Presentation Overview

- Brevard County Spatial Watershed Iterative Loading (SWIL) Model Status.

- Seagrass Target Step 1 Analysis.

- Update on Implementation Efforts for the Central Indian River Lagoon.

Florida Department of Environmental Protection

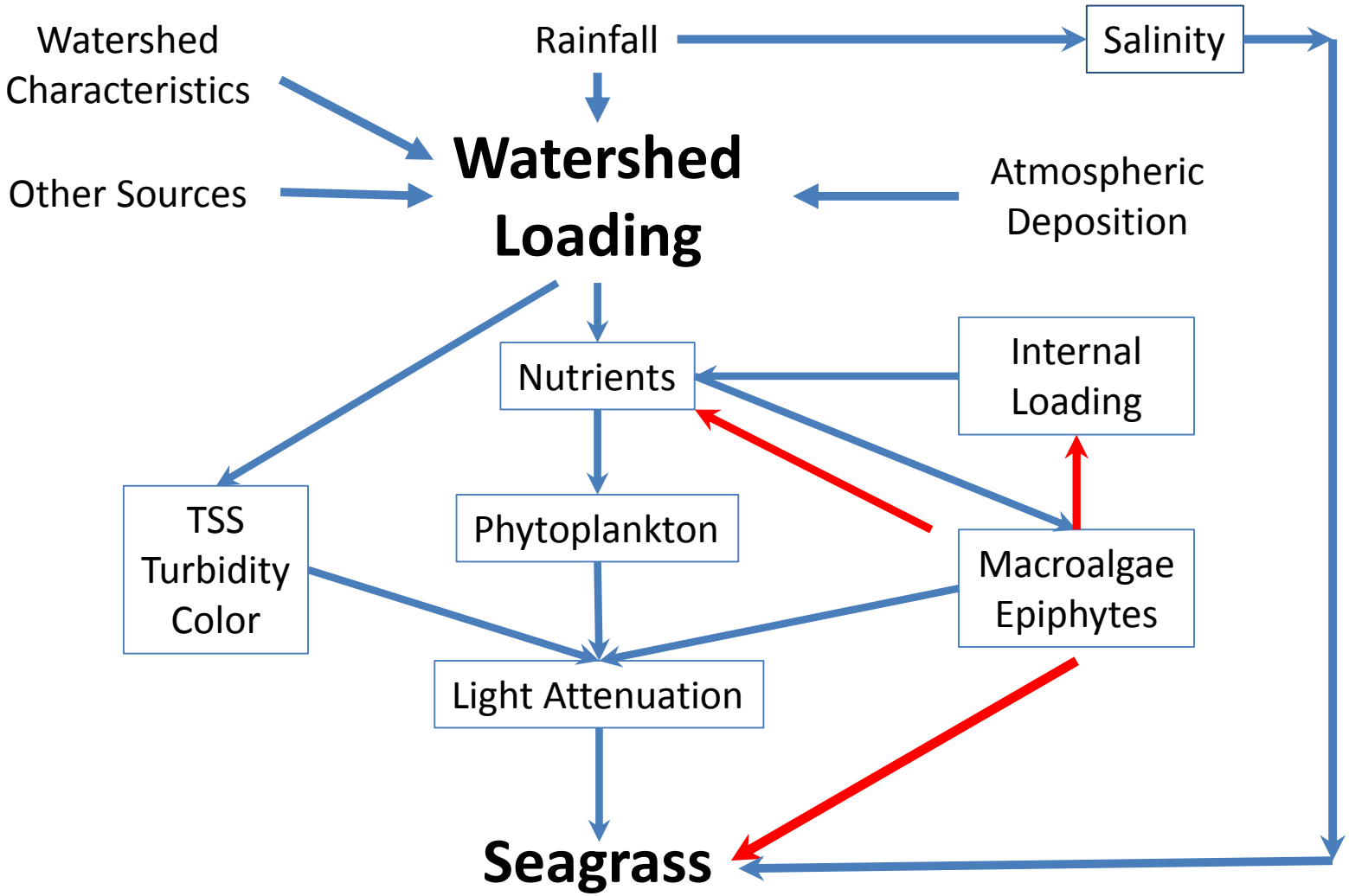
Indian River Lagoon Total Maximum Daily Load (TMDL) Refinement

Xueqing Gao
Florida Department of Environmental Protection
xueqing.gao@dep.state.fl.us
April 21, 2015





FDEP Comments on The Revised Conceptual Model



TMDL Loads Simulation Refinement

SWIL Model Development and Refinement

SWIL Model Improves the Watershed Loading Simulation

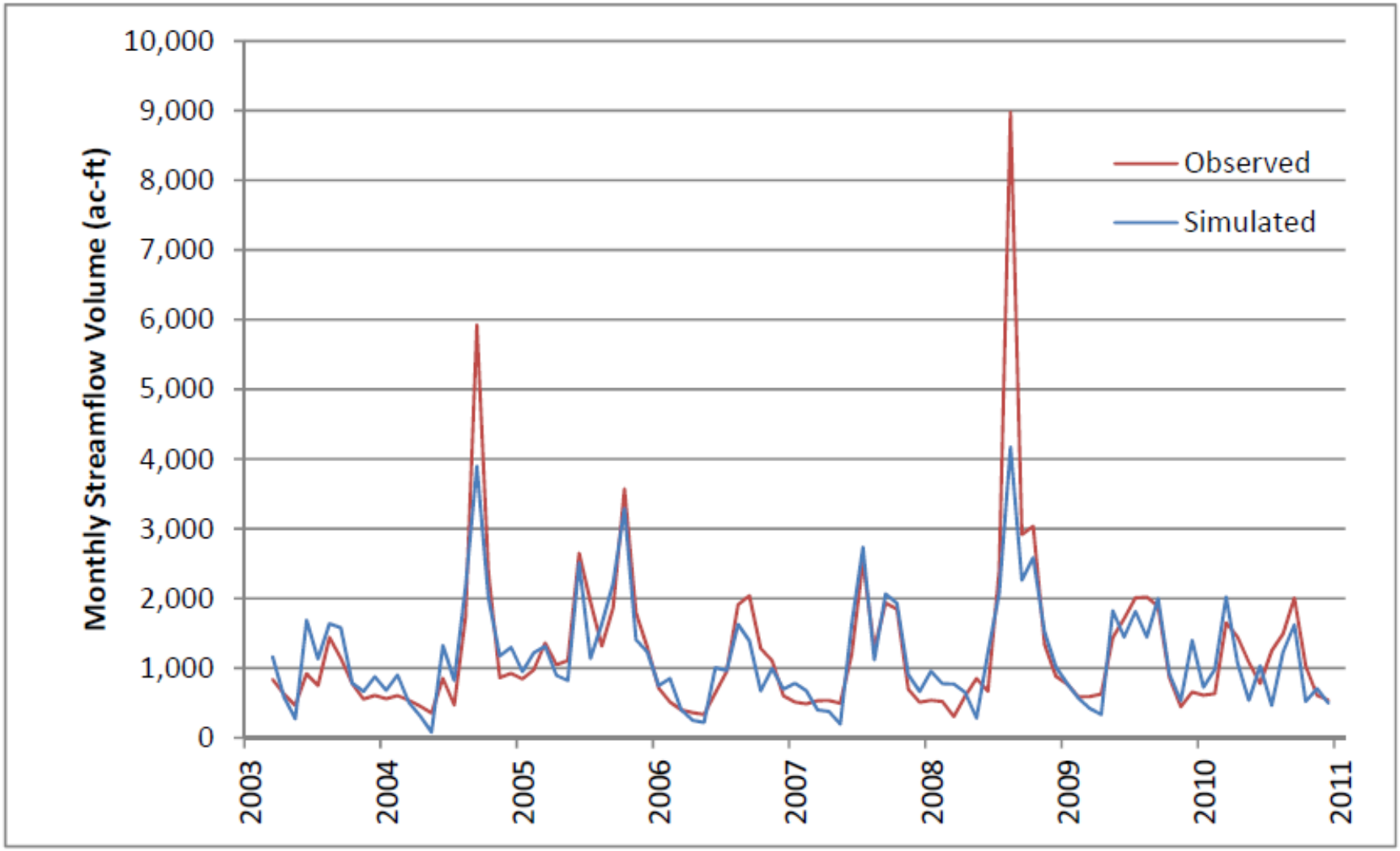
- **FDEP found SWIL model improved the watershed loading simulation on several aspects:**
  - **Used data from multiple sources to verify the land use accuracy.**
  - **Updated soil information from the Natural Resource Conservation Service (NRCS) 1999 soil data to 2010 data.**
  - **Enhanced the rainfall data spatial resolution to address the spatial heterogeneity of the rainfall in the Indian River Lagoon.**
  - **Took into account of the soil antecedent moisture condition when simulating the runoff.**
  - **Simulated the surface runoff and baseflow load separately.**

