# State Parties Review Comments on the National Park Service Shark River Slough Presentation

Provided July 22, 2011

Provided by

**Garth Redfield**

**South Florida Water Management District**

**gredfiel@sfwmd.gov**

# State Parties Review Comments on the National Park Service Shark River Slough Presentation

This document summarizes technical comments from the South Florida Water Management District and the Florida Department of Environmental Protection, together referred to as the State Parties, on the presentation by Dr. Donatto Surratt, Everglades National Park (Park), at the May 31, 2011 meeting of the Technical Oversight Committee (TOC) (Figure 1). The State Parties appreciate the work done on Shark River Slough data and the opportunity of provide comments on the effort. Representatives of the Park requested comments on their investigation and the State Parties agreed to provide input by late July. The Shark River Slough presentation highlighted preliminary data and findings of an investigation into total phosphorus (TP) dynamics and trends for Shark River Slough. The actual slides provided to the TOC are used to organize comments. We hope that these comments will help guide further investigation towards useful findings for the TOC and interested parties.

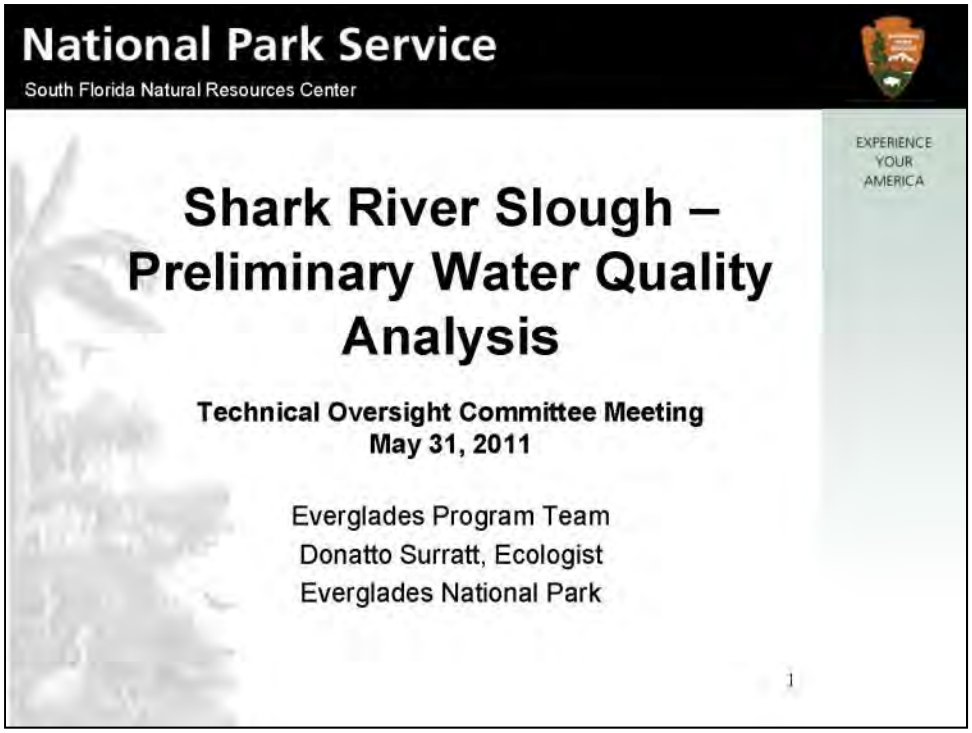


**Figure 1. Slide 1 of Dr. Surratt's presentation**

**Summary of State Comments**

Overall, this presentation reflects a good first attempt at taking on a complex set of issues. Areas that should be considered as you move forward with this investigation are as follows: (1) much more of the available data should be used (i.e., include additional rain and interior TP monitoring sites in your analysis); (2) any discussion of the effect of the S-9 pump station should include data from the S-9A station, which was built to improve its water quality, and also include

other sources of water moving south; (3) greater attention should be given to the effect of water management strategies such as the Interim Operational Plan (IOP), diversion of S-6 discharges to Water Conservation Area (WCA) 2, and delays in implementing the United States Army Corps of Engineers' Modified Waters Delivery General Design Memorandum; and (4) the investigation should be modified to better accommodate the many technical comments provided in this review.

**State Parties Review Comments**

1. Dr. William Walker derived Appendix A limits as an annual water year test to sum over variability generated by flow dynamics and that seen in flow-weighted concentrations at inflow structures on a shorter term basis. The equations were derived from annual data for concentrations and total flows. Although Appendix A does indicate that monthly data will be tracked and reported to the TOC, monthly data can be misleading and will always show values above those predicted by the equation during drier months. There is nothing wrong with using monthly data for trends and other analyses, but not in the context of an annual test. "Hovering at the 90$^{th}$ percentile" is true per slide 2 of Dr. Surratt's presentation (Figure 2), but it should also be noted from the slide that the difference between the limit and the flow-weighted mean concentrations has decreased, now hovering at 2 parts per billion (ppb) or less from the 50$^{th}$ percentile. Is all data being analyzed for this effort being presented for federal water years or calendar years?

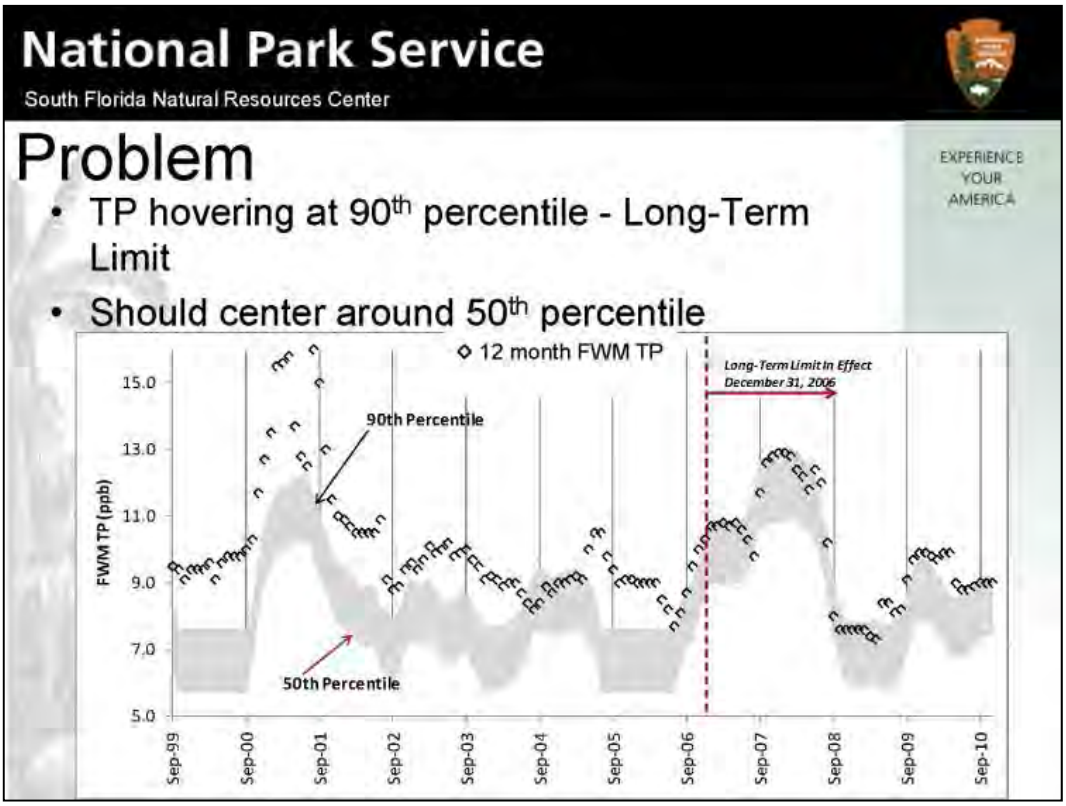


**Figure 2. Slide 2 of Dr. Surratt's presentation**

**2.** Dr. Surratt noted that the overall goal is 8 ppb when discussing slide 2. Page A-2 of the Settlement Agreement confirms this assertion. However, knowing that 8 ppb is essentially background for water in WCA 3A (Figure 3) and water in motion from a mixture of sources can be expected to be somewhat higher, our ability to control TP in inflow at background levels becomes a real issue here and should be noted.

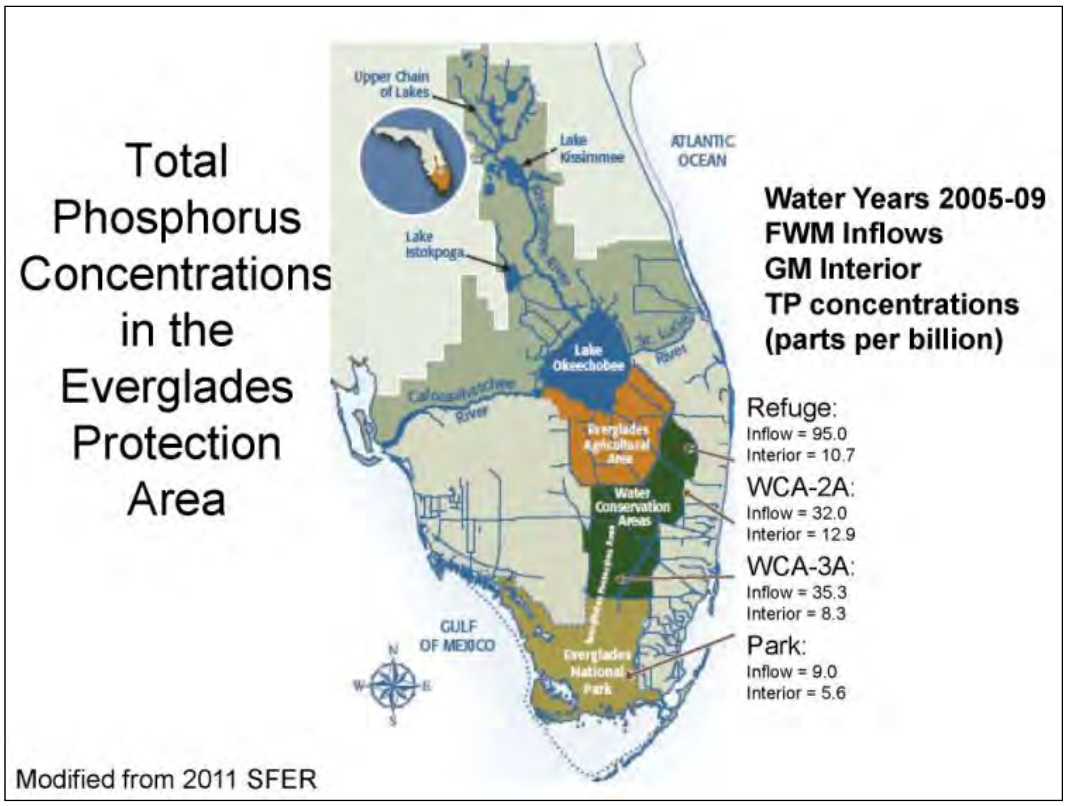


**Figure 3. Slide 3 of Dr. Surratt's presentation**

**3.** It is important to point out clearly that, as noted from slide 3 (Figure 3) and other slides later in this presentation, that all stations in the Park average extremely low values — less than 6 ppb — providing no evidence for a downstream water quality issue associated with current inflow concentrations. In fact, this presentation highlights consistent declines in concentrations for inflows and downstream stations alike.

