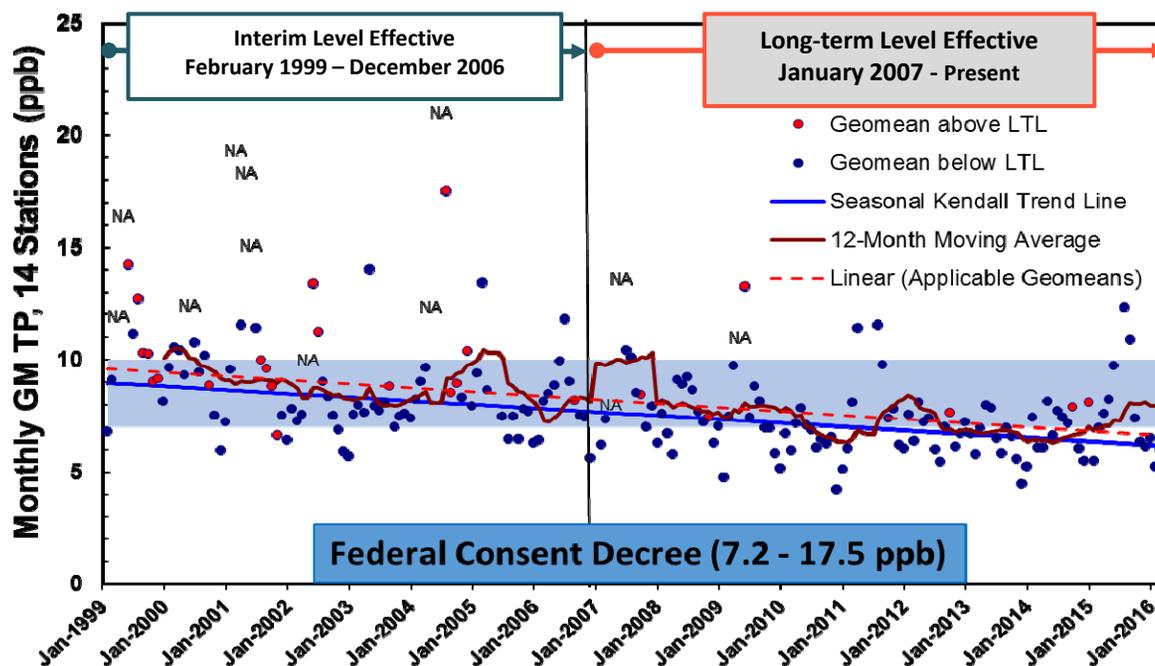
(Appendix A, page A-2)



# A.R.M. Loxahatchee NWR Marsh Sites

## Federal Consent Decree (Appendix B)

- 5 years Feb 1999 – Jan 2004 average ~1.1 ppb below LTL
  - Average ~8.9 ppb
- 5 years Apr 2011 – Mar 2016 average ~3.2 ppb below LTL
  - Average ~7.2 ppb
  - 95% of months below level by 3.4 ppb
  - 5% of months above level by 0.4 ppb



Monthly 14-Station Geometric Mean TP Concentrations Deviation from Long-term Levels (LTL) in ppb (5-year period April 2011 – March 2016)

	Number of Months	Minimum Difference	Maximum Difference	Average Difference
<b>In-Compliance (below level)</b>	53	-0.2	-9.4	-3.4
<b>Excursion (above level)</b>	3	0.1	0.7	0.4

Notes:

- The laboratory margin of error is +/- 2 ppb
- Four months in this period were not applicable (NA) due to stage being outside compliance equation range

