

Evaluation of Florida's Status Network Data Relative to EPA's Proposed Numeric Nutrient Criteria In-stream Protection Values (IPVs) and Downstream Protection Values (DPVs) for Streams

Prepared by the staff of the Watershed Monitoring Section of
Bureau of Assessment and Restoration Support
Florida Department of Environmental Protection

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Introduction

The Florida Department of Environmental Protection (FDEP) conducted an analysis of data from the Watershed Monitoring Program to determine what percentage of Florida's rivers and streams would be expected to attain the numeric nutrient criteria proposed by the United States Environmental Protection Agency (EPA) on January 14, 2010. This analysis was conducted to evaluate the proposed criteria and gauge the resource demands that the new criteria would impose. An evaluation of lakes is not incorporated in this document and will be provided at a later date.

For this analysis, data from the FDEP Status Monitoring Network were used to estimate statewide waterbody attainment of the proposed nutrient criteria. The Status Monitoring Network, a probabilistic survey network, was designed to address questions about the condition of Florida's waters at the state and regional level (29 watershed basins), rather than at specific sites. Sample sites were selected with equal probability within each basin. The Status Network design separates the State's surface waters into four categories: large lakes, small lakes, rivers and streams. Since rivers and streams were divided into 2 separate resources, and regulated similarly under the EPA proposed rule, the two were combined to increase the numbers of samples included in these analyses.

The Status Network's design relies upon random sampling to minimize bias; as a consequence, the resultant data can be used to estimate water resource conditions for the entire state. In addition, for any given area with an adequate numbers of stations, this network may provide an assessment of the range of nutrient conditions within that area. The Status Network data are single data points collected once at a randomly generated location, while the proposed numeric nutrient criteria are expressed as annual geometric means or long-term averages from multiple samples collected from the same site. Therefore, the exceedance rates for individual Status Network results have been aggregated to provide an inference of the attainment rates for each of the estuarine and nutrient regions.

Disclaimer: The Status Network relies on a single sample per station taken at a discrete moment in time, and can therefore provide just a snapshot estimate against the magnitude of the proposed EPA criteria. The proposed criteria also contain a duration that establishes an averaging period (i.e., one year geometric mean) of multiple samples and an allowable frequency of exceedance (i.e., no more than one exceedance in a three year period (33%)). The actual targeted assessment of a particular waterbody's attainment would consider multiple samples over an entire period of record against the magnitude, duration, and frequency of the criteria. Given the natural variability of nutrient concentrations in

waterbodies, a targeted assessment would have a higher probability of exceeding the criteria at some point during an entire period of record. Therefore, the inferred attainment statistics in this document may overestimate the extent of true attainment under the Clean Water Act.

Rivers and Streams

For EPA's proposed in-stream protection values (IPVs), the State was divided into the EPA proposed nutrient regions (Figure 1) and an attainment frequency was estimated for total nitrogen (TN) and total phosphorus (TP). Downstream protection values (DPVs) were derived on an estuarine drainage area (Figure 2) basis for TN, and attainment frequency was estimated for each drainage area.

Methods

Status Network data from the combined river and stream resources were reassigned to a Geographic Information System (GIS) coverage of the EPA nutrient regions to calculate the attainment frequency for IPVs. To ensure equal probability among the samples for the EPA nutrient regions, data were weighted based on stream miles, which eliminates any bias towards heavily sampled regions. For the DPV attainment frequencies, Florida was further divided into individual waterbody regions, referred to as waterbody ids (WBIDs). Data from combined river and stream resources were reassigned and weighted to the estuarine drainage area coverage.

After the data were combined and weighted, TN was calculated by adding the Total Kjeldahl Nitrogen to Total Nitrate-Nitrite values. Total Phosphorus data required no manipulation. These data were analyzed using the computer program S-PLUS with the EPA-provided `psurvey.analysis` module. Functions included in `psurvey.analysis` are intended for analysis of probability surveys (www.epa.gov/nheerl/arm/designpages/design&analysis.htm). Refer to www.dep.state.fl.us/water/monitoring/status.htm for more information on the Status Monitoring Network.