Two Comments from FDEP on SWIL Model

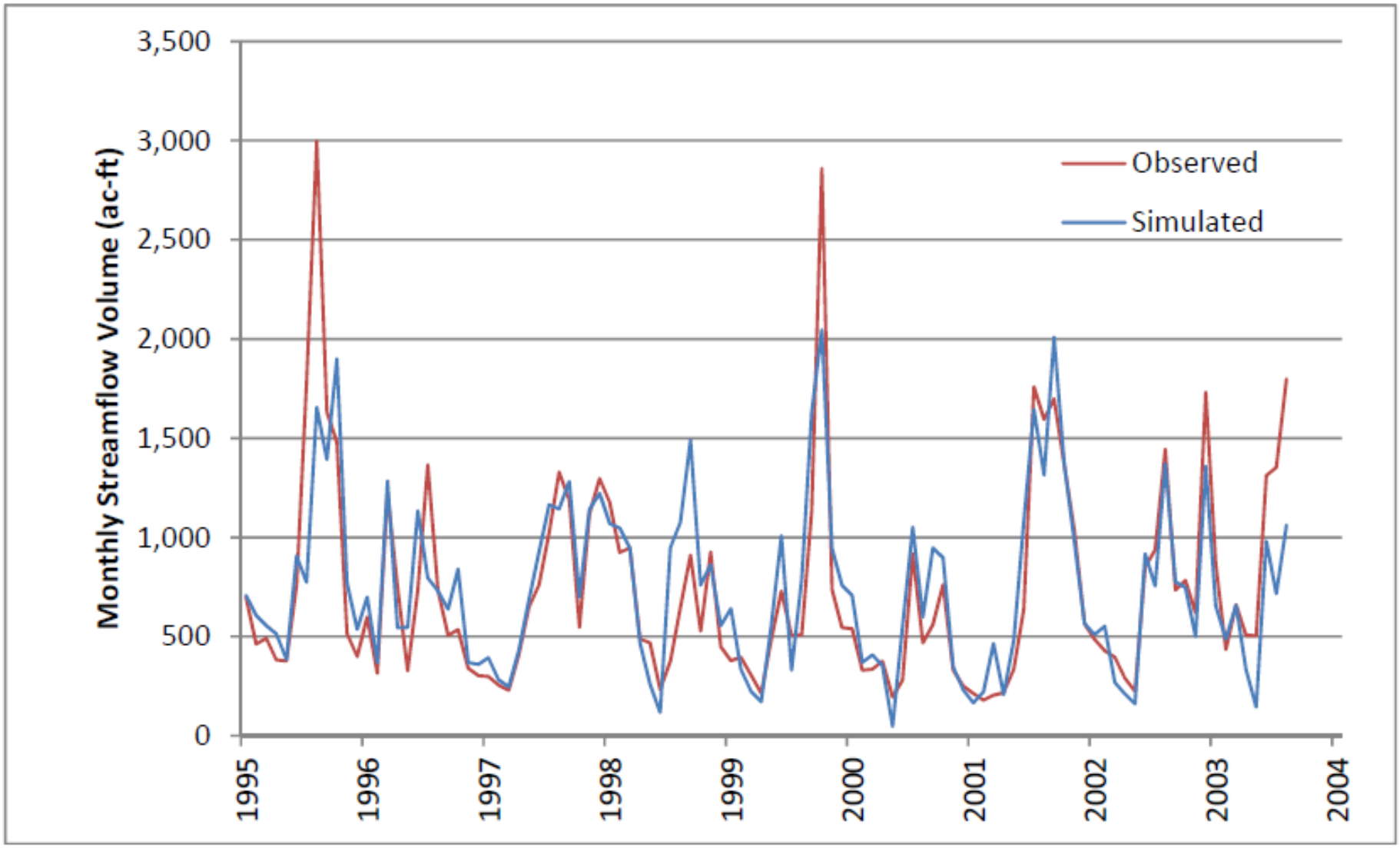
First Comment:

Hydrology Calibration

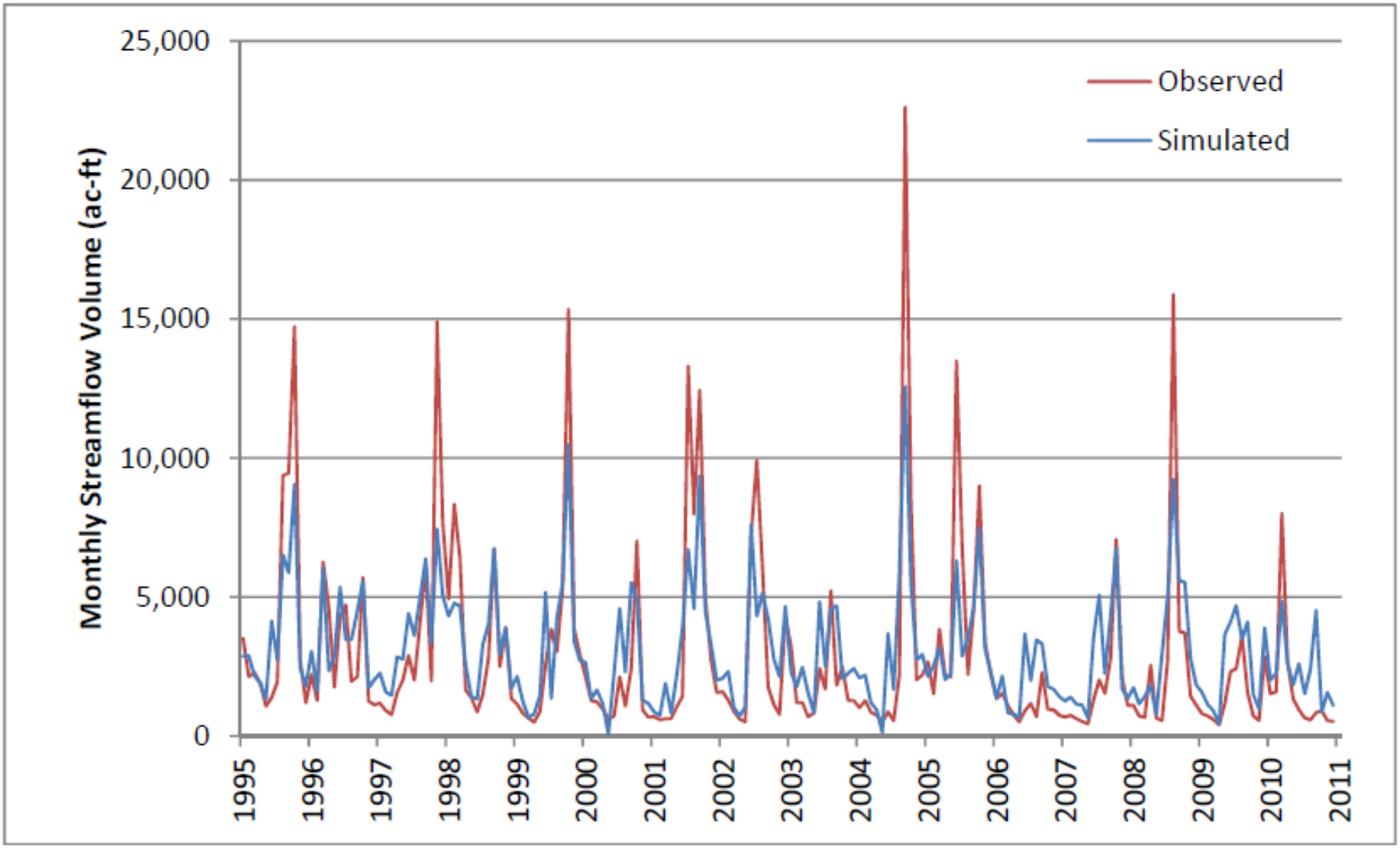
Crane Creek Total Flow Calibration



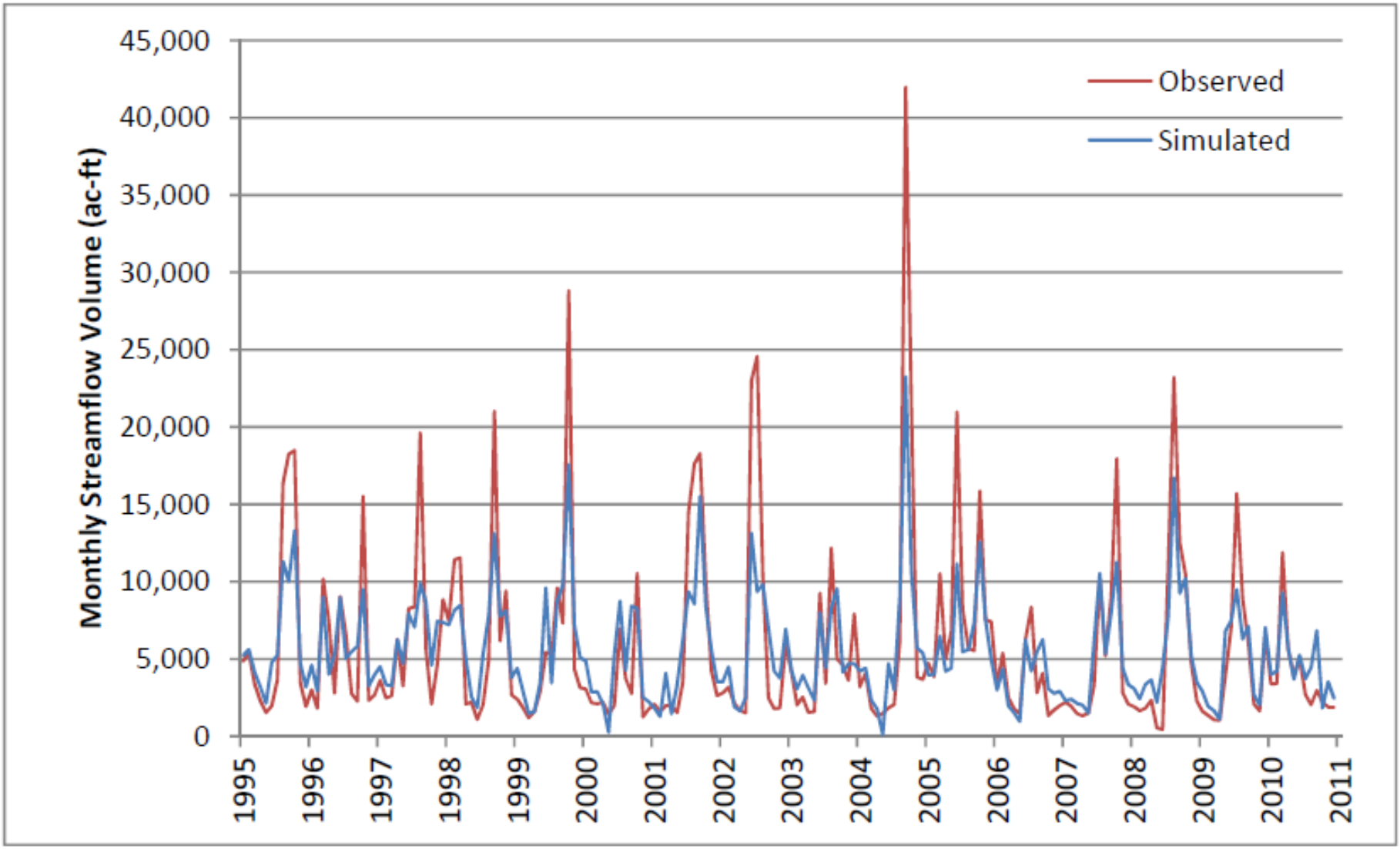
Hickory Creek Total Flow Calibration



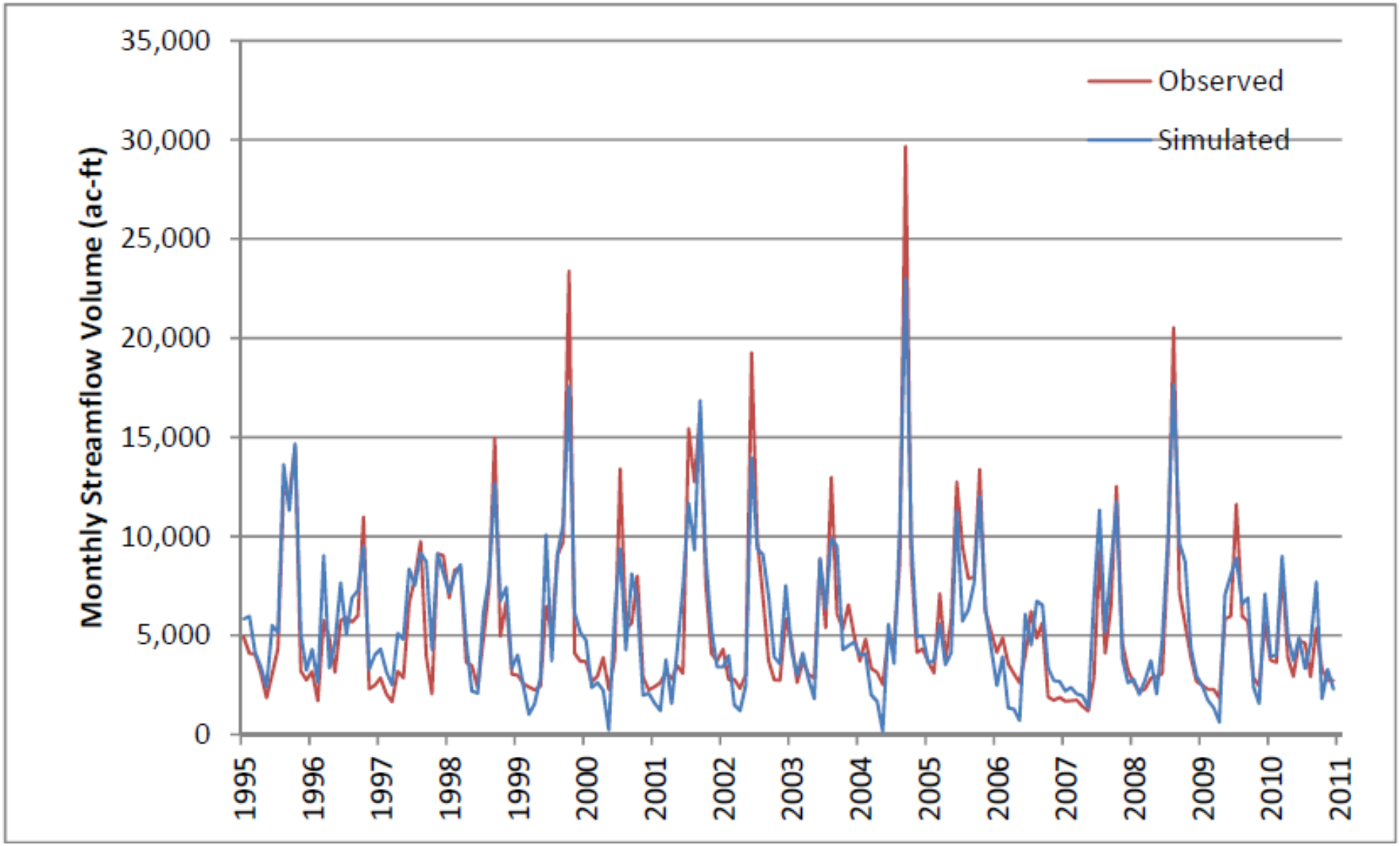
North Prong Total Flow Calibration



South Prong Total Flow Calibration



Fellsmere Total Flow Calibration



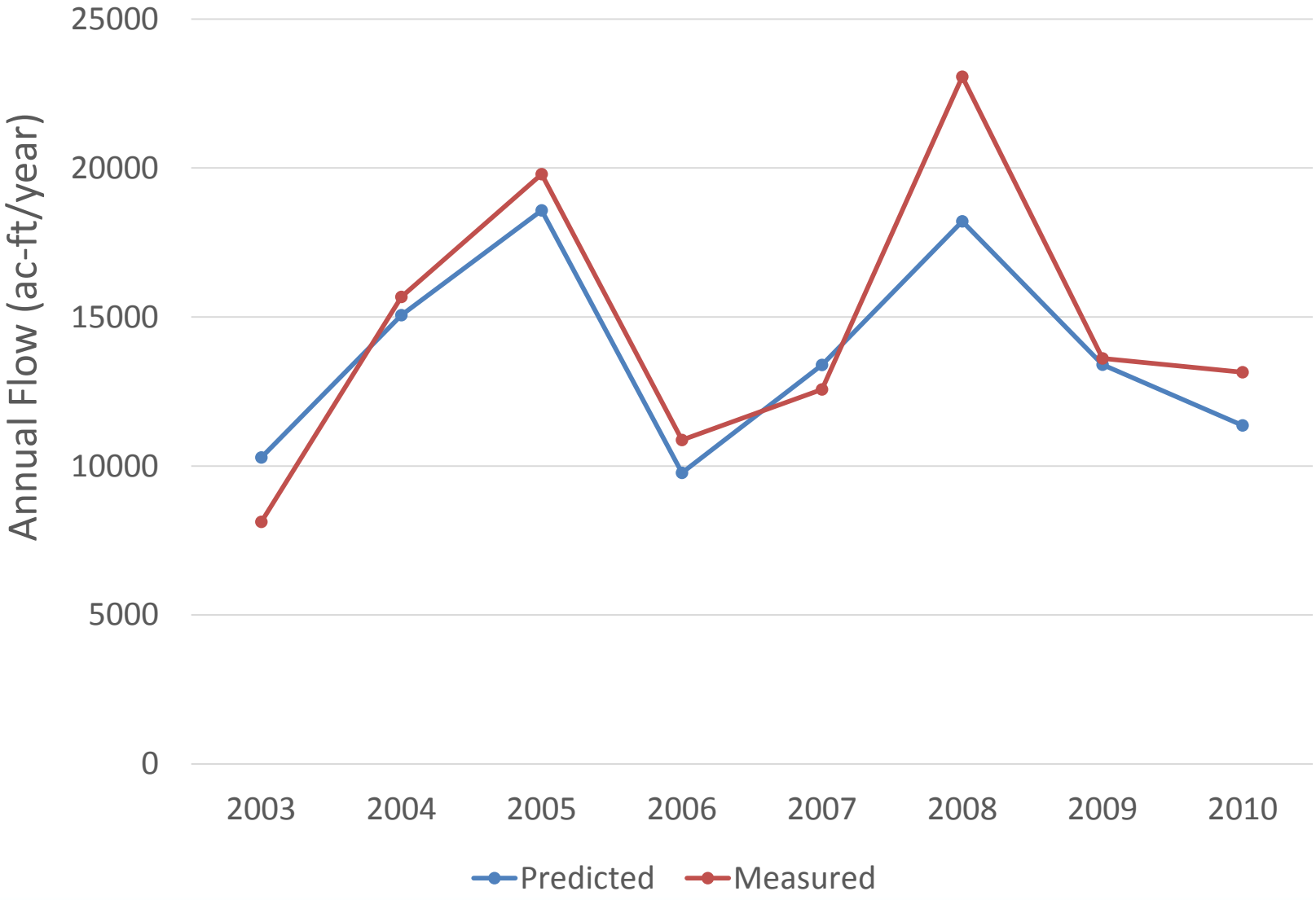
One Suggestion from FDEP for Refining the Hydrology Calibration

- **When the SWIL model was reviewed by FDEP last year, it used 12 long-term mean monthly runoff coefficients to estimate monthly runoff volume.**
- **FDEP suggestion: estimate runoff coefficient for each and all months during the 192 months simulation period and use these month-specific monthly runoff coefficients to estimate the monthly runoff volume**