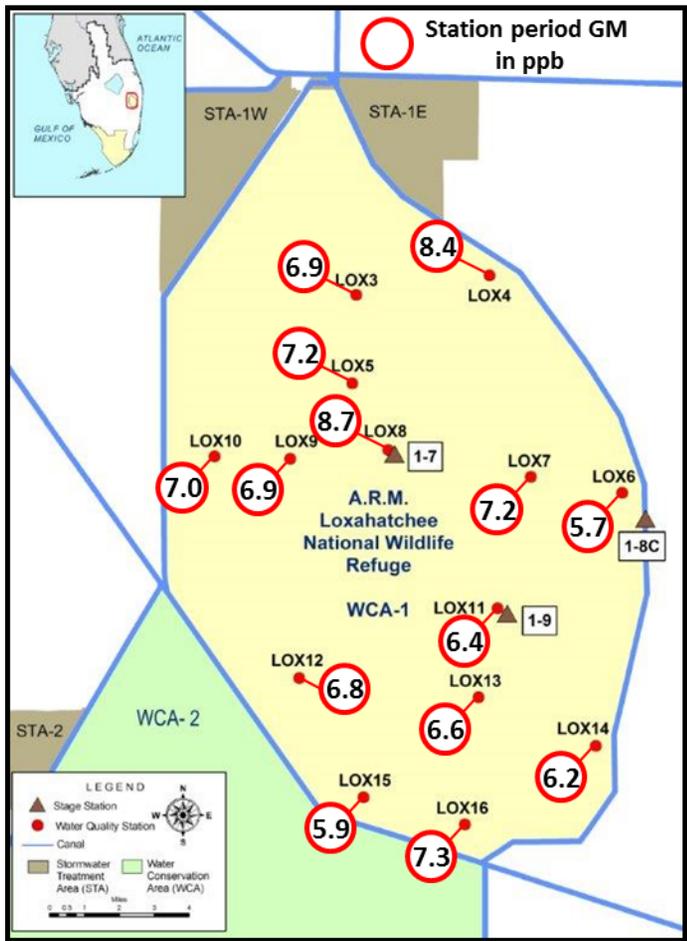
Exceedance Event TP Differences in ppb

	Actual	Long-term Level	Difference
<b>2008 Nov</b>	7.4	7.2	0.2
<b>2009 Jun</b>	13.2	12.1	1.1
<b>2014 Oct</b>	7.9	7.2	0.7
<b>2015 Jan</b>	8.1	7.9	0.2

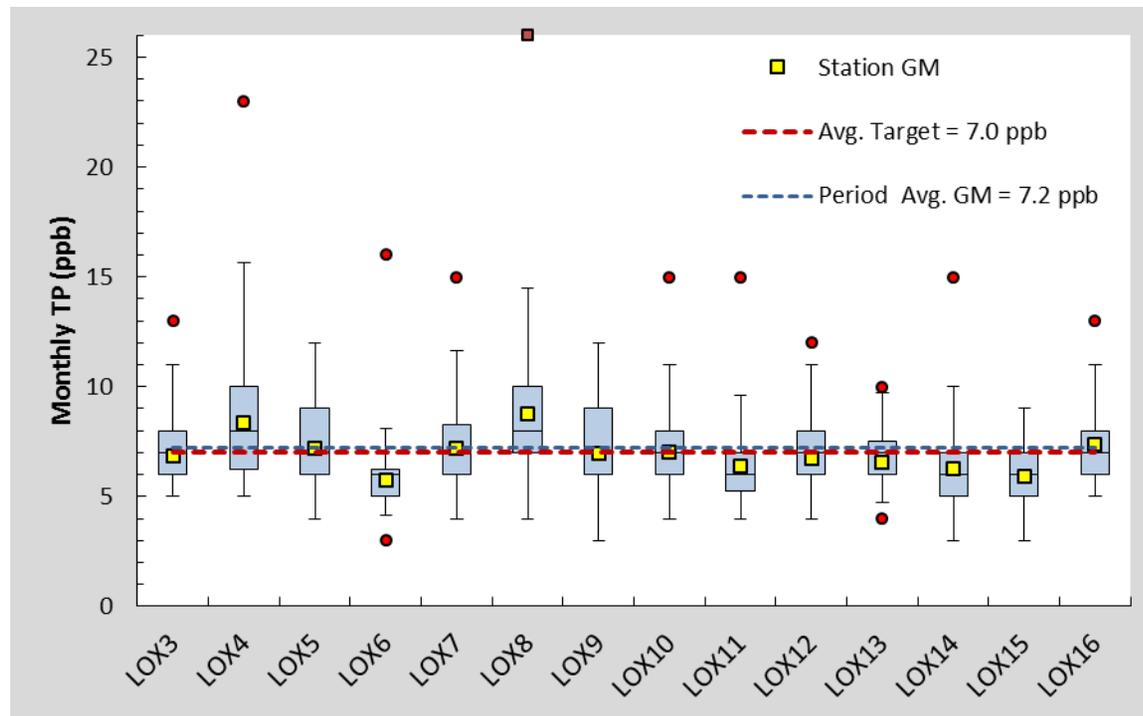
Note: Two monthly Excursions in 12-month period result in an Exceedance of long-term compliance level.