The TN and TP results for each site (see EPA nutrient region map with site locations, Figure 1) were compared to the USEPA region-specific IPV and a pass-fail result was recorded for the site. For the entire South Region, the nutrient criteria for canals were used since the stream resources in the region are predominantly canals, or function similarly to canals. The South Region had a proposed chlorophyll *a* IPV which was also analyzed. These pass-fail data were then analyzed using `psurvey.analysis`, which produced inferred attainment statistics for all waters within each nutrient region and for the state as a whole. Attainment statistics are presented in Tables 1 and 3, and graphically in Figures 3 and 5.

The TN results for each site (see estuarine drainage area map with site locations, Figure 2) were compared to the DPV values for each individual WBID and a pass-fail result was recorded for the site. These pass-fail data were then analyzed using `psurvey.analysis`, which produced inferred attainment statistics for all waters within each estuarine drainage area and for the entire state (Table 2, Figure 4).

Along with the percentage of waters attaining the proposed nutrient criteria, the 95% confidence bounds are presented. Confidence bounds are an estimate of a population parameter interval. Instead

of estimating the parameter by a single value, an interval likely to include the parameter is given. Thus, confidence bounds are used to indicate the reliability of an estimate.

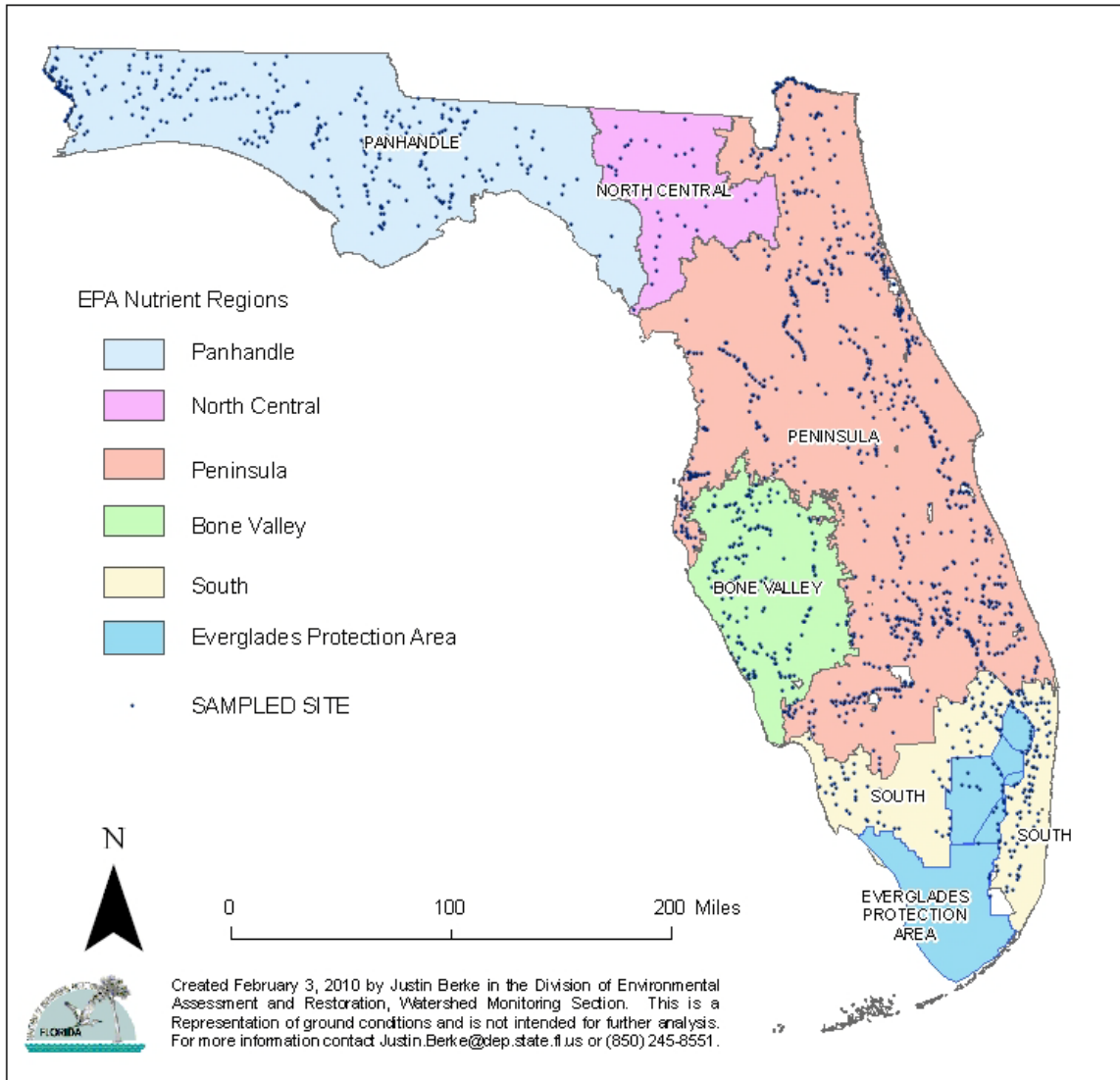