- **ERD created 192 monthly runoff coefficients and re-ran the SWIL model. The hydrology calibration was not improved significantly.**
- **A delay-factor was also added to the model to adjust the monthly baseflow. The monthly flow simulation was improved, but significant errors still existed.**

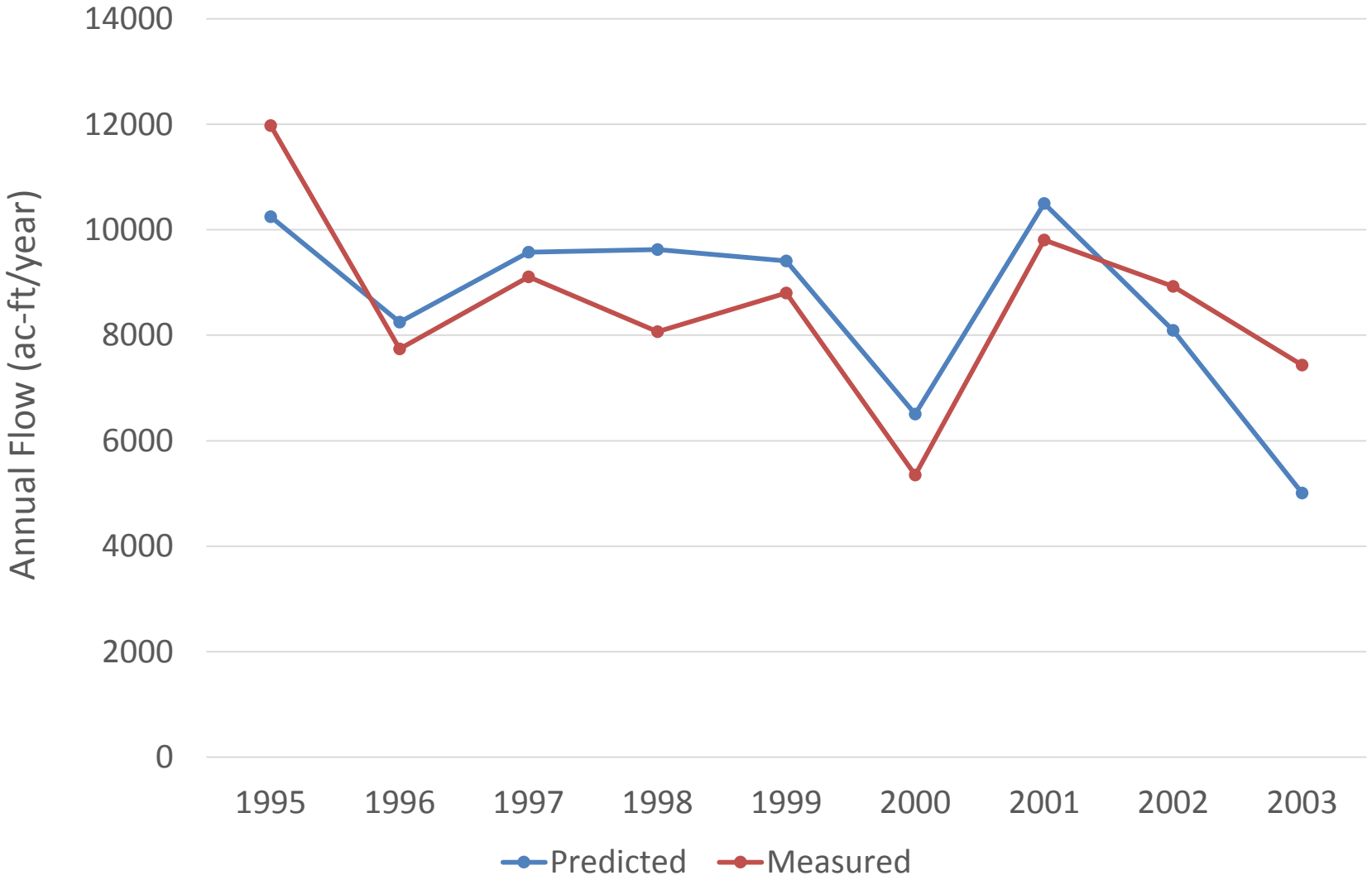
Decision on Hydrology Calibration

- **FDEP agreed that 12 long-term mean monthly runoff coefficients can be used to simulate the monthly flow, instead of using 192 month-specific monthly runoff coefficients.**
- **FDEP cautioned using the monthly runoff volume for statistical analyses because of the error associated with the monthly flow simulation.**
- **Annual flow calibration appeared to be better than the monthly flow, which is favored for the seagrass-nutrient relationship analyses.**