# Status of TP at A.R.M. Loxahatchee NWR Marsh Sites



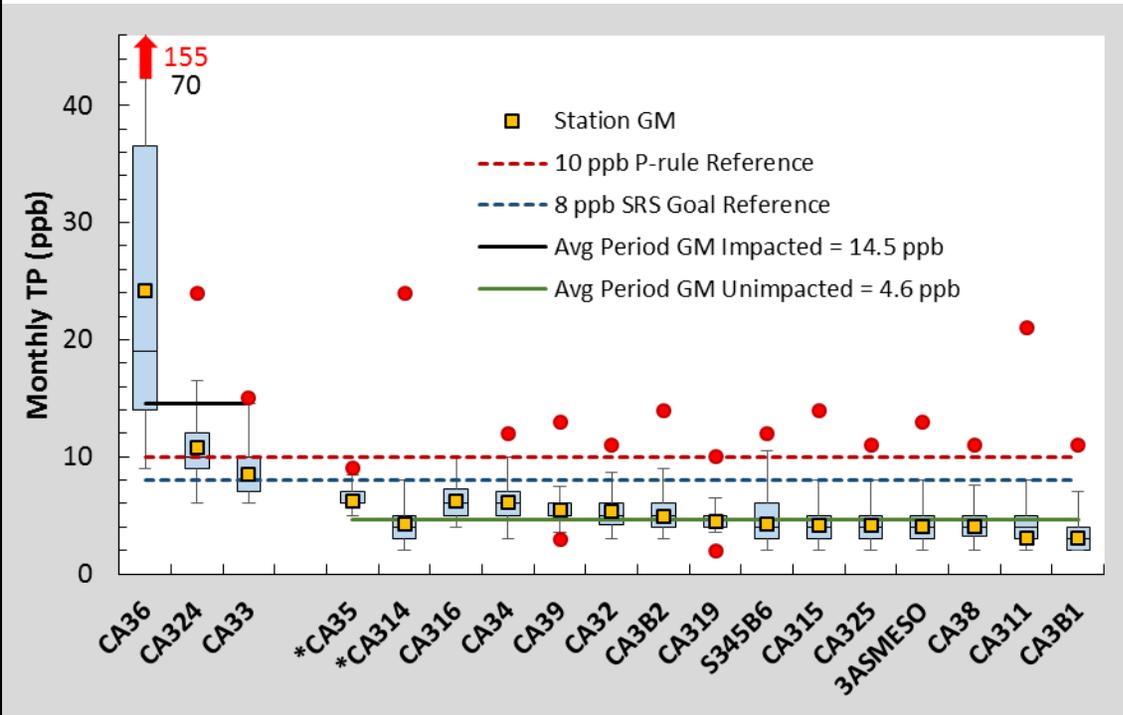
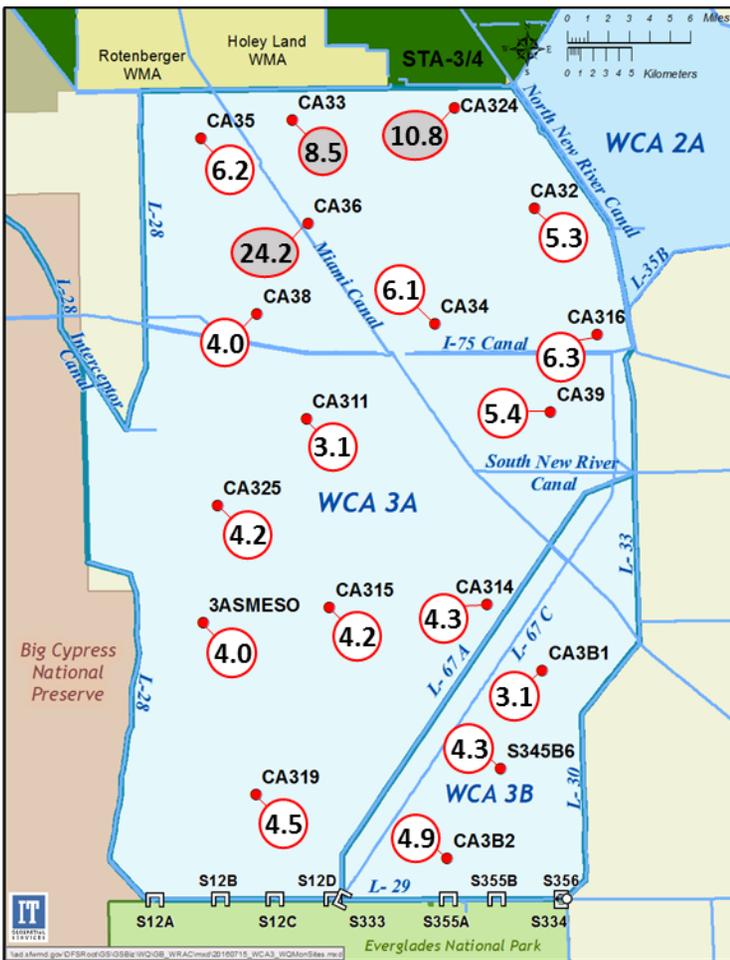
April 2011 – March 2016