Fig. 1 EPA Nutrient Regions With River And Stream Sample Locations 2004 -2008

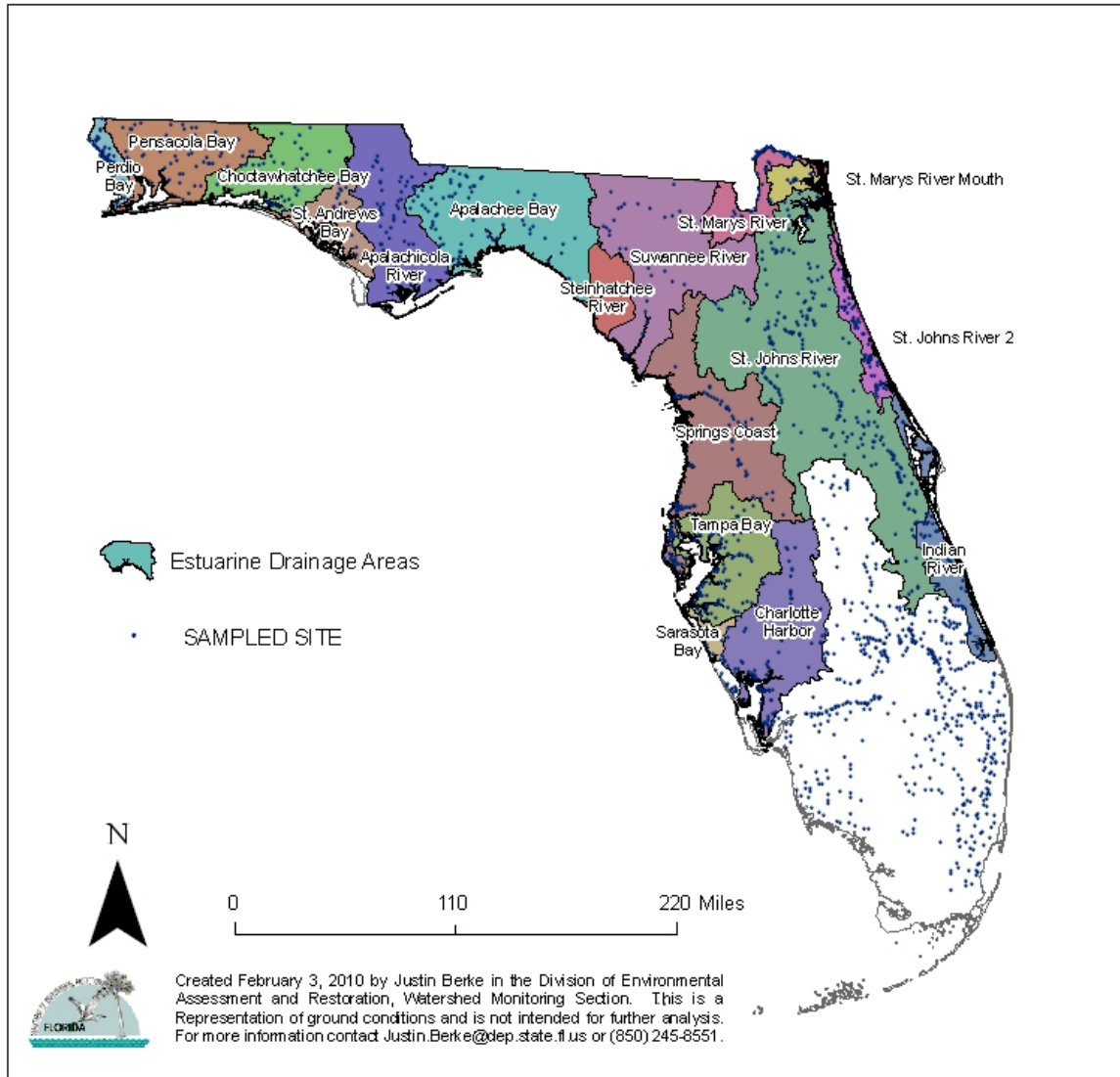


Fig. 2 Estuarine Drainage Areas With River And Stream Sample Locations 2004 -2008

Table 1. IPV Attainment Results for Total Nitrogen
***-South region used proposed canal criteria**

Status Network

Designated Use: Recreation and Aquatic Life

Units: Miles

Basin	Number of Samples	Percent Attaining	95% Confidence Bounds (Percent Attaining)	Proposed In-stream criteria
Panhandle	311	75.3	70.4-80.3	0.824
North Central	35	73.4	55.2-91.5	1.479
Peninsula	799	34.5	30.0-39.0	1.205
Bone Valley	165	67.4	58.1-76.8	1.798
South	160	34.6	28.2-40.9	1.600*
Everglades Protection Area	36	43.3	20.6-66.1	1.600*
Statewide	1506	47.5	44.6-50.4	