**4.** We urge that the analyses by Dr. Walker (May 17, 2010) on variations in TP and WCA 3A stage and change in stage be repeated and updated as part of Park's analysis. Refinement of Dr. Walker's ideas on the use of empirical data to understand TP variations going into the Park might lead to ways of managing inflows that could reduce flow-weighted mean concentrations slightly and help to fulfill expectations of the Consent Decree and the state's TP Rule alike.

**5.** The fourth slide (Figure 4) is a great start but it should be focused on actions more relevant to water quality and include more historical events. The Park's investigation is on Shark River Slough, and management changes need to reflect some reasonable linkage to TP levels in Park inflows. Are the actions listed for Everglades Nutrient Removal and Stormwater Treatment Areas 5 and 6 expected to have a quantifiable linkage to water flowing into the Park? Conversely, beginning early in the twentieth century, the Park was literally cut off from most upstream water and this starvation for water and associated nutrients continued for decades up until the Central and Southern Florida (C&SF) Project was completed below the Everglades Agricultural Area in the mid-1970s. This historical perspective needs to be reflected in the Park's investigation and presentation. Pages 65–75 in chapter 4 of Davis and Ogden (1994) (Light and Dineen 1994) will be very helpful for historical water management facts. Other actions that should be added to the list include the S-6 diversion, change in regulation schedules for the WCAs, S-9A construction and the Everglades Agricultural Area Best Management Practice Program.

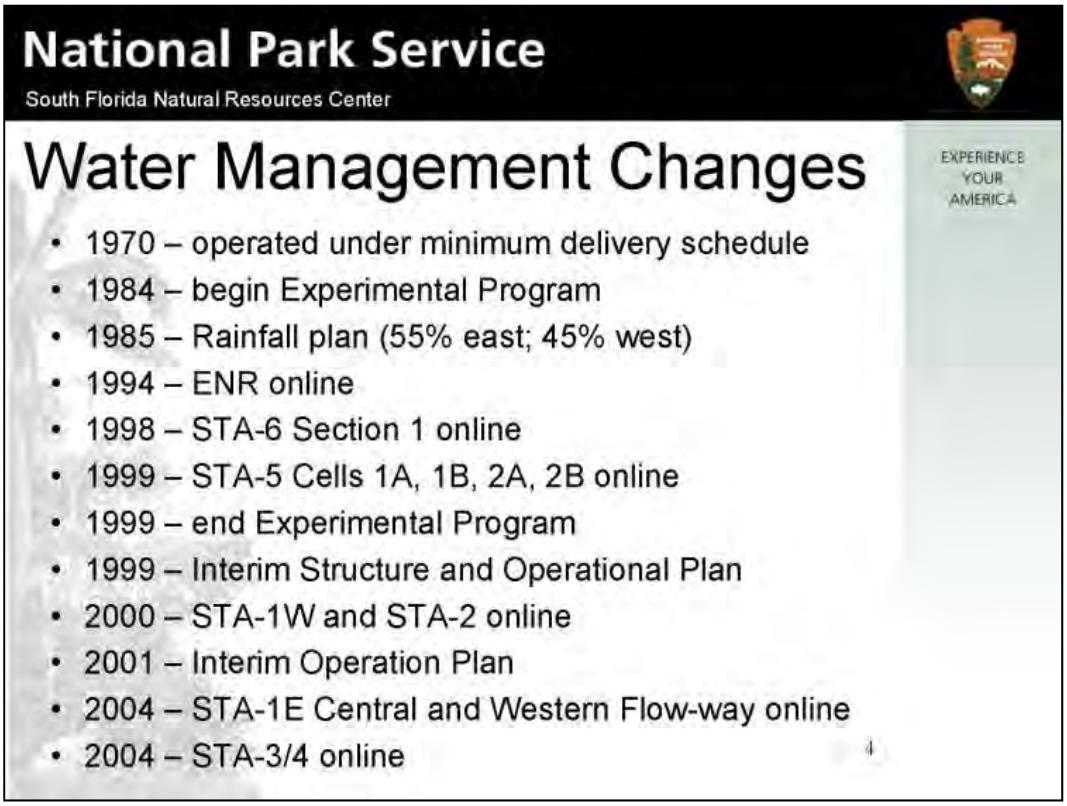


**Figure 4. Slide 4 of Dr. Surratt's presentation**

**6.** Much more of the available data should be included in this investigation. There are many more rain and stage gages for the area (Figure 5) and using few stations can be misleading (see comment 10). Further, analysis of water quality for the Park should always subtract S334 from S333 in order to reflect actual inflows to the Park. Otherwise, the influence of S333 will be overestimated. The selection of water quality sites in WCA 3A is not representative; all seven TP rule sites should be used to represent the whole area or a rationale provided for their exclusion.

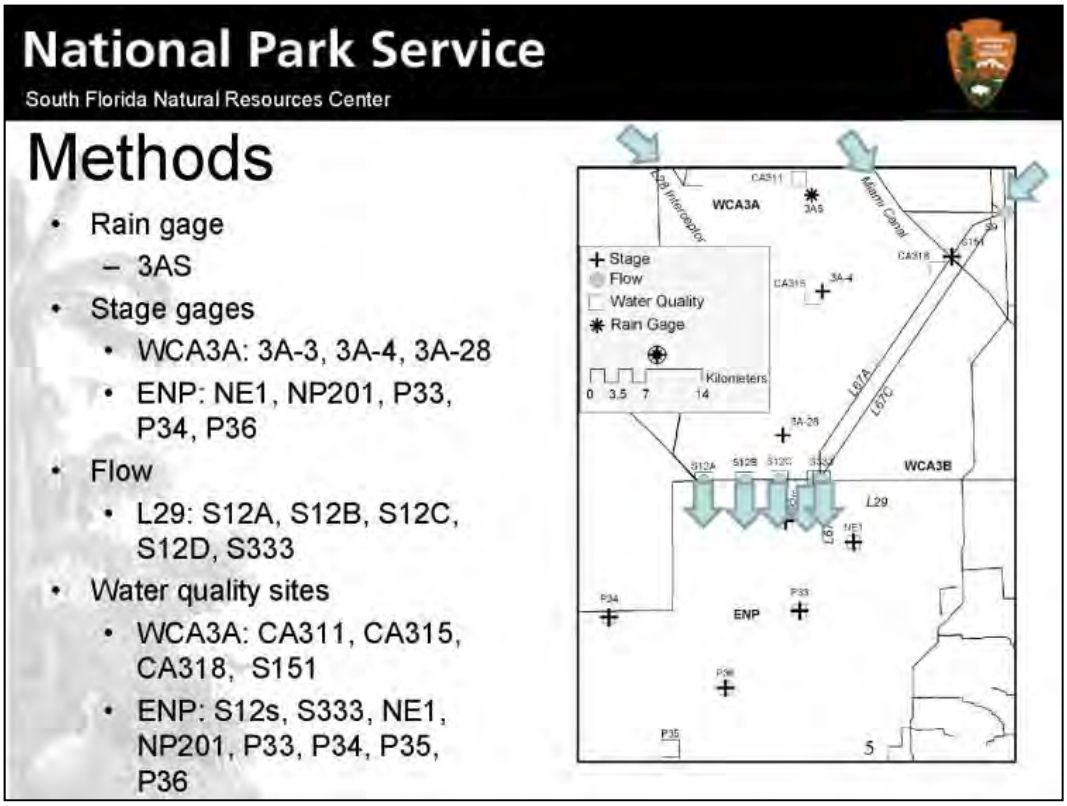


**Figure 5. Slide 5 of Dr. Surratt's presentation**

**7.** It may be reasonable to use the ratio of sodium to calcium (Na:Ca) as an index of canal water (Figure 6), but we urge that additional data be provided on various influences on this ratio. For example, the Park can provide a review of atmospheric deposition chemistry and ratios for background. Why not use chloride concentrations or specific conductivity for an index?