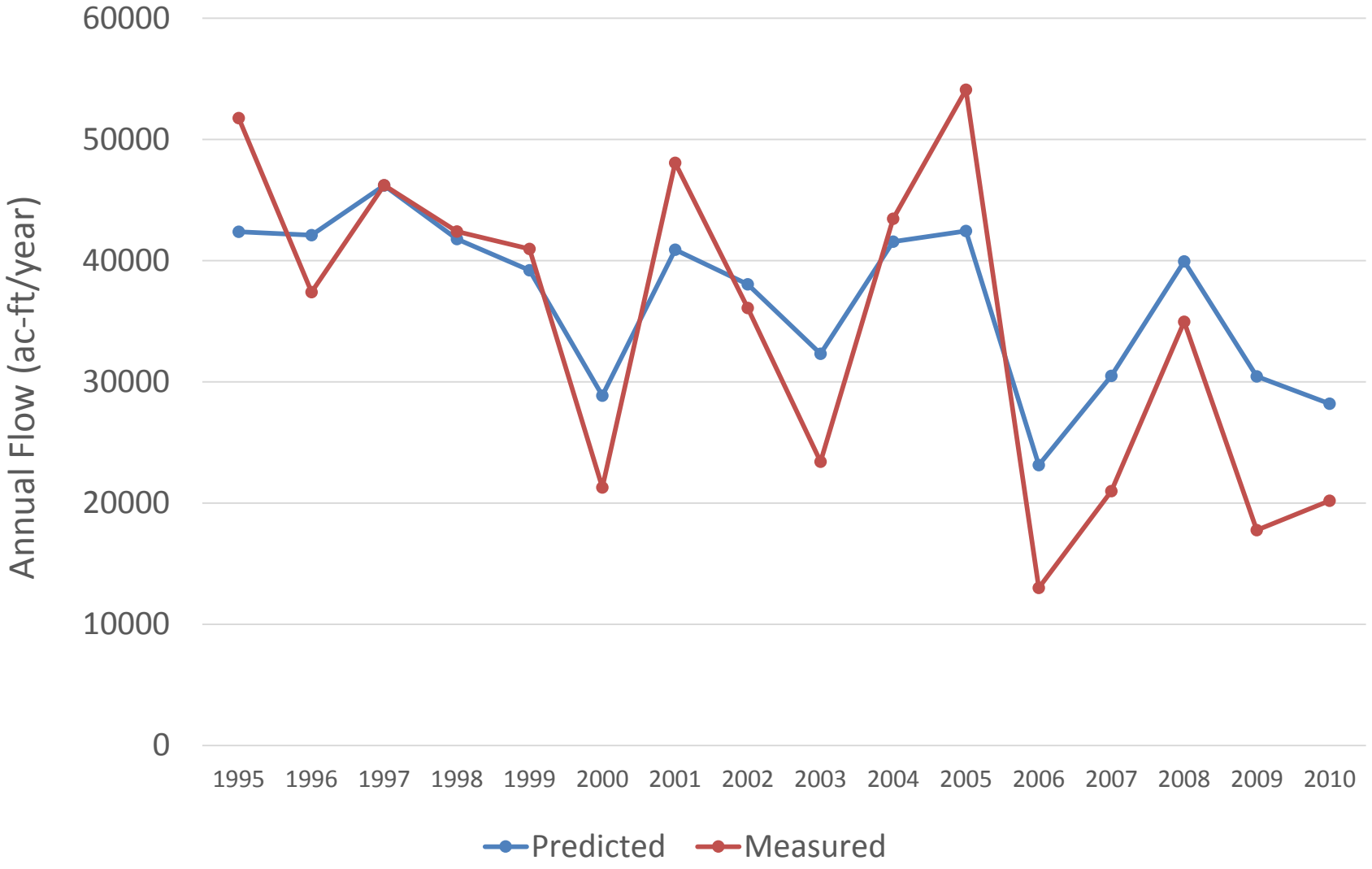
Crane Creek Annual Total Flow Calibration



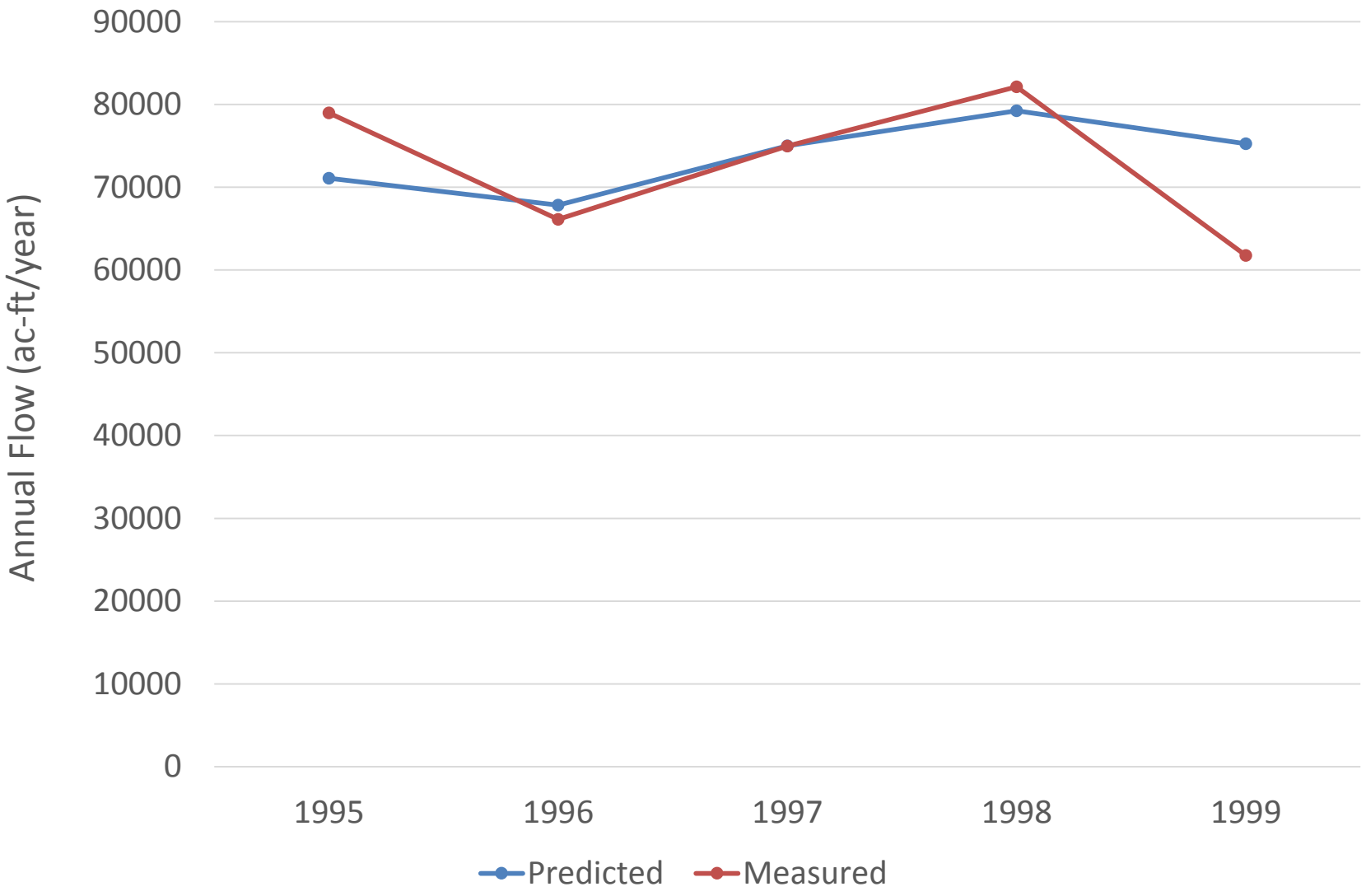
Hickory Creek Annual Total Flow Calibration