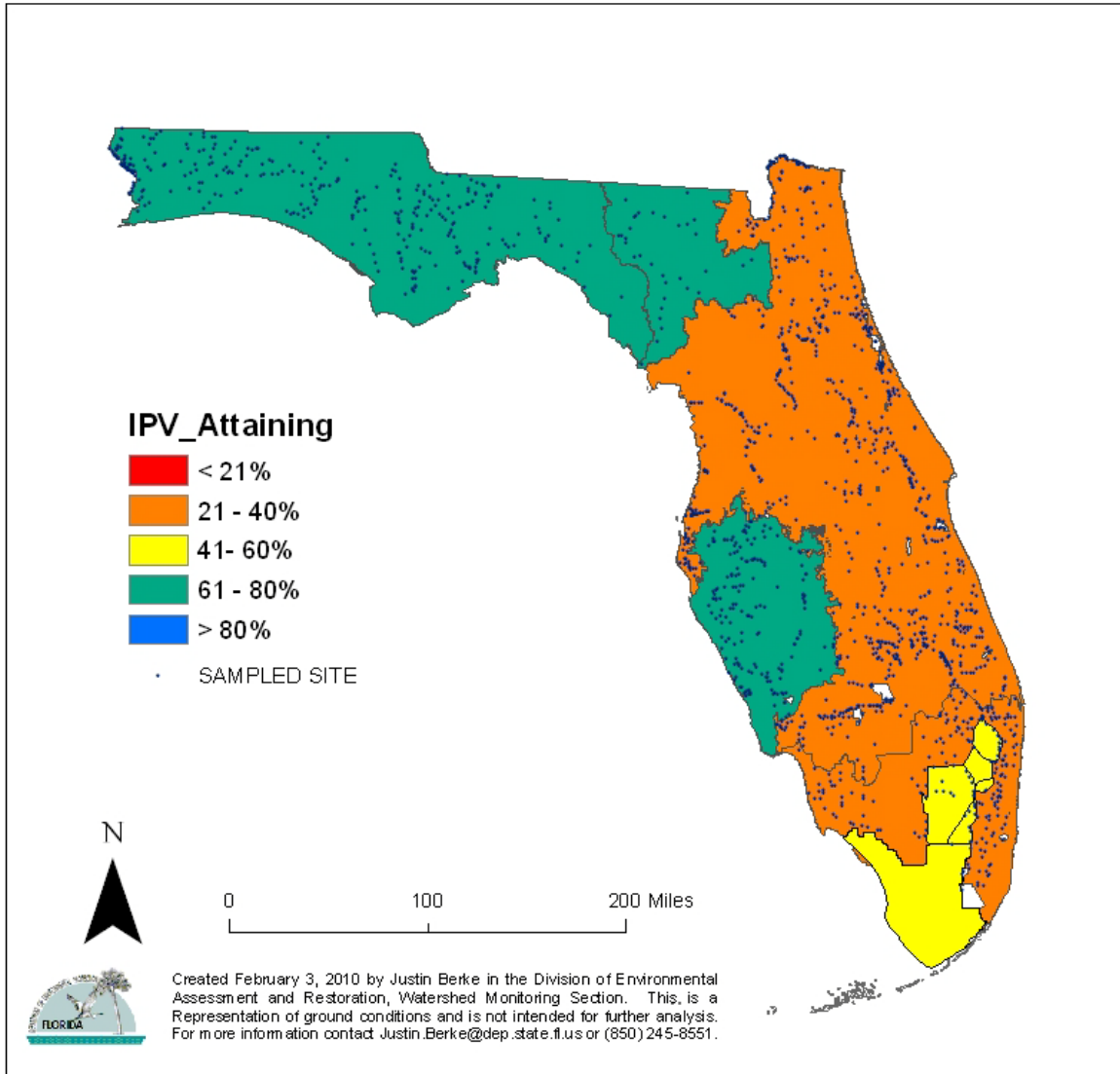


Fig.3 Total Nitrogen Attainment Results Using EPA Proposed Instream Criteria

Table 2. DPV Attainment Results for Total Nitrogen

Status Network

Designated Use: Recreation and Aquatic Life

Units: Miles

<i>Basin</i>	<i>Number of Samples</i>	<i>Percent Attaining</i>	<i>95% Confidence Bounds (Percent Attaining)</i>
Apalachicola River	59	12.4	3.7-21.1
Apalachee Bay	76	48.0	36.8-59.2
Choctawhatchee Bay	41	66.2	52.5-79.8
Charlotte Harbor	60	44.4	30.5-58.4
Indian River	18	7.4	0.0-20.1
Pensacola Bay	54	55.2	41.2-69.2
Perdido Bay	60	15.7	5.0-26.4
Sarasota Bay	7	0.0	0.0
St. Andrews Bay	19	65.3	41.9-88.7
St. Johns River	218	13.2	8.4-17.9
St. Mary's River	48	0.0	0.0
St. Mary's mouth	12	0.0	0.0
Suwannee River	35	8.1	0.0-21.0
Tampa Bay	71	12.2	4.7-19.8
Statewide	820	31.9	20.0-43.7