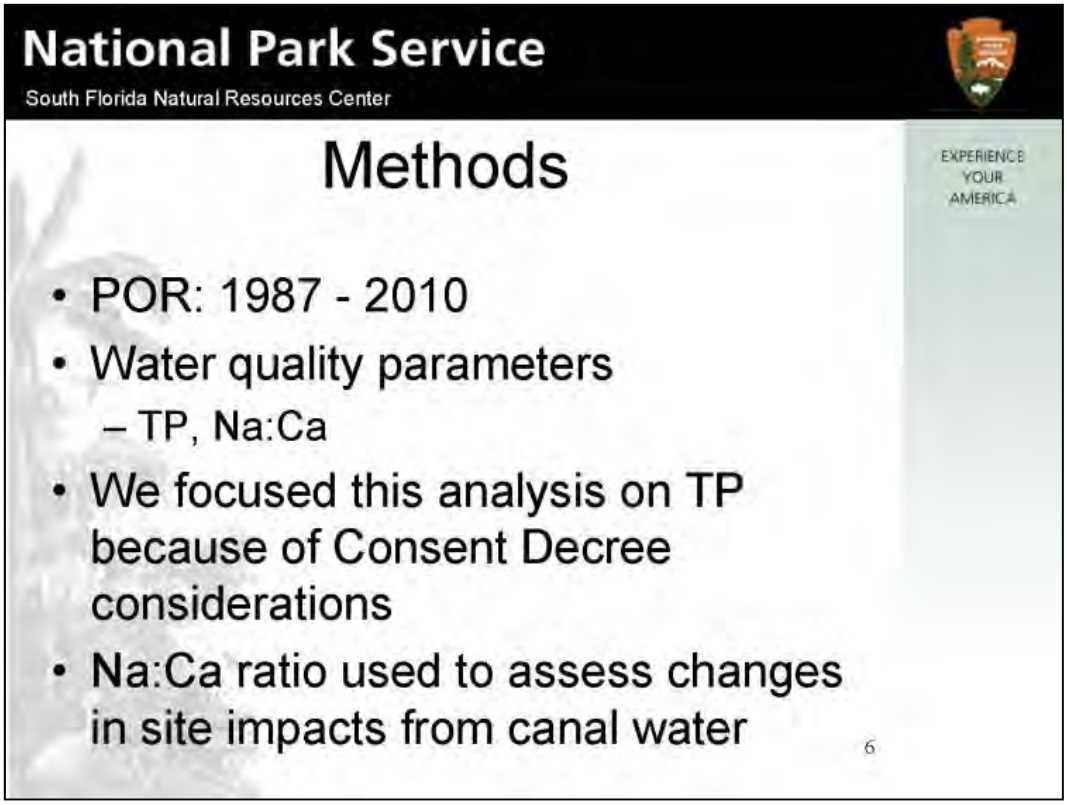


**Figure 6. Slide 6 of Dr. Surratt's presentation**

**8.** The justification and value of natural log transformation (Figure 8) is not clear here, particularly when data are also being treated for seasonality and autocorrelation. Please be more specific about the statistical procedures employed (Figure 7 and Figure 8). Many are possible within these software packages.

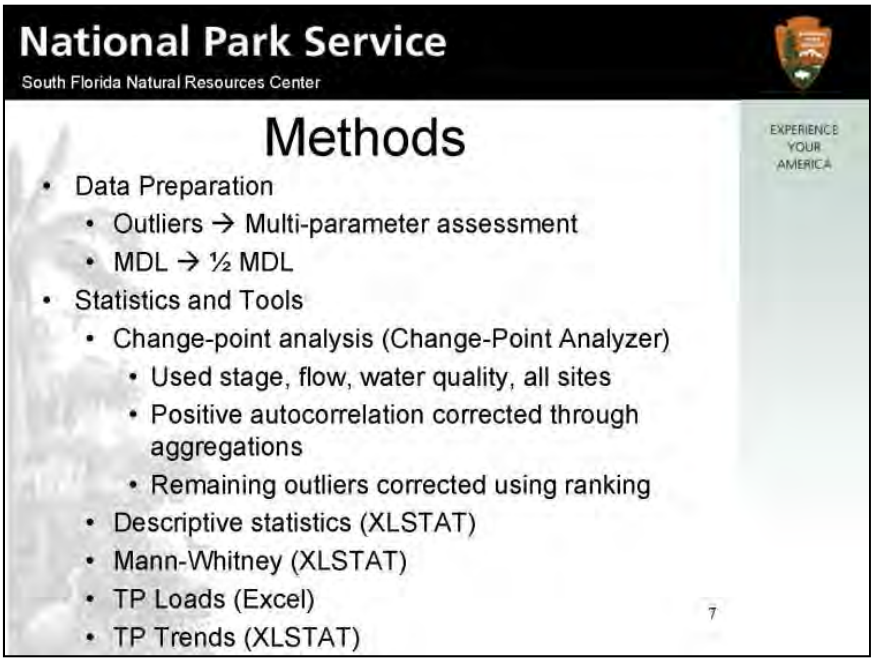


**Figure 7. Slide 7 of Dr. Surratt's presentation**

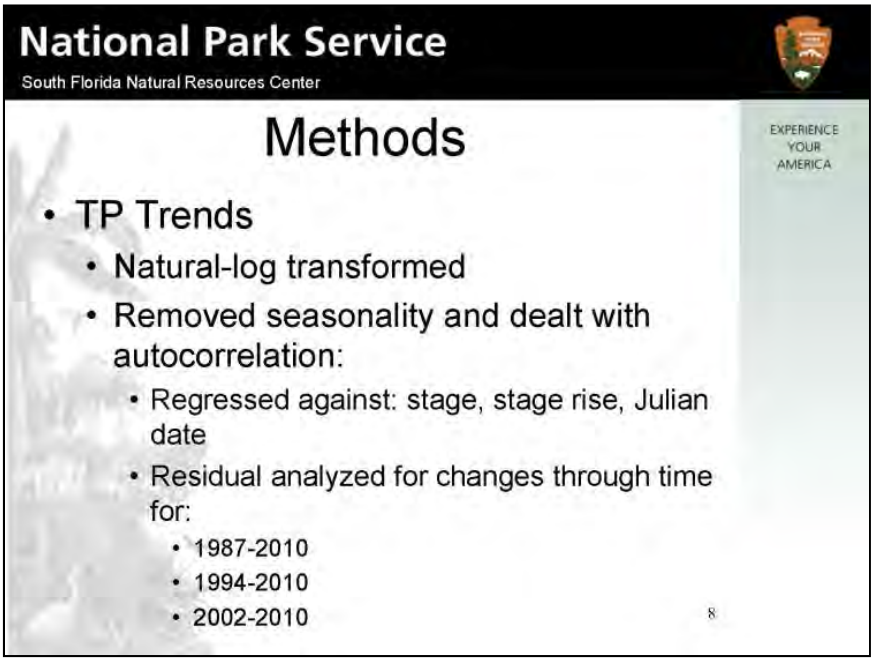


**Figure 8. Slide 8 of Dr. Surratt's presentation**

**9.** The use of change-point analysis is reasonable under very select circumstances. However, it must be made very clear that there is circularity here in the way change-point analysis is being applied (Figure 9). It is well known that water quality in Shark River Slough and WCA 3A is altered by rainfall dynamics and resulting changes in flow and stage from the work of Dr. William Walker and others. This investigation divides the data set into periods of different rainfall amounts (Figure 10) and then notes changes in water quality. In view of the weaknesses of this approach (see comment 10), doing more trend analyses using biweekly or other data would appear to be more informative.

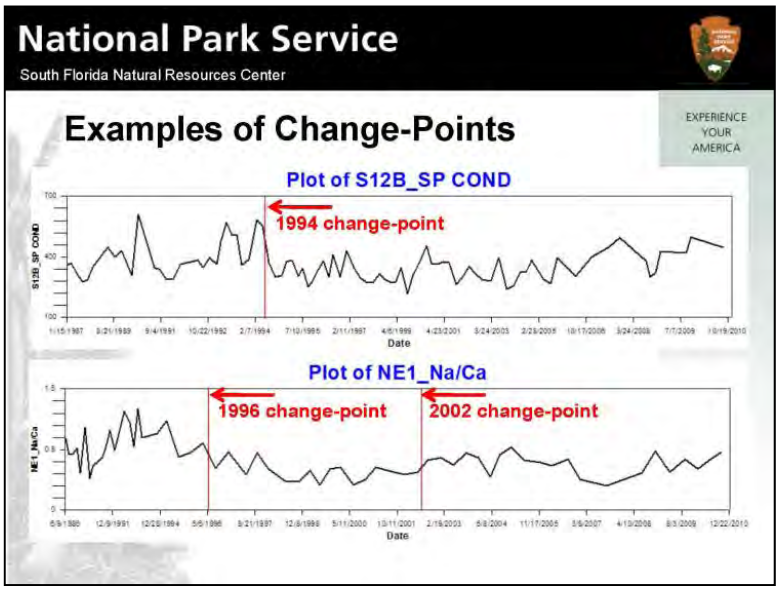


**Figure 9. Slide 9 of Dr. Surratt's presentation**

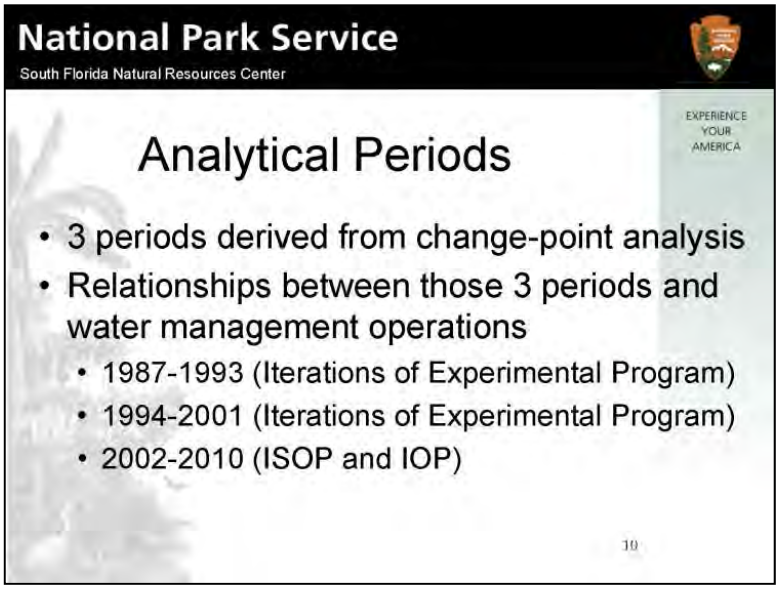


**Figure 10. Slide 10 of Dr. Surratt's presentation**

**10.** The bias introduced by using just one station to represent WCA 3A rainfall is obvious when comparing the data presented in slide 11 (Figure 11) and those from the South Florida Environmental Report (SFER). The WCA 3A values in Table 1 are from the SFER hydrology chapter using 21 stations (Abtew et al. 2005, 2006, 2007, 2008, 2009, 2010, 2011). Some annual SFER values are very different from the data for 3AS, especially for 2006, 2007 and 2010. The analysis justifying change-point grouping must be redone with more complete rainfall data if the grouping approach is to be used at all. The Thiessen polygon-weighted regional rainfall data for WCA 3 (available in DBHYDRO) would be much more appropriate for the study.