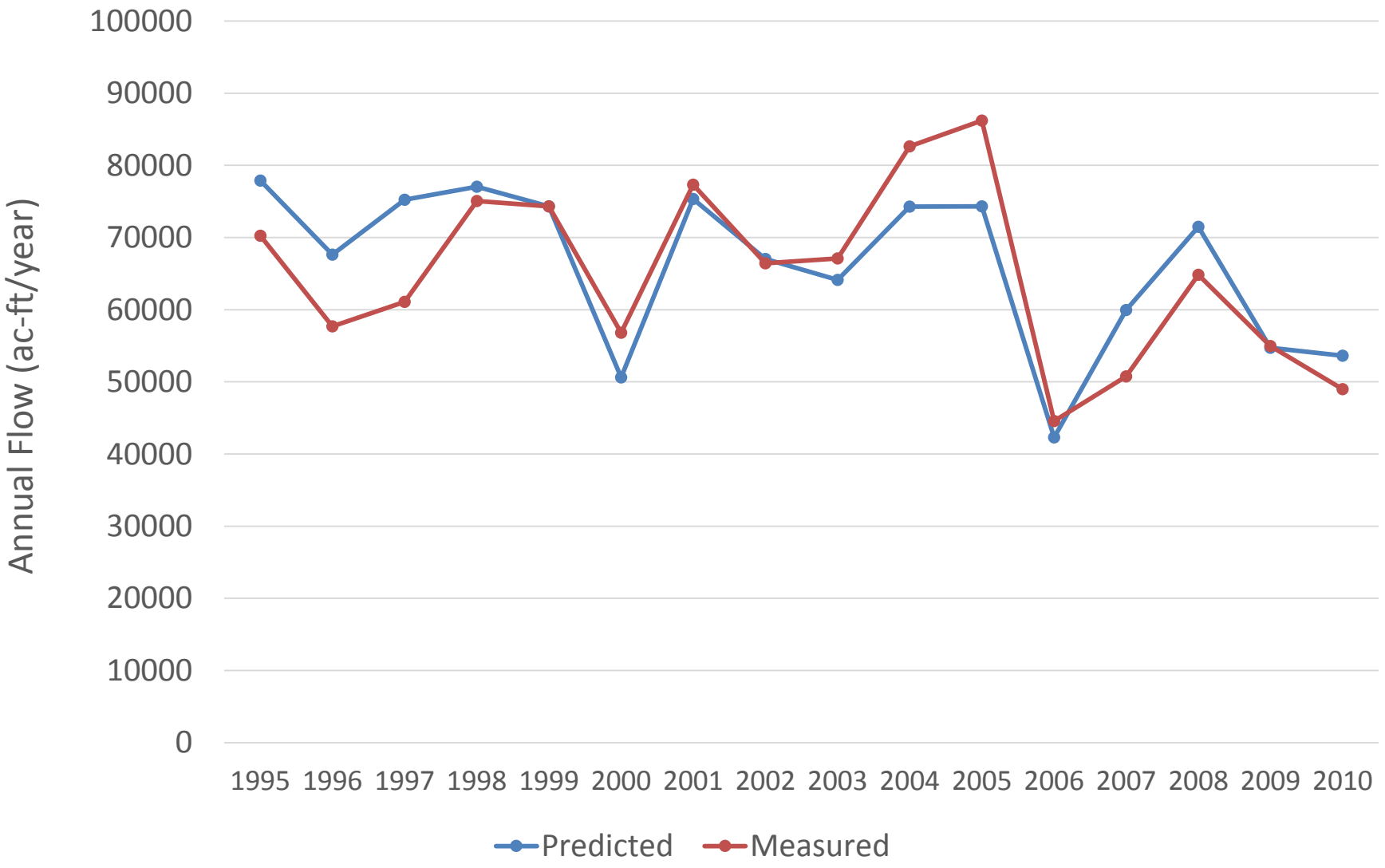
North Prong Annual Total Flow Calibration



South Prong Annual Total Flow Calibration



Fellsmere Annual Total Flow Calibration



Two Comments from FDEP on SWIL Model

Second Comment:

No Water Quality Calibration Was provided

Status

- **ERD used the SWIL model loading output to calibrate the water quality simulation of the model**
- **There was only one waterbody met the water quality calibration requirement – the USGS gauge and the water quality station are co-located – Crane Creek**
- **The model simulated TN and TP loads appeared matching with the loads calculated based on measured data.**

Other Issues

- **The evapotranspiration (ET) data applied to the undeveloped area in SWIL model were generated by the Numerical Terradynamic Simulation Group (NTSG) at the University of Montana.**
- **NTSG replaced the old ET data with a new dataset and declared that they would no longer support the old data.**
- **The most up-to-date version of the SWIL model uses the new ET dataset. FDEP hasn't seen the new modeling results.**

Other Issues

- **The final products from the SWIL model does not include a GIS shapefile that would allow easy clip to any jurisdiction area for load allocation purpose.**
- **FDEP suggested that a GIS shapefile that includes land use and nutrient unit loads information can be created for the future BMAP management purpose.**

Nutrient Target Refinement

Nutrient Target Refinement

- **ATM provided some preliminary results on the inter-segment nutrient transport in the lagoon.**
- **The nutrient loads entering any given lagoon segment from the neighboring lagoon segments could be much higher than the nutrient loads from the other sources.**
- **How should the inter-segment transport information be used in refining the relationship between seagrass matrics and nutrient loads is still to be decided.**
- **One concern is the double counting of the nutrient loads exchange between different lagoon segments because most of the loads transported between lagoon segments are from other sources already being considered by the loading model.**
- **How to evaluate the effects of these loads on the seagrass in each lagoon segment is also an issue. Possible way to evaluate the effect could be to look at the water residence time.**

Nutrient Target Refinement

- **Seagrass depth-limit statistics were examined**
- **Several uncertainties associated with the seagrass depth-limit were raised.**
- **Further data analyses will be conducted to include both the seagrass depth-limit as well as the seagrass coverage.**

Florida Department of Environmental Protection

Indian River Lagoon (IRL) Basin Management Action Plans (BMAPs)

Yesenia Escribano
Florida Department of Environmental Protection
Yesenia.Escribano@dep.state.fl.us
April 21, 2015





2013 Seagrass Mapping

Restoration Target

- Seagrass recovery based on depth limit of the union coverage of mapping years 1943-1999.

- TMDL depth limit based on 90% of the union coverage.