Compliance with [long-term level] concentrations is expected to provide a long term average 14 station interior marsh concentration of approximately 7 ppb (Settlement Agreement, 1991, Appendix B, Page B-3).

# Status of TP at WCA3 Marsh Sites

April 2011 – March 2016

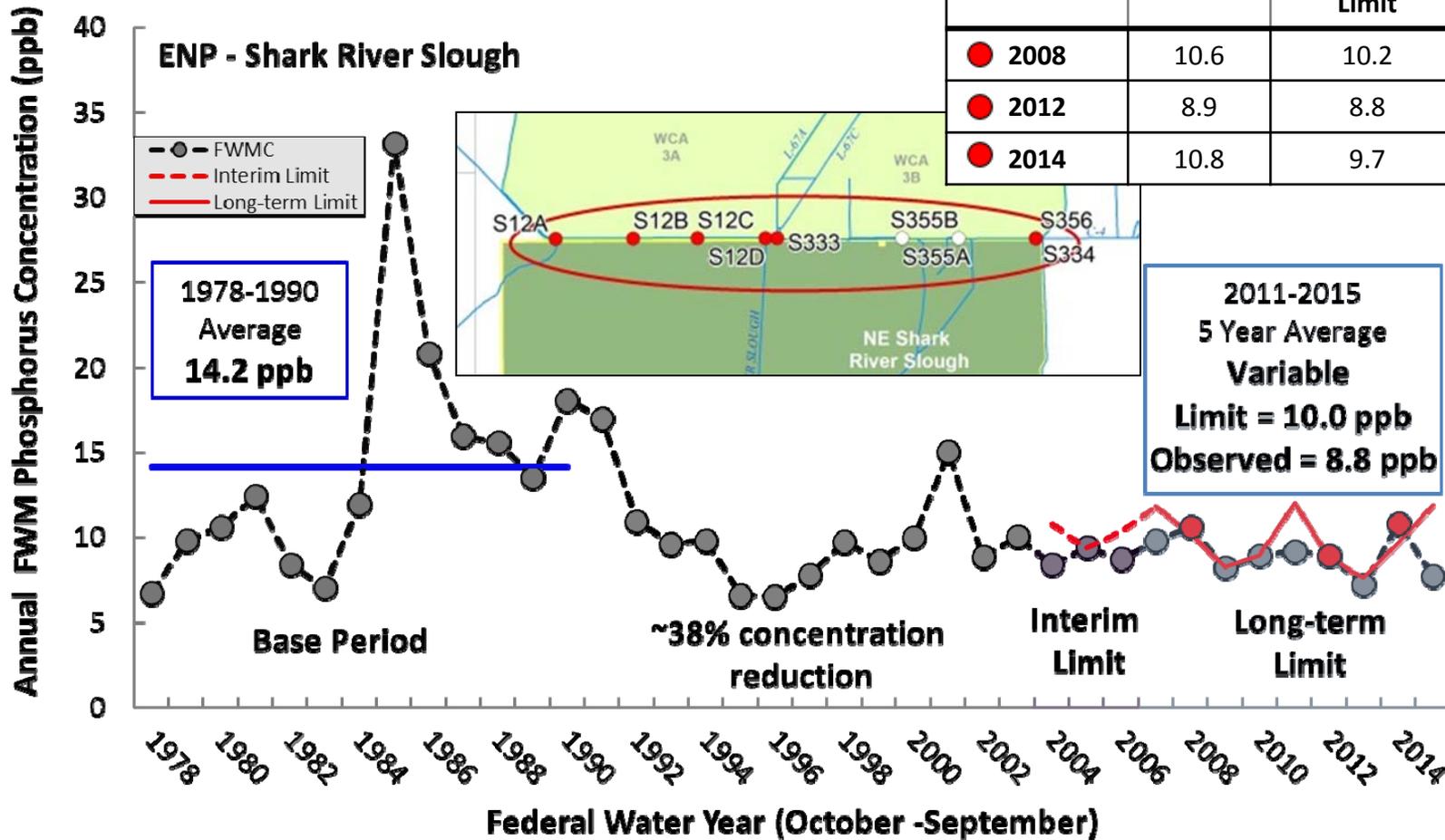


\* Sites CA35 and CA314 transitioned from Impacted to Unimpacted per State P-Rule WY2014  