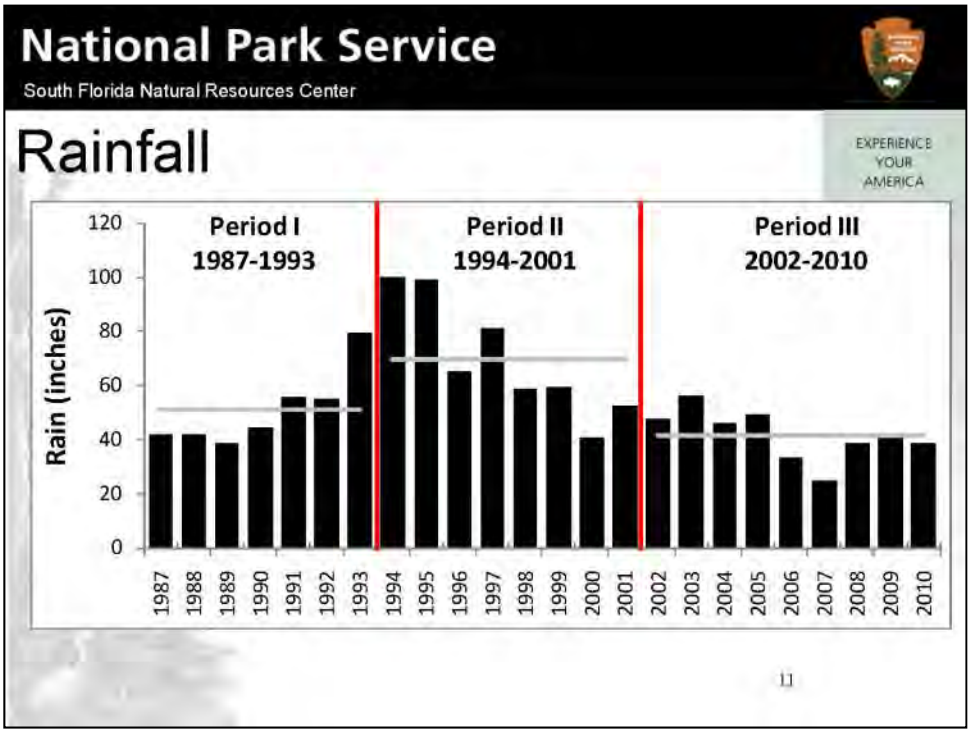


**Figure 11. Slide 11 of Dr. Surratt's presentation**

**Table 1. Comparison of rainfall data from the SFER and Slide 11 of Dr. Surratt's presentation**

| Water Year | SFER Report | Rainfall from SFER | Slide 11 Rainfall Estimate |
|---|---|---|---|
| 2004 | 2005 | 46.9 | 45 |
| 2005 | 2006 | 40.3 | 50 |
| 2006 | 2007 | 53.4 | 31 |
| 2007 | 2008 | 44.3 | 25 |
| 2008 | 2009 | 48.9 | 38 |
| 2009 | 2010 | 44.3 | 40 |
| 2010 | 2011 | 60.6 | 38 |

**11.** The selection of data being presented in slide 12 is not clear (Figure 12). If S9 is presented, then S9A must be included. S9A was built and is being managed to improve water quality. Just reporting values from S9 is not representative of water quality leaving the S9 structures. Why not show and analyze the complete data for the S12s, S333 and S334 so that your data matches that used routinely to quantify inputs to the Park? Why is only S12C data being presented? Obviously, this comment applies to other slides presenting S12C and S9 data as well.

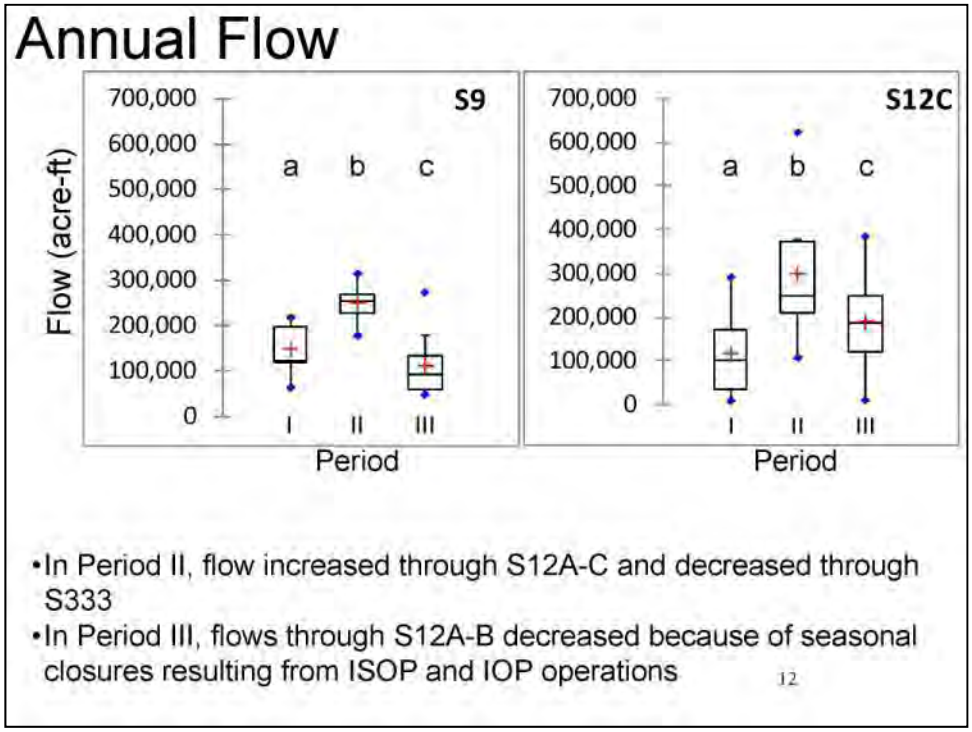


**Figure 12. Slide 12 of Dr. Surratt's presentation**

**12.** The total mass ratio for at least the S12s would be more useful here (Figure 13 and Figure 14).

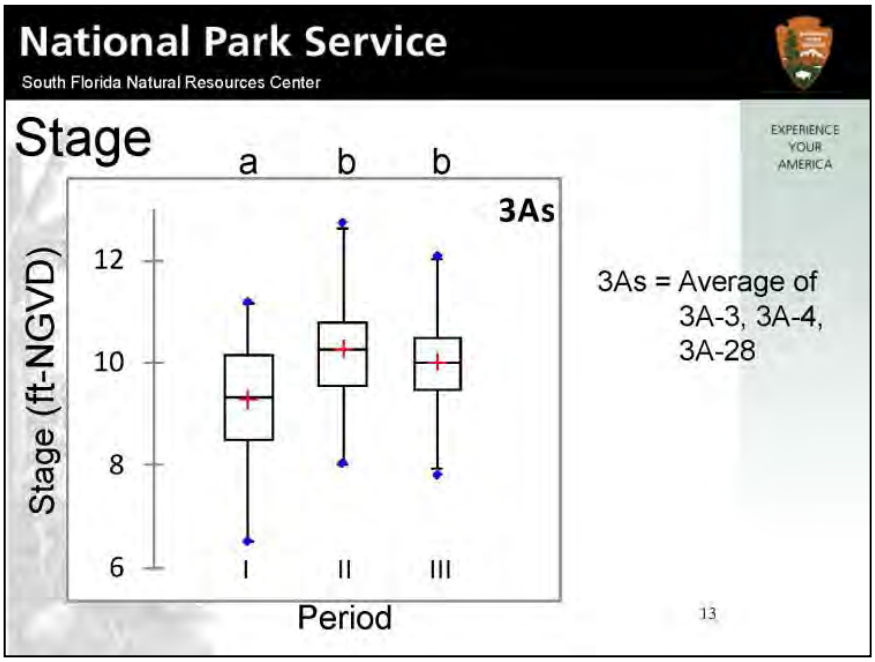


**Figure 13. Slide 13 of Dr. Surratt's presentation**

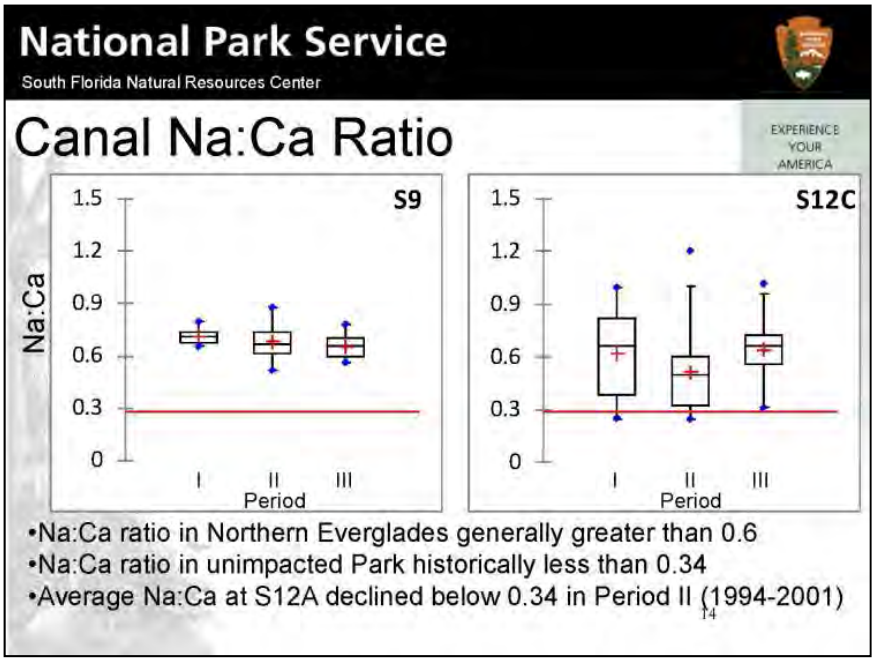


**Figure 14. Slide 14 of Dr. Surratt's presentation**

**13.** S9 appears unchanged with rainfall, while S12C went down in Period II with higher rainfall (Figure 15). However, using data from both S9 and S9A might give a very different picture. Why did S12C not go back up in Period III?