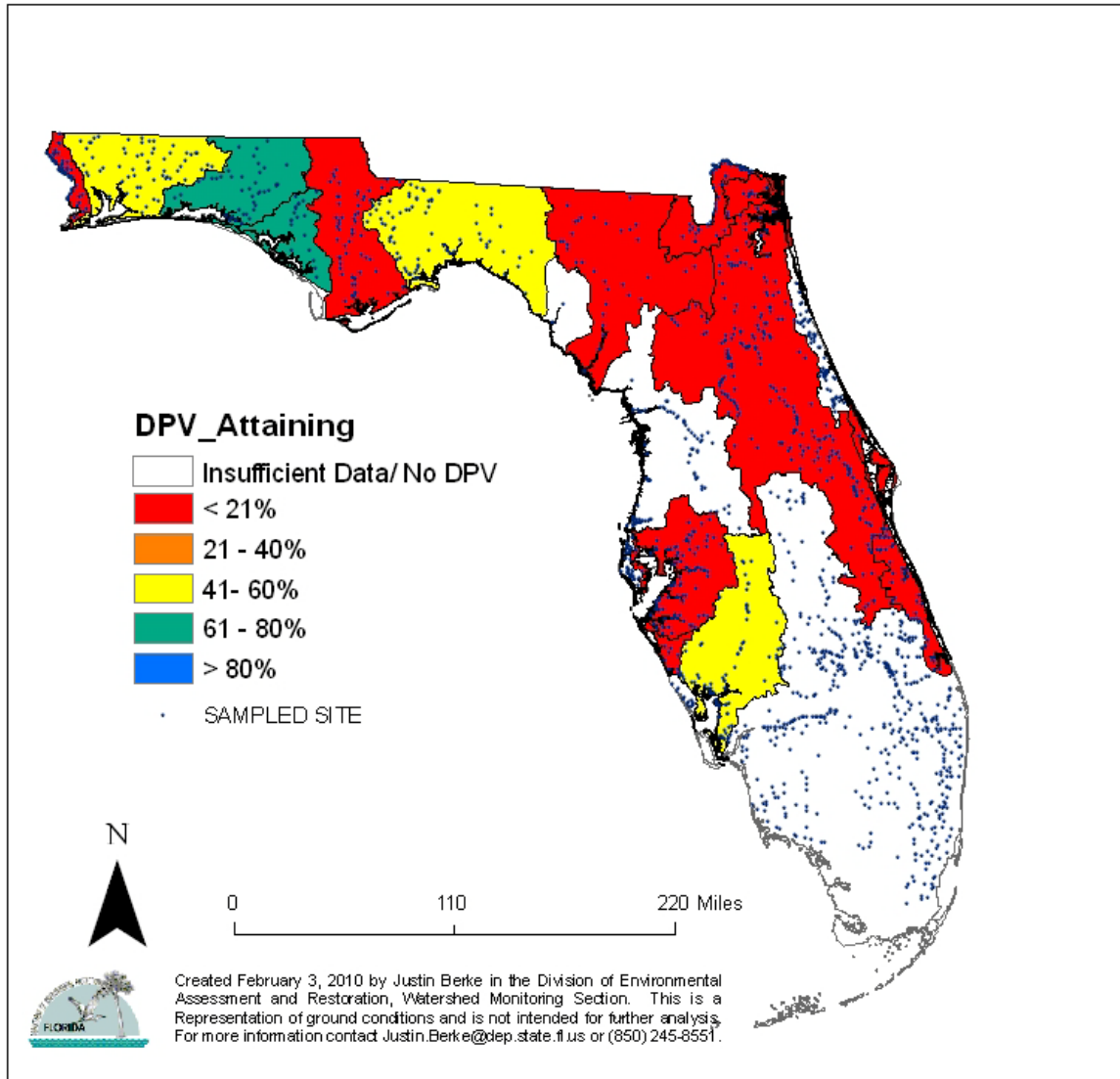


Fig. 4 Total Nitrogen Attainment Results Using Downstream Protective Values

Table 3. IPV Attainment Results for Total Phosphorous
***-South region used proposed canal criteria**

Status Network

Designated Use: Recreation and Aquatic Life

Units: Miles

<i>Basin</i>	<i>Number of Samples</i>	<i>% Attaining</i>	<i>95% Confidence Bounds (% Attaining)</i>	<i>Proposed In-stream criteria</i>
Panhandle	311	74.3	70.3-78.4	0.043
North Central	35	55.8	34.3-77.2	0.359
Peninsula	799	43.7	39.0-48.5	0.107
Bone Valley	165	78.0	69.5-86.4	0.739
South	160	37.2	30.0-44.4	0.042
Everglades Protection Area	36	36.8	14.1-59.6	0.010
Statewide	1506	52.9	49.9-55.9	