 - Grey shaded sites (CA36, CA324, and CA33) remain Impacted



# Shark River Slough Compliance History and Total Phosphorus (TP) Trends

## Federal Consent Decree (Appendix A)



### Exceedance Event TP Differences in ppb

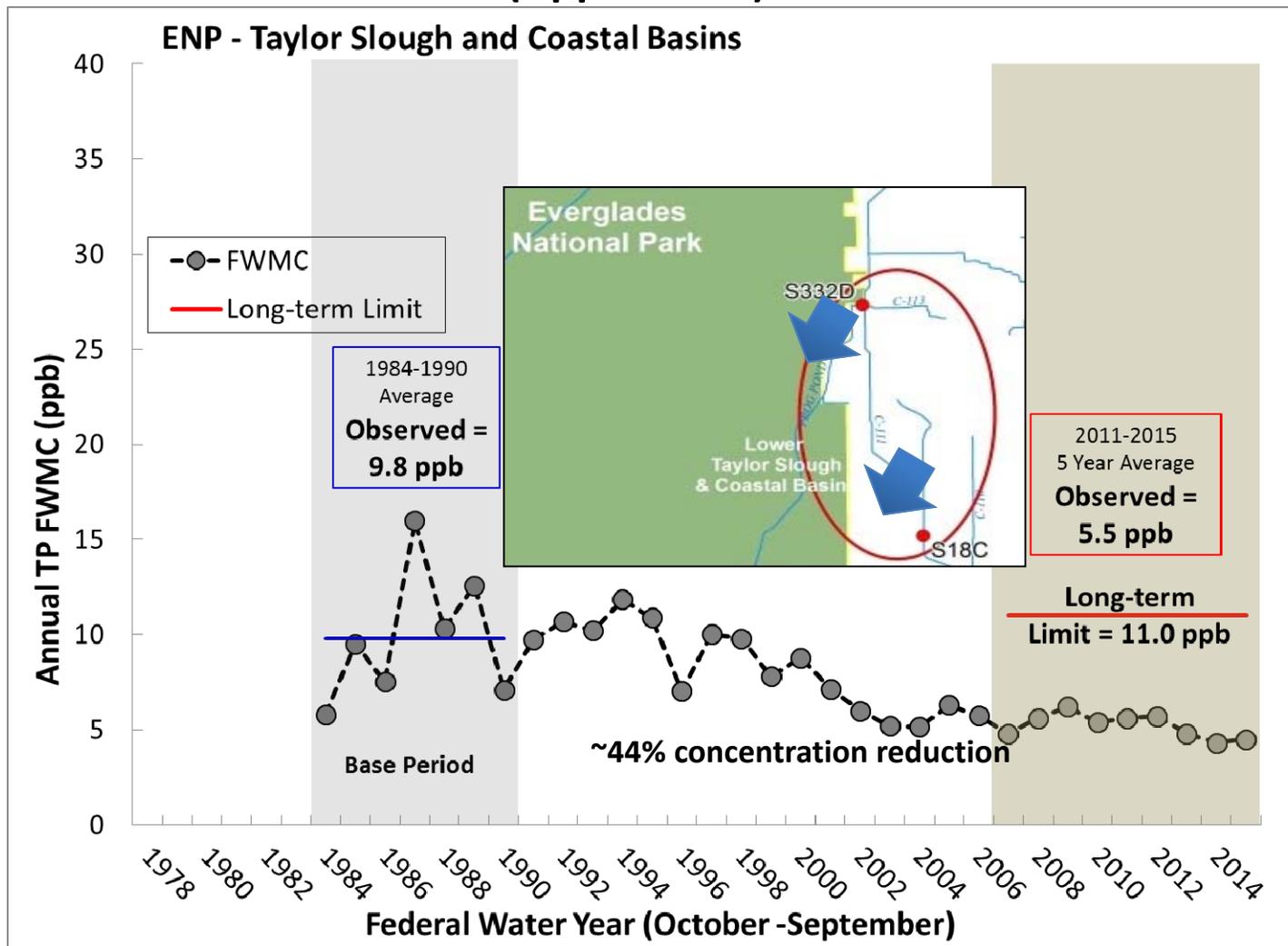
	Actual	Long-term Limit	Difference
● 2008	10.6	10.2	0.4
● 2012	8.9	8.8	0.1
● 2014	10.8	9.7	1.1