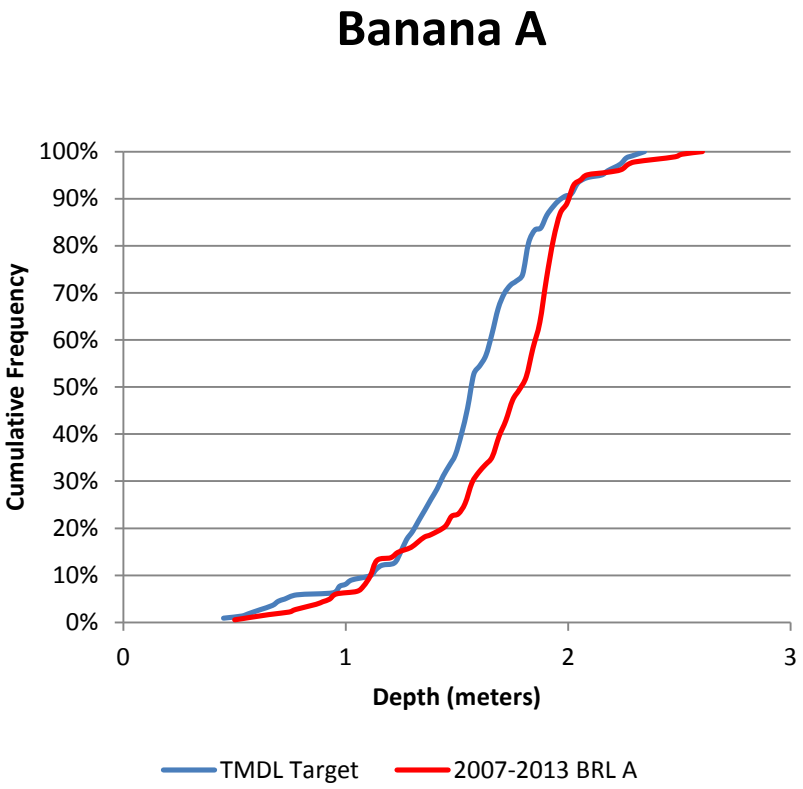
Seagrass Evaluation

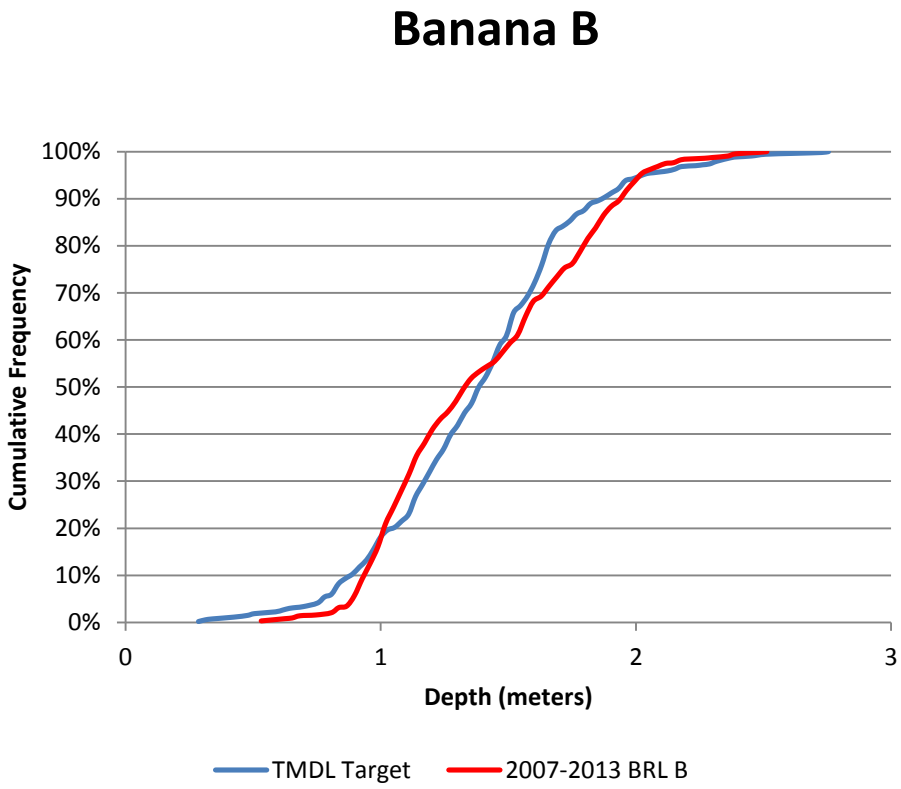
- Seagrass compliance is two step process:
  - Step 1 - Cumulative frequency distribution analysis.
  - Step 2 - Median seagrass depth comparison.

Step 1 and Step 2 Assessment

Project Zone	Step 1 Compliant?	Step 2 Compliant?
Banana A	Yes	No
Banana B	No	No
North A	No	No
North B	No	No
Central A	Yes	No
Central SEB	Yes	No
Central B	Yes	No

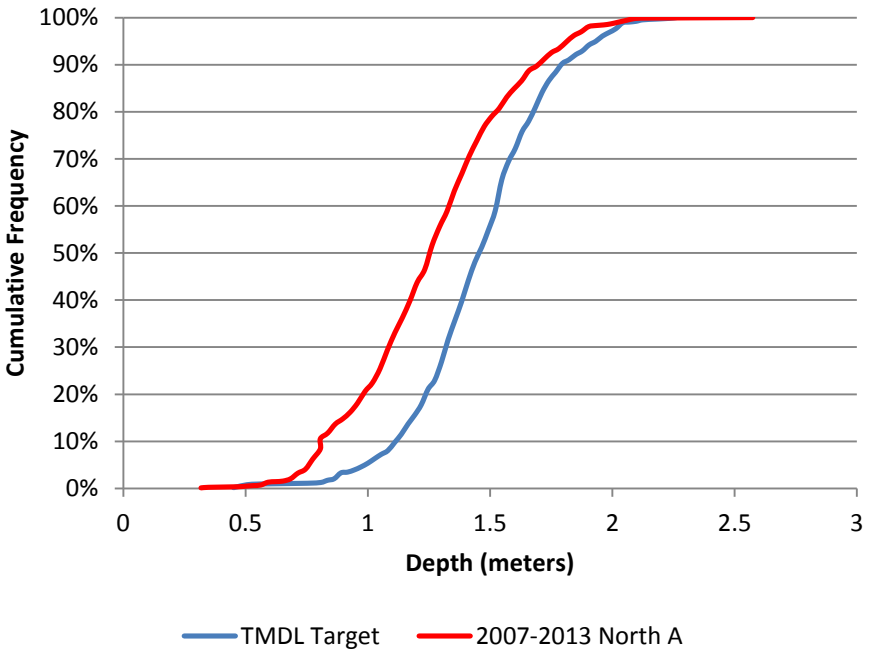
Step 1 Assessment – BRL A and BRL B



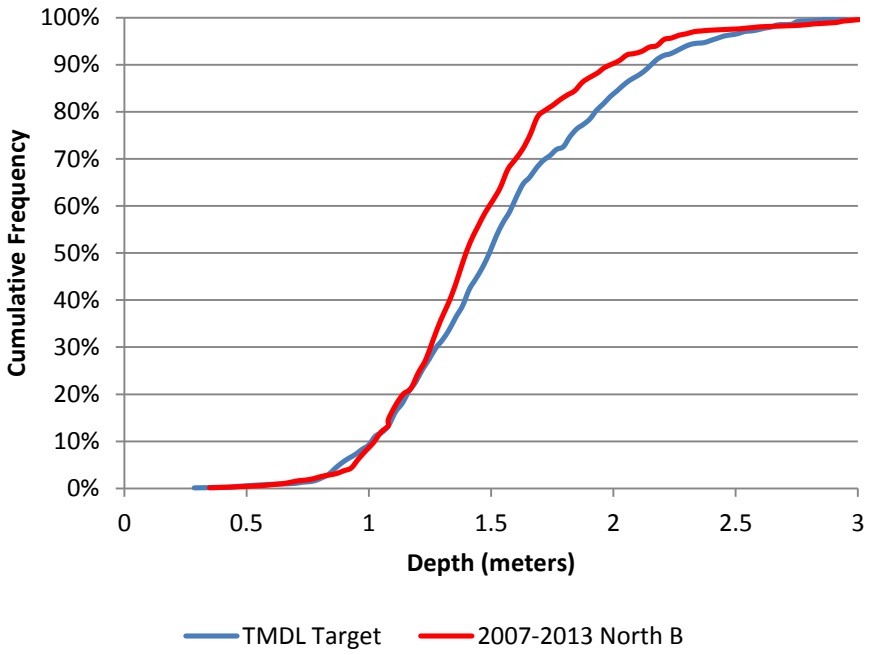


Step 1 Assessment – NIRL A and NIRL B

North A

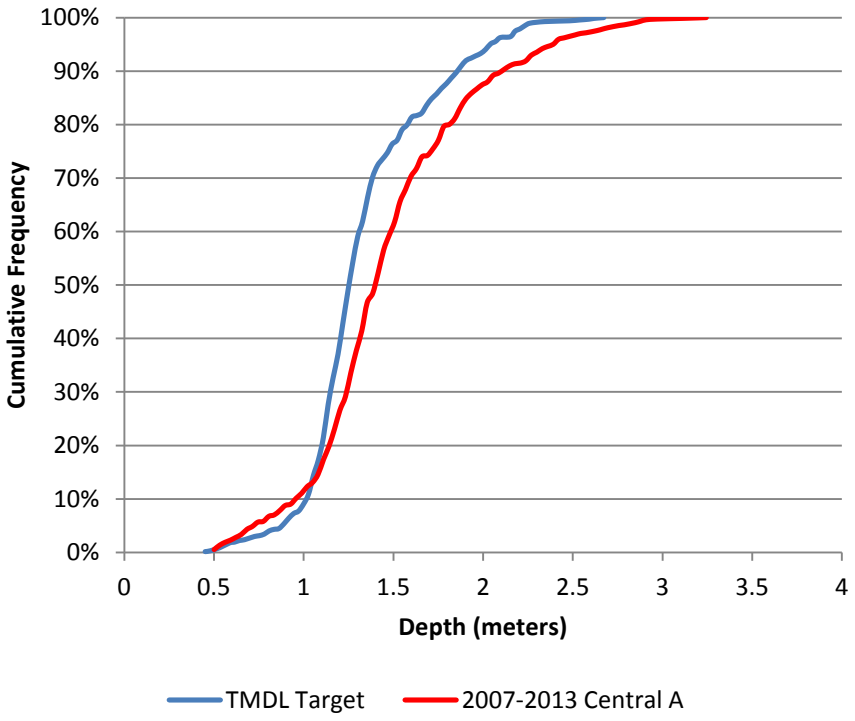


North B

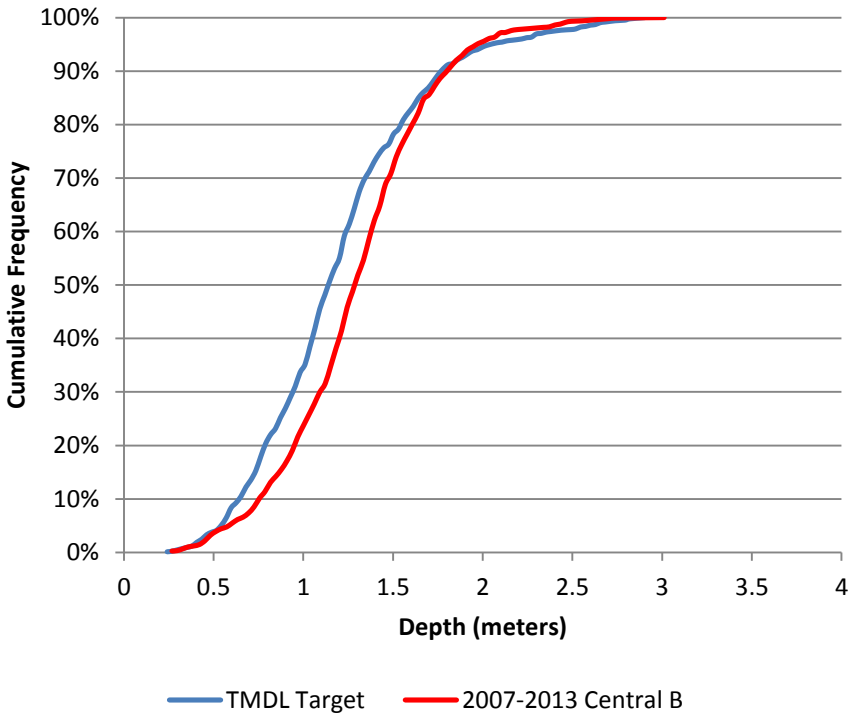


Step 1 Assessment – CIRL A and CIRL B

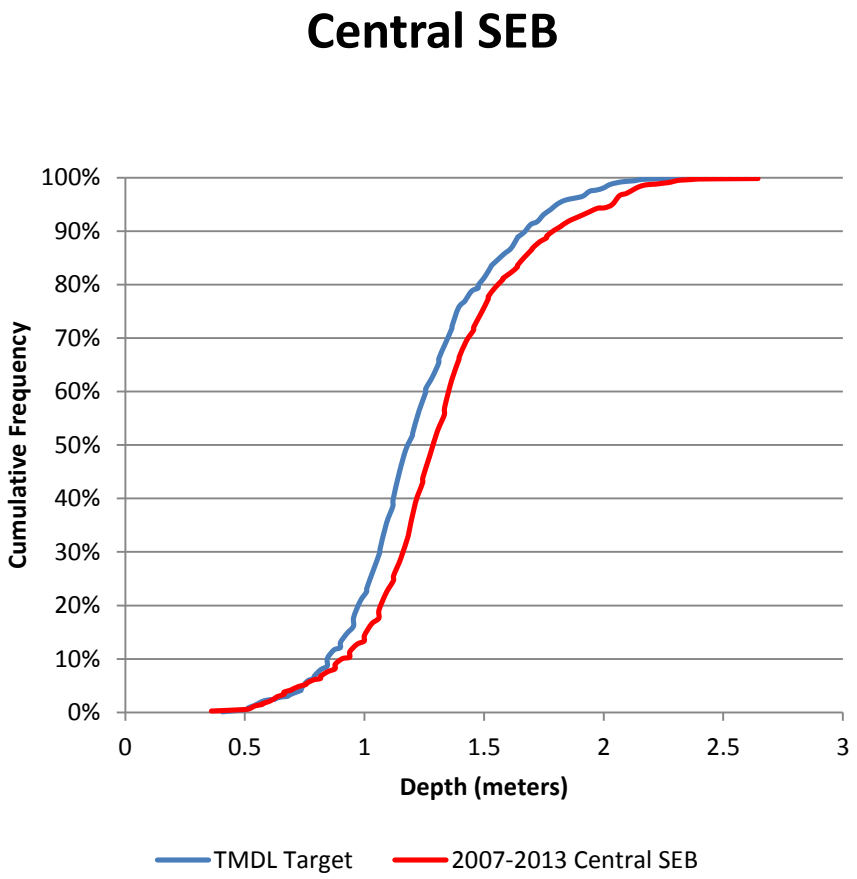
Central A



Central B



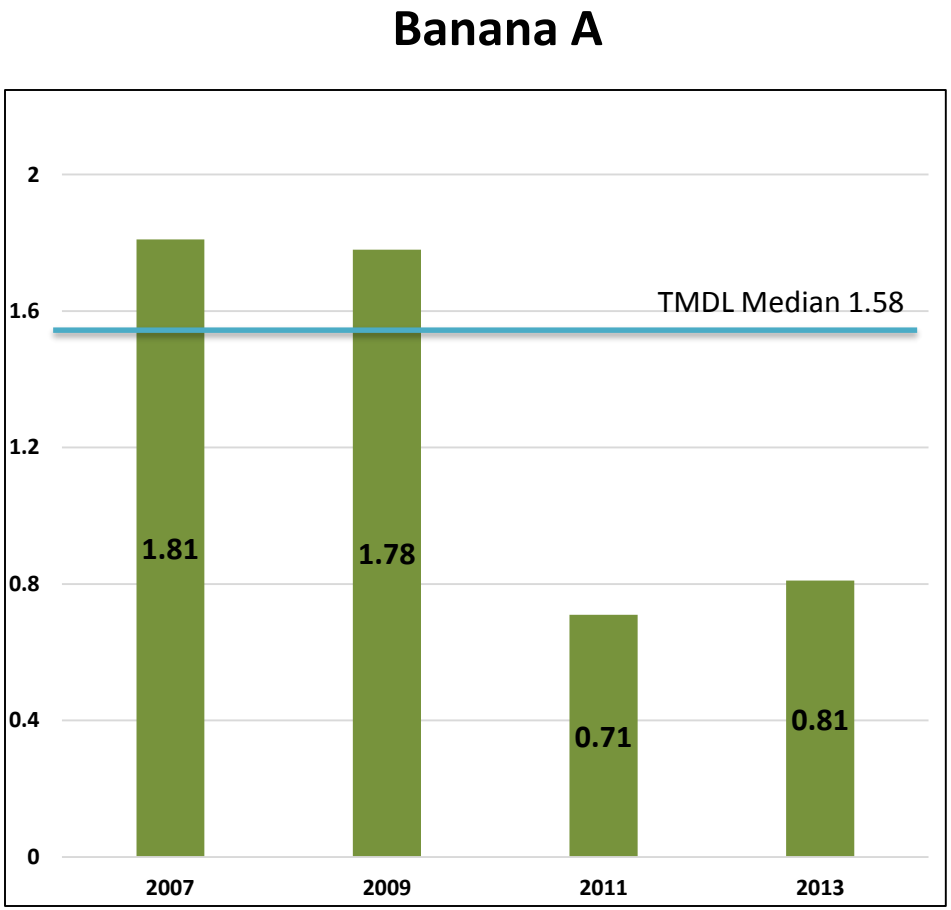
Step 1 Assessment – CIRL SEB