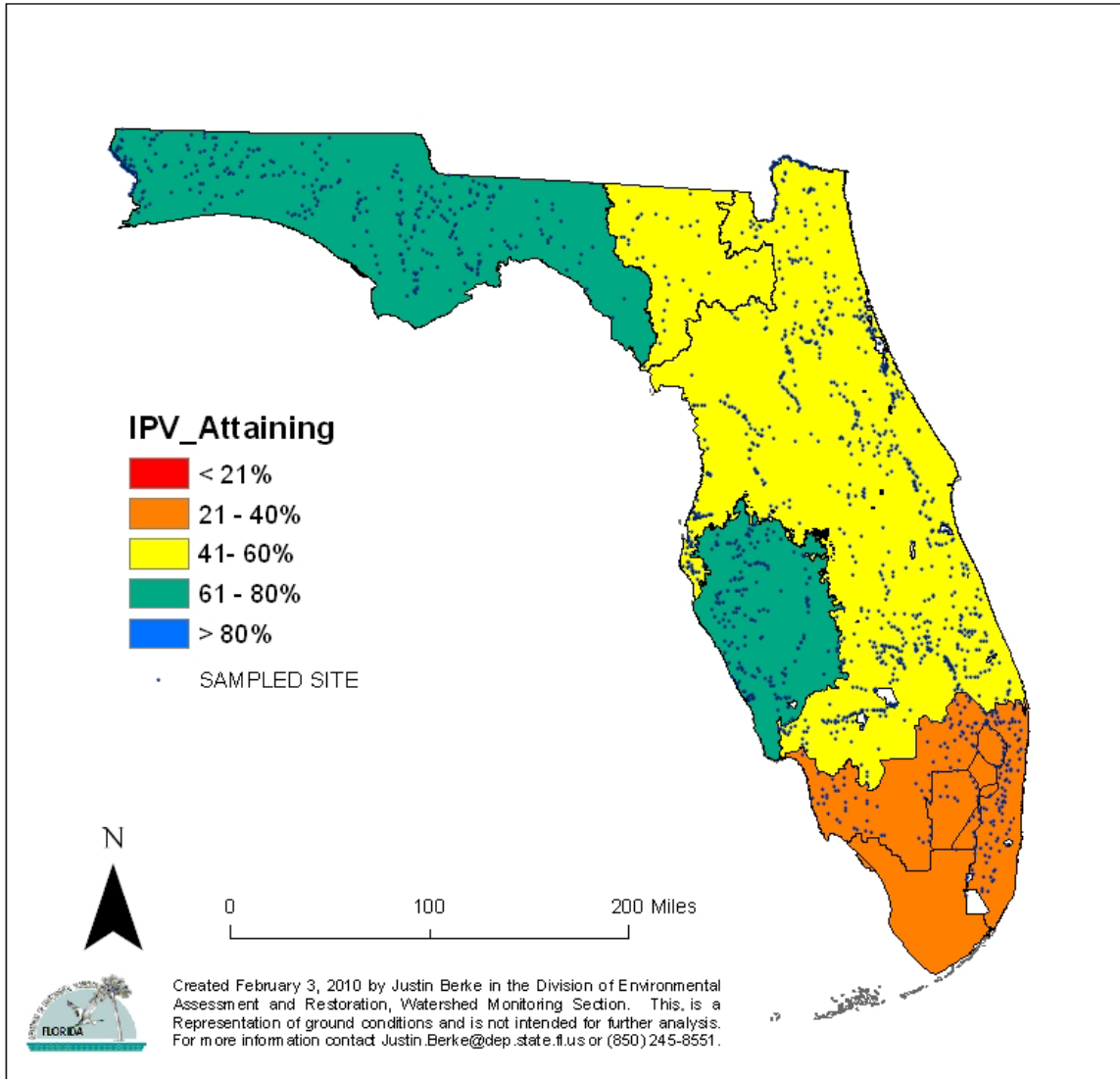


Fig.5 Total Phosphorus Attainment Results Using EPA Proposed Instream Criteria

Conclusions

EPA's In-stream Protection Values

This analysis indicates three of the six nutrient regions (Peninsula, Everglades Protection Area and South) had fewer than 60% of the waterbodies attaining the IPV for TN. The other three nutrient regions had a higher percentage of attainment for TN based upon the IPVs.

Four of the six nutrient regions (Peninsula, South, Everglades Protection Area and North Central regions) had fewer than 60% of the waterbodies attaining the IPV for TP. The Panhandle and Bone Valley regions had attainment levels over 70%, based on TP IPVs.

In addition, EPA is proposing numeric criteria for chlorophyll *a* in canals at a level of 4- $\mu\text{g/L}$. The South Region is dominated with canals and canalized rivers and streams, and had an attainment frequency of 30.9% for the chlorophyll *a* criterion level. There were 196 of samples and the 95% confidence bounds were 23.0-38.7.

EPA's Downstream Protection Values

Most of the peninsular section of the state (12 of the 14 estuarine drainage areas) had attainment percentages below 60% for the TN DPV. Six of the 14 areas had attainment percentages below 20 percent. With the exception of the Apalachicola River basin and Perdido Bay, the Panhandle had a higher percentage of waters attain the DPV for TN (60% level of waters meeting or exceeding TN DPV).