Notes: The laboratory margin of error is +/- 2 ppb; FWM – flow weighted mean concentration.



# Taylor Slough/Coastal Basins Compliance History and Total Phosphorus (TP) Trends

## Federal Consent Decree (Appendix A)

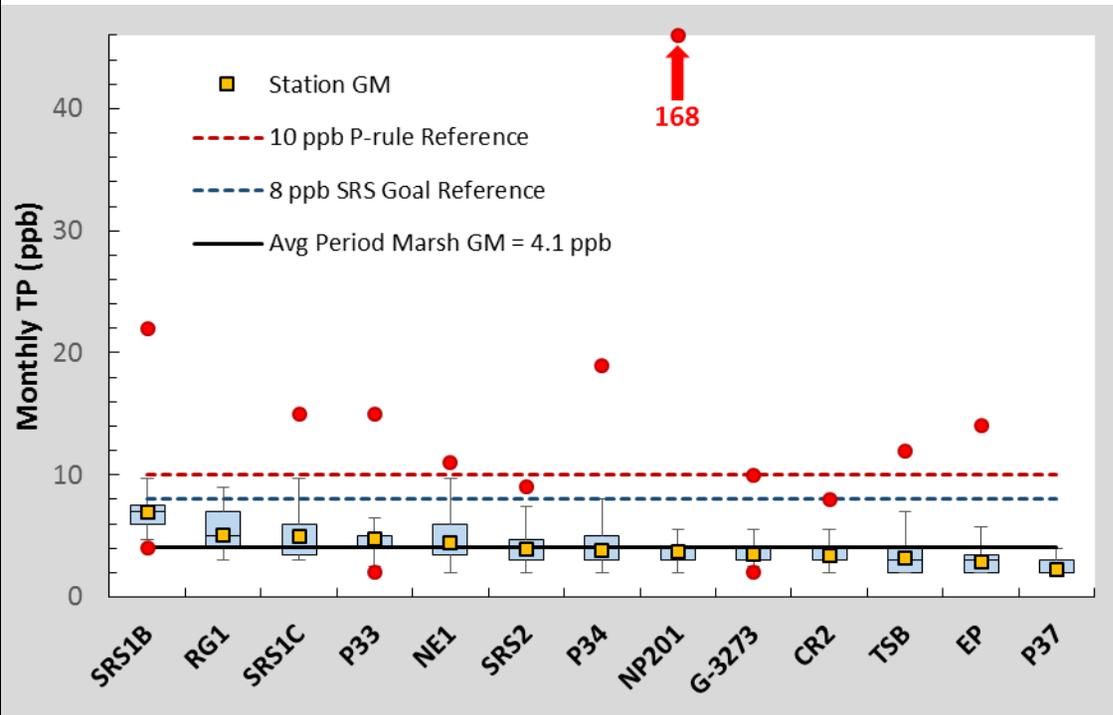
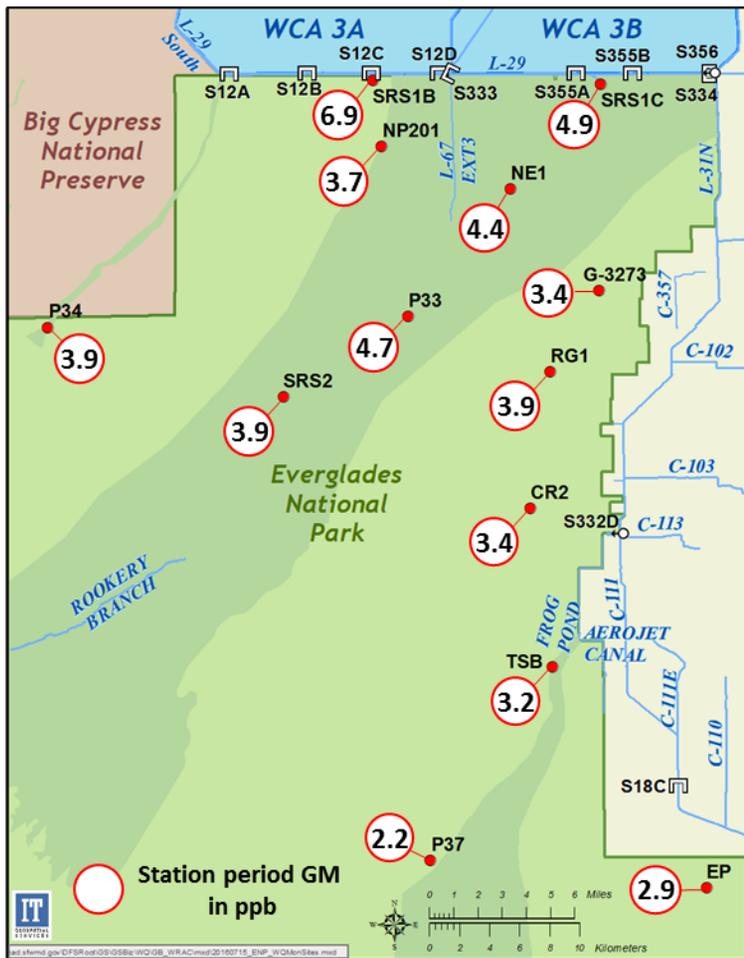