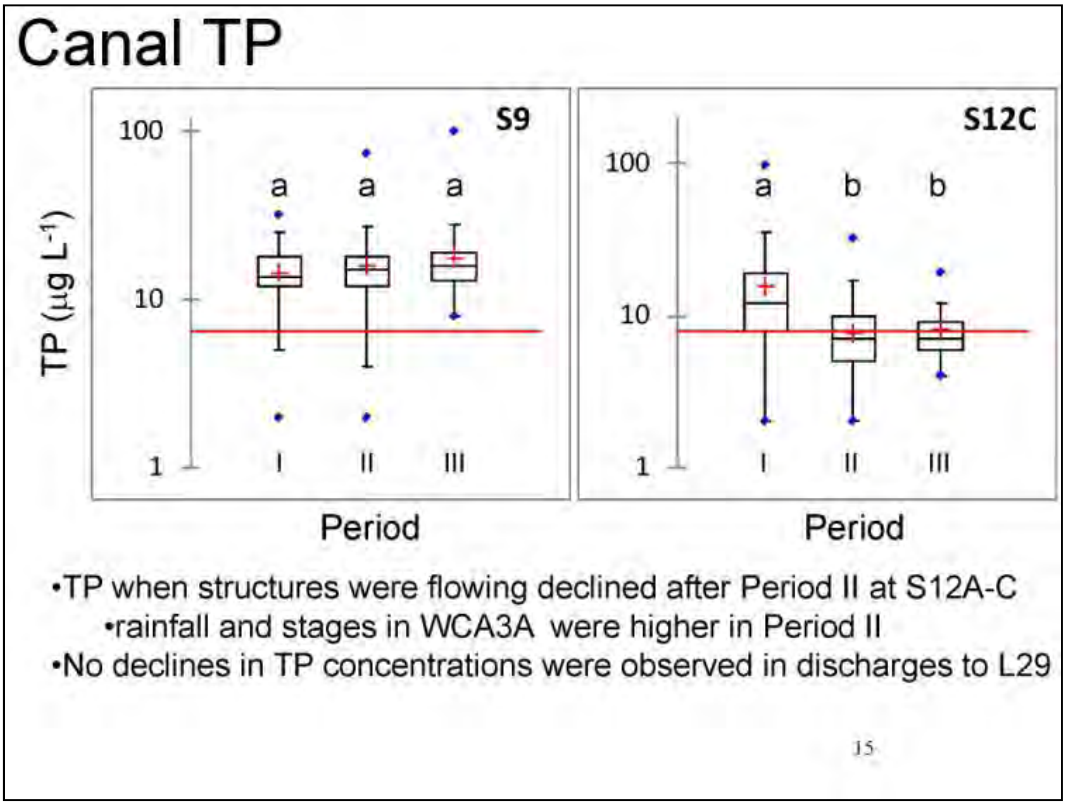


**Figure 15. Slide 15 of Dr. Surratt's presentation**

**14.** Looking at the right-hand panel of slide 16 (Figure 16), the statement "FWM TP declined after Period II at S12A-C" does not follow. It looks as though it declined in Period II and stayed down during Period III. Also, as stated in comment 13, the flow-weighted mean concentration at S9 does not follow a similar pattern to that seen at S12C and relative to the last bullet. There are no statistical differences seen at S12C, so how is the statement on increase justified? Using data from both S9 and S9A structures will likely give a very different perspective of average levels.

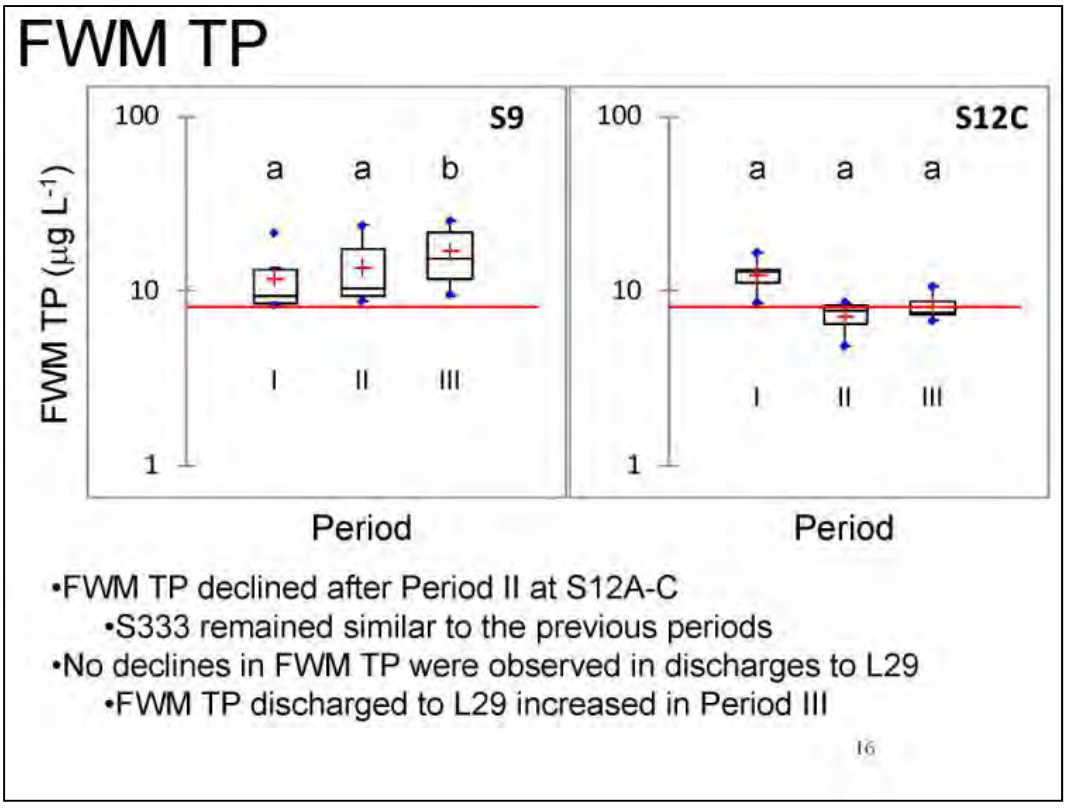


**Figure 16. Slide 16 of Dr. Surratt's presentation**

**15.** Was autosampler data used in the analyses presented in slide 17 (Figure 17)? It is not clear how data were aggregated to do this frequency distribution. Why not simply show the distribution of the original data? We have plenty to do a solid distribution.

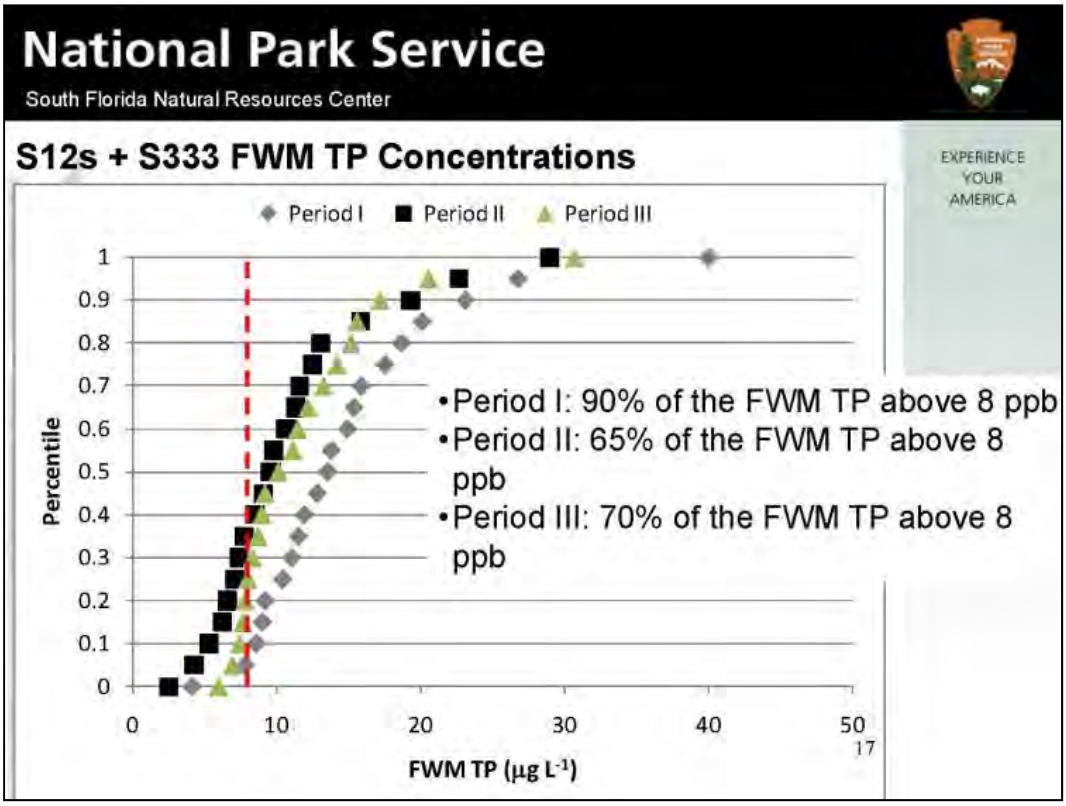


**Figure 17. Slide 17 of Dr. Surratt's presentation**

**16.** Please show the data summarized for P35 and P36 and for all slides with data for the Park interior (Figure 18 through Figure 22).

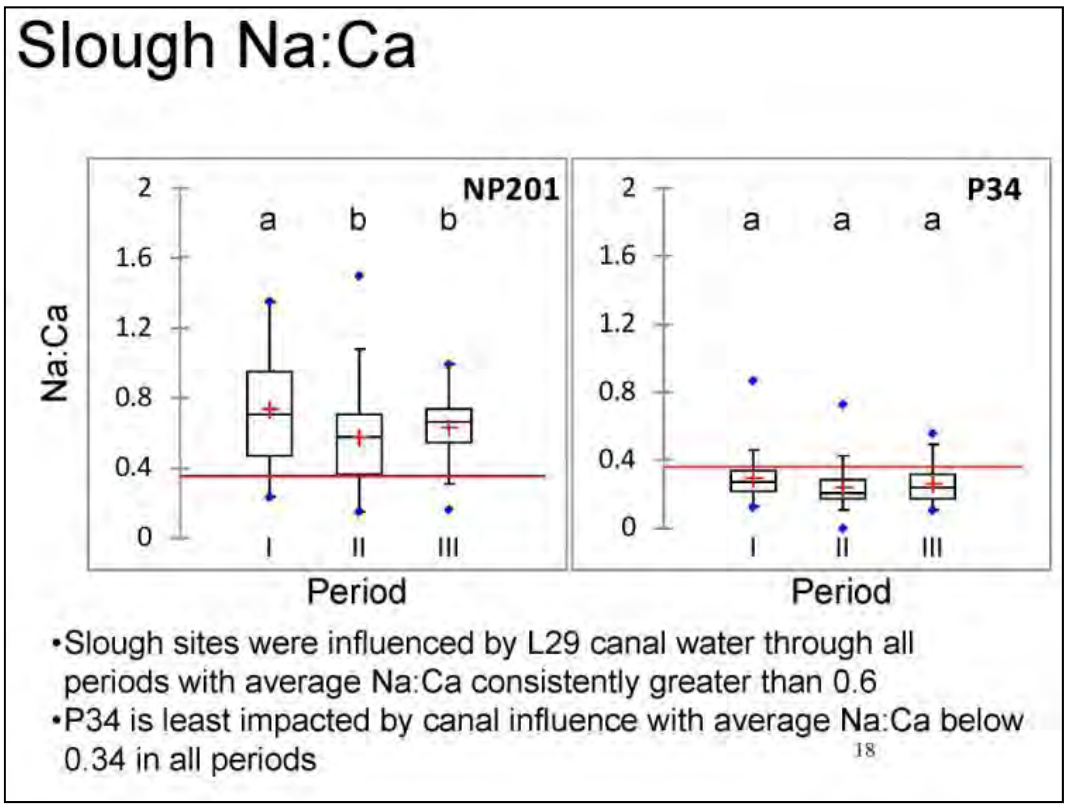


**Figure 18. Slide 18 of Dr. Surratt's presentation**

**17.** Much more spatial and temporal analysis needs to be done on TP levels downstream of the S12s and S333. At these very low TP levels in the Park, changes in the method detection limit from 4 to 2 ppb need to be evaluated. There simply is not enough information to conclude anything about changes in these stations from this data summary alone (Figure 19).

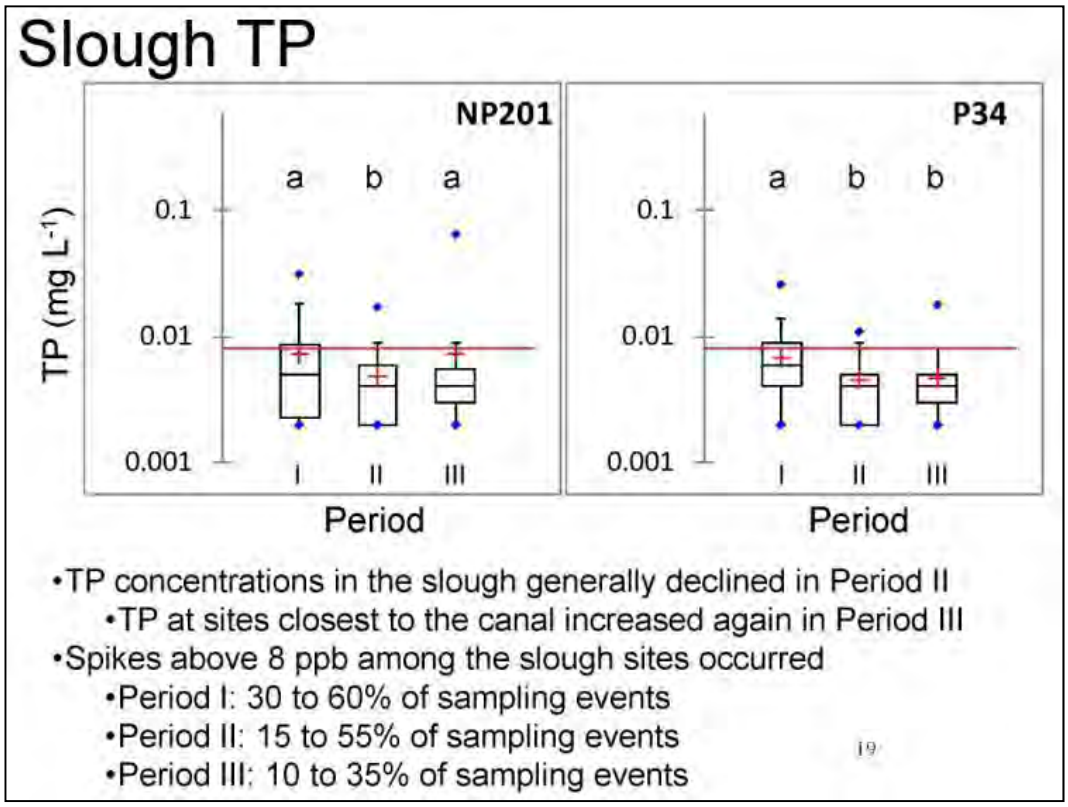


**Figure 19. Slide 19 of Dr. Surratt's presentation**

**18.** These trends are very interesting and raise real concerns about the role of natural cycles versus any influence of upstream controls in TP concentrations in the Park (Figure 20 through Figure 22). While we can make arguments about upstream influences at the S12s, S333 or S151, the trends at P35, P36, P33 or even NE1 are not easily explained by inflow concentrations.

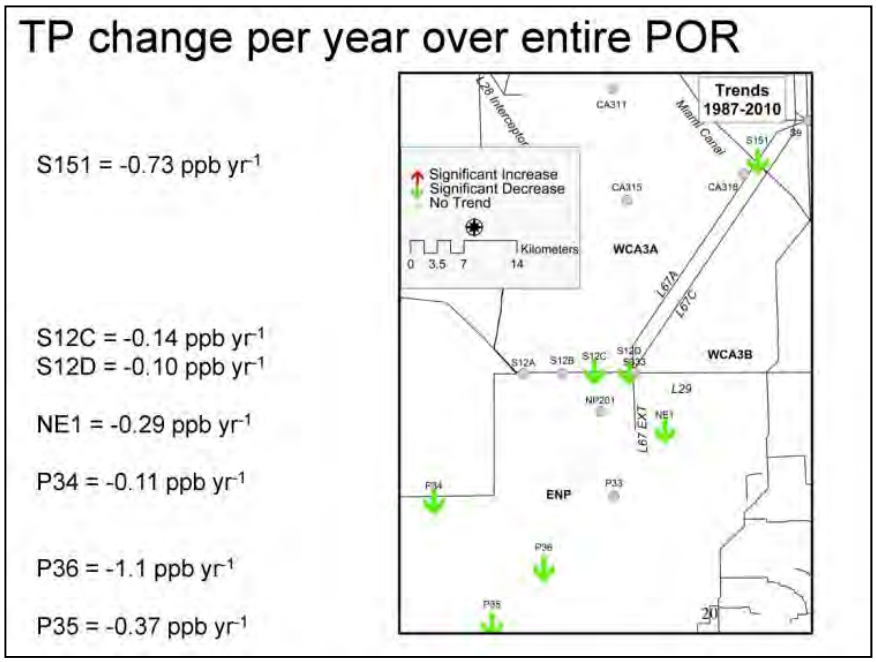


**Figure 20. Slide 20 of Dr. Surratt's presentation**

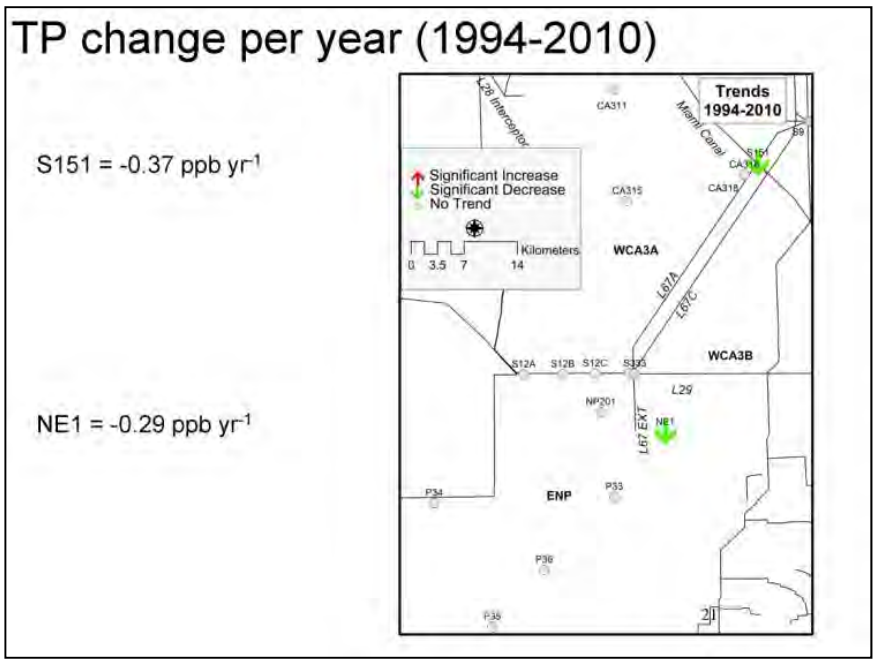


**Figure 21. Slide 21 of Dr. Surratt's presentation**

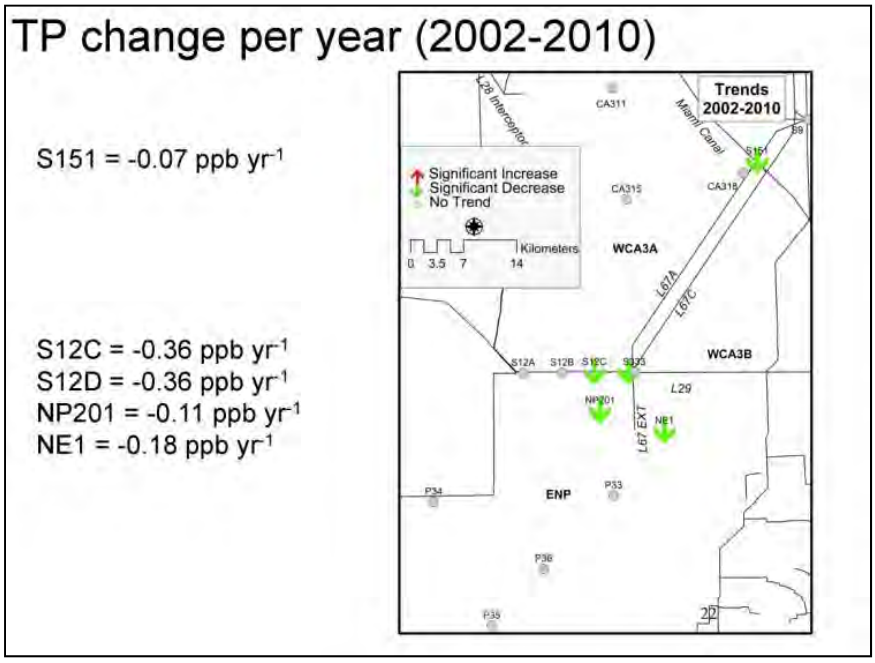


**Figure 22. Slide 22 of Dr. Surratt's presentation**

**19.** Similarly, the relatively steep declines seen at the remote downstream sites P35 and P36 does not argue for the influence of inflows on TP concentrations downstream in the Park. Still, improvements in TP are notable and welcome (Figure 20).

**20.** Please include trends of all stations in each period so the reader can compare findings. This would include S151, S333–S334, S12s, NP201, NE1, P33, P34, P35 and P36. This comment applies to the three slides on TP change (Figure 20 through Figure 22).

**21.** Again, it is not clear what value is added by S9 data (Figure 23). Clearly, S9 is not the total load delivered to L29. A more complete mass balance is essential to support any such statements and we can see no simple way to estimate loads entering L29. Using L29 loading for trends into the Park is not feasible even with substantial effort; the L67 gets TP and water from many sources. Rainfall can explain loads in Period II.

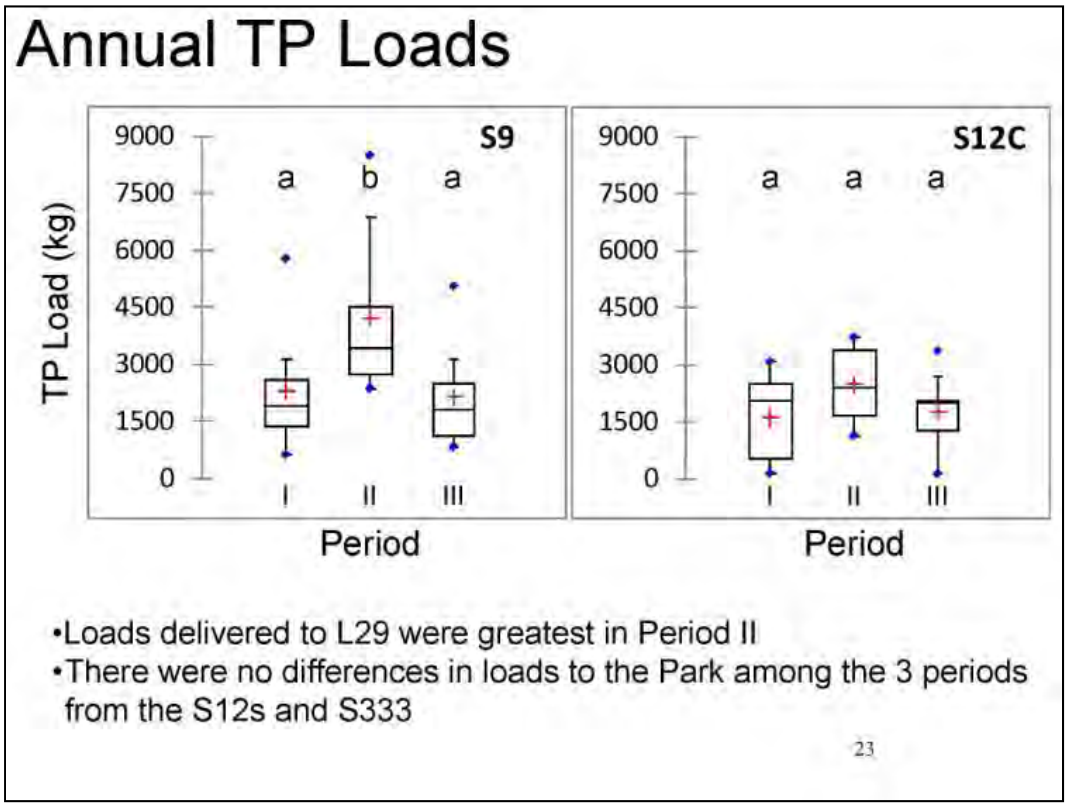


**Figure 23. Slide 23 of Dr. Surratt's presentation**

**22.** If soils data are going to be investigated as part of this process (Figure 24), please include all soils surveys. The United States Environmental Protection Agency has published several surveys. Looking at soils over time and throughout the Park would be much more useful in understanding what factors may be involved in the observed patterns.

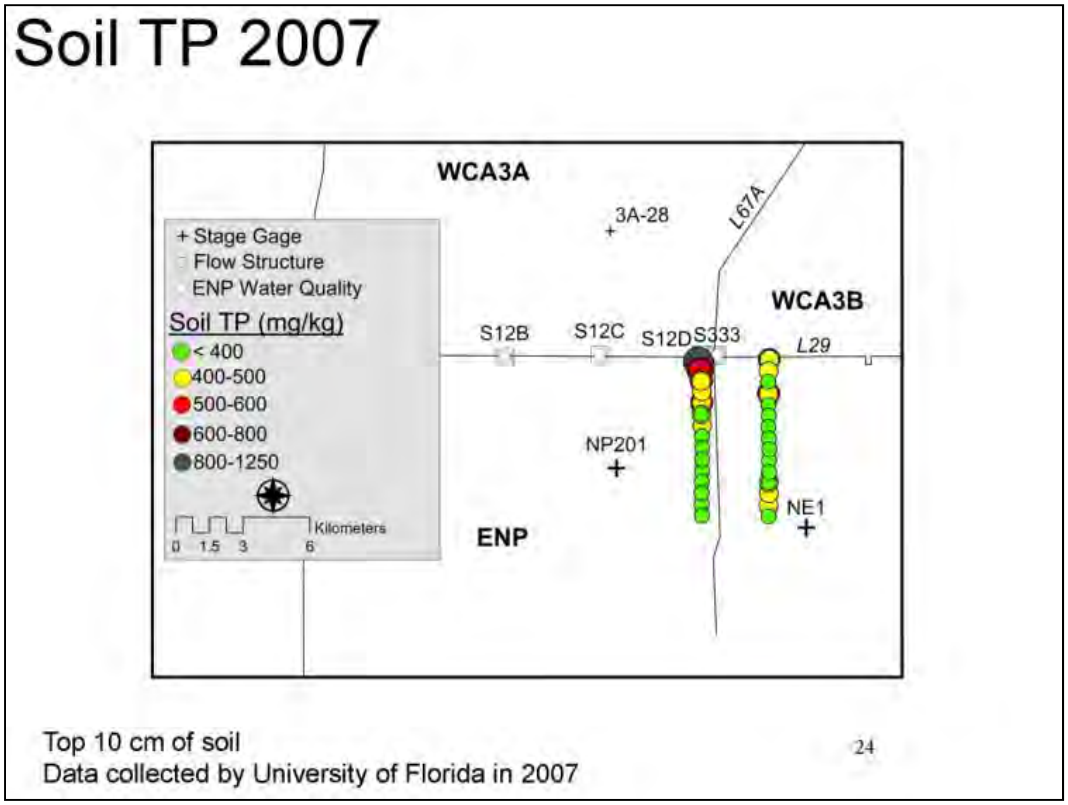


**Figure 24. Slide 24 of Dr. Surratt's presentation**

**23.** While there is general agreement that TP concentrations delivered to WCA 3A are higher than may be desirable, this word needs to be defined in light of the fact that the required 80 percent load reduction in the Consent Decree has been achieved (Figure 25). Furthermore, no complete data or analysis of inflow trends to WCA 3A has been presented as part of this investigation; thus the conclusion seems out of place.

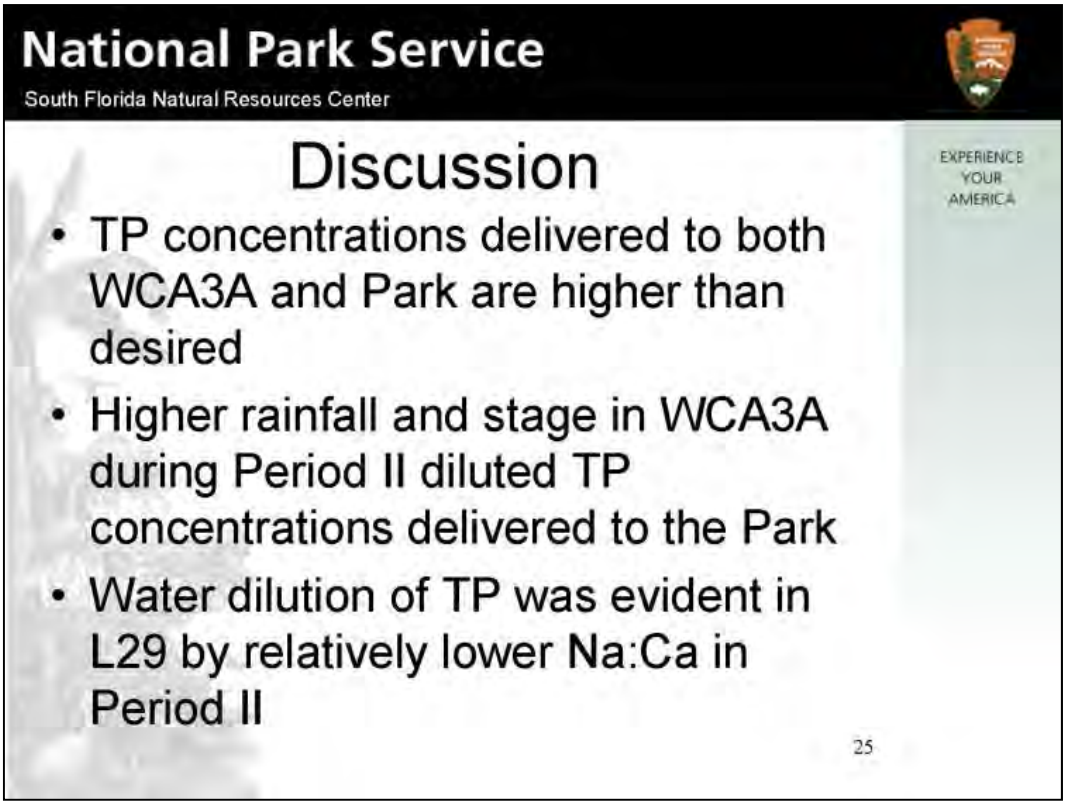


**Figure 25. Slide 25 of Dr. Surratt's presentation**

**24.** Knowing that TP cycles continuously in aquatic systems and is the ultimate non-conservative substance, physical dilution as evidenced by Na:Ca ratios is not well justified as a means for explaining patterns in TP (Figure 25). Based on the data provided here, there was no difference between TP concentrations entering the Park during Periods II and III. How can dilution be invoked to explain changes in TP even if it had some small influence? How can the influence of marsh uptake during high and stable stages be factored in here?

**25.** The data summarized for TP between periods II and III do not support the bulleted conclusion on slide 26 (Figure 26). Please see your slides 15 and 16 (Figure 15 and Figure 16, respectively) that do not support this conclusion. Including all data from S9 and S9A would likely change this conclusion if we accept that S9 inputs do correlate with downstream dynamics.

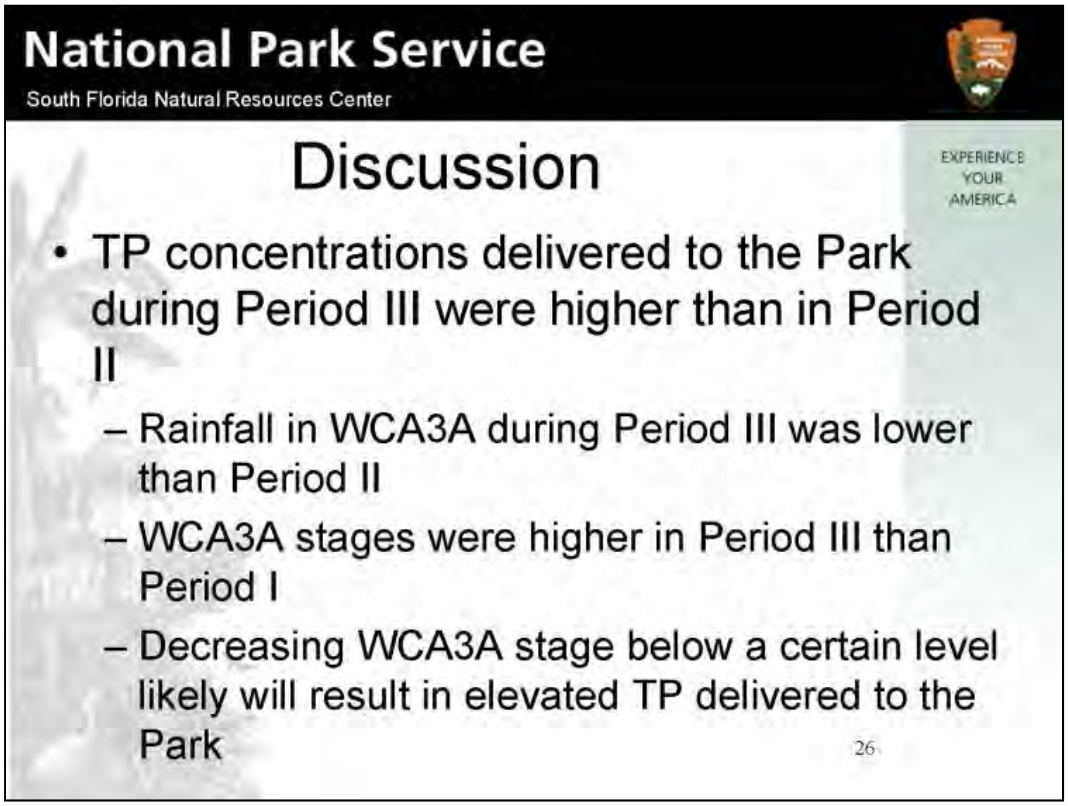


**Figure 26. Slide 26 of Dr. Surratt's presentation**

**26.** How has the relationship between annual flow volume and TP concentration been factored in to the overall conclusion presented on slide 26 (Figure 26)? On the last point, please refer to Dr. William Walker's regression models for a more complete empirical analysis of stage and TP.

**27.** Until a more thorough and complete analysis is available from which to draw conclusions, comments on next steps and monitoring are premature (Figure 27 and Figure 28).

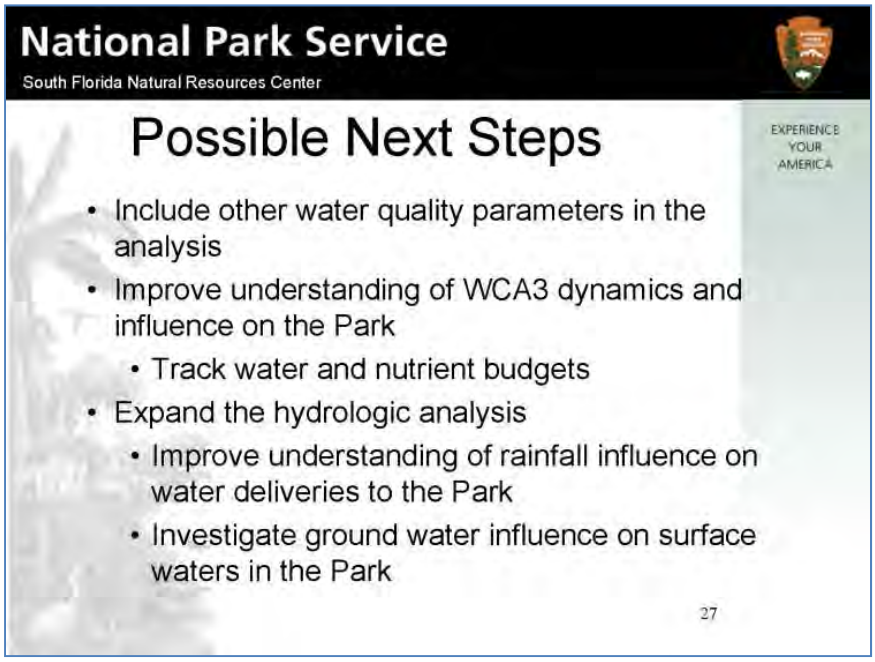


**Figure 27. Slide 27 of Dr. Surratt's presentation**

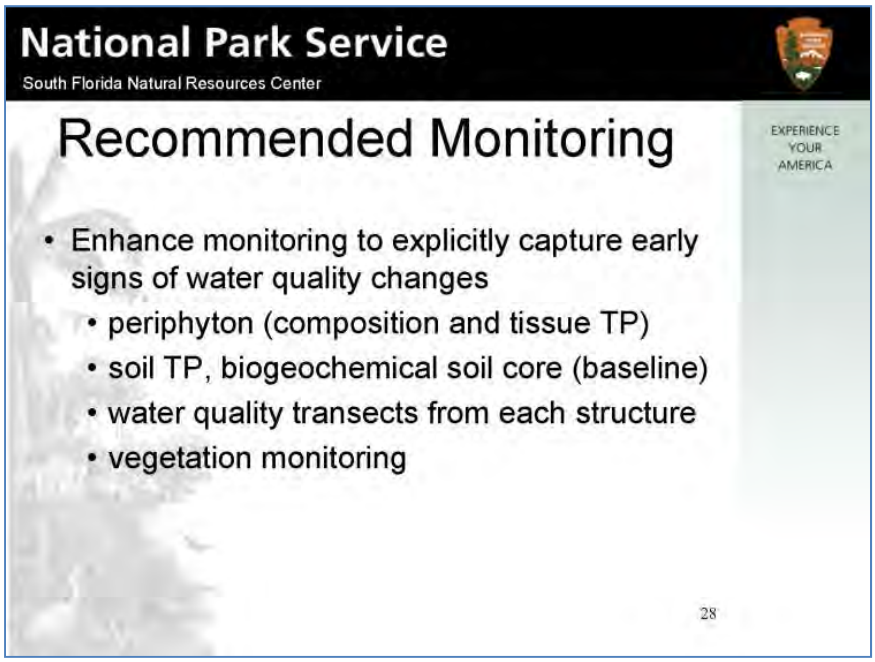


**Figure 28. Slide 28 of Dr. Surratt's presentation**

**References**

Abtew, W.R., R.S. Huebner and V. Ciuca. 2005. Chapter 5: Hydrology of the South Florida Environment. In SFWMD, 2005 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W.R., R.S. Huebner and V. Ciuca. 2006. Chapter 5: Hydrology of the South Florida Environment. In SFWMD, 2006 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W., C. Pathak, R.S. Huebner and V. Ciuca. 2007. Chapter 2: Hydrology of the South Florida Environment. In SFWMD, 2007 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W., C. Pathak, R.S. Huebner and V. Ciuca. 2008. Chapter 2: Hydrology of the South Florida Environment. In SFWMD, 2008 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W., C. Pathak, R.S. Huebner and V. Ciuca. 2009. Chapter 2: Hydrology of the South Florida Environment. In SFWMD, 2009 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W., C. Pathak, R.S. Huebner and V. Ciuca. 2010. Chapter 2: Hydrology of the South Florida Environment. In SFWMD, 2010 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Abtew, W., C. Pathak, R.S. Huebner and V. Ciuca. 2011. Chapter 2: Hydrology of the South Florida Environment. In SFWMD, 2011 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.

Davis, S.M and J.C. Ogden (eds). 1994. *Everglades: The Ecosystem and Its Restoration*. St. Lucie Press, Delray Beach, FL.

Light, S.S. and J.W. Dineen. 1994. Water Control in the Everglades: A Historical Perspective. pp 47–84 in Davis, S.M and J.C. Ogden (eds), *Everglades: The Ecosystem and Its Restoration*. St. Lucie Press, Delray Beach, FL.