FWMC – flow weighted mean concentration



# Status of TP at Everglades National Park Marsh Sites

April 2011 – March 2016



“Compliance with these limits is expected to provide a long term average flow-weighted mean inflow concentration of approximately 8 ppb for Shark River Slough Basin and 6 ppb for the Taylor Slough and Coastal Basins.” (Settlement Agreement, 1991, Appendix A, Page A-2).

## Long Term Trend Observations

### A.R.M. Loxahatchee NWR

- Downward trend in the average TP concentration for LNWR continued through 2015 (last 5 years at ~ 7ppb)
- >2 ppb drop in concentration from relative to LTL 1999-2004 to 2011-2016
- Seasonal fluctuations are expected in interior marsh concentrations
- Since 2007 (long-term limit effective):
  - 6 excursions observed or ~ 6% of monthly GM period of record
  - 5 out of the 6 excursions are within ~1 ppb of the expected long-term average concentration of 7 ppb.

### Everglades National Park

- Shark River Slough
  - 5-yr average inflow 8.8 ppb
  - Average Long-term Limit 10.0 ppb
  - 3 exceedances average 0.5 ppb
- Taylor Slough/Coastal Basins
  - 5-yr period average inflow 5.5 ppb
  - Long-term Limit fixed at 11.0 ppb
  - 44% reduction from Base Period
- Marsh sites in and surrounding (ENP) and upstream (WCA3) of Shark River Slough much lower than 8 ppb goal
- Marsh sites in Taylor Slough/Coastal Basins areas much less than 6 ppb goal



# Discussion

# Revisions Summary

The following revisions were made to correct this presentation September 23, 2016.

- Slide 3: Chart legend has been expanded to include 12- month moving, Seasonal Kendall Trend, and Linear trend lines
- Slide 8: Erroneous indicator for data point at 19 ppb off chart deleted. Incorrect appendix reference corrected.
- Slide 9: Typo “3 years” corrected to “5 years”. Typo “7 ppb goal” corrected to “6 ppb goal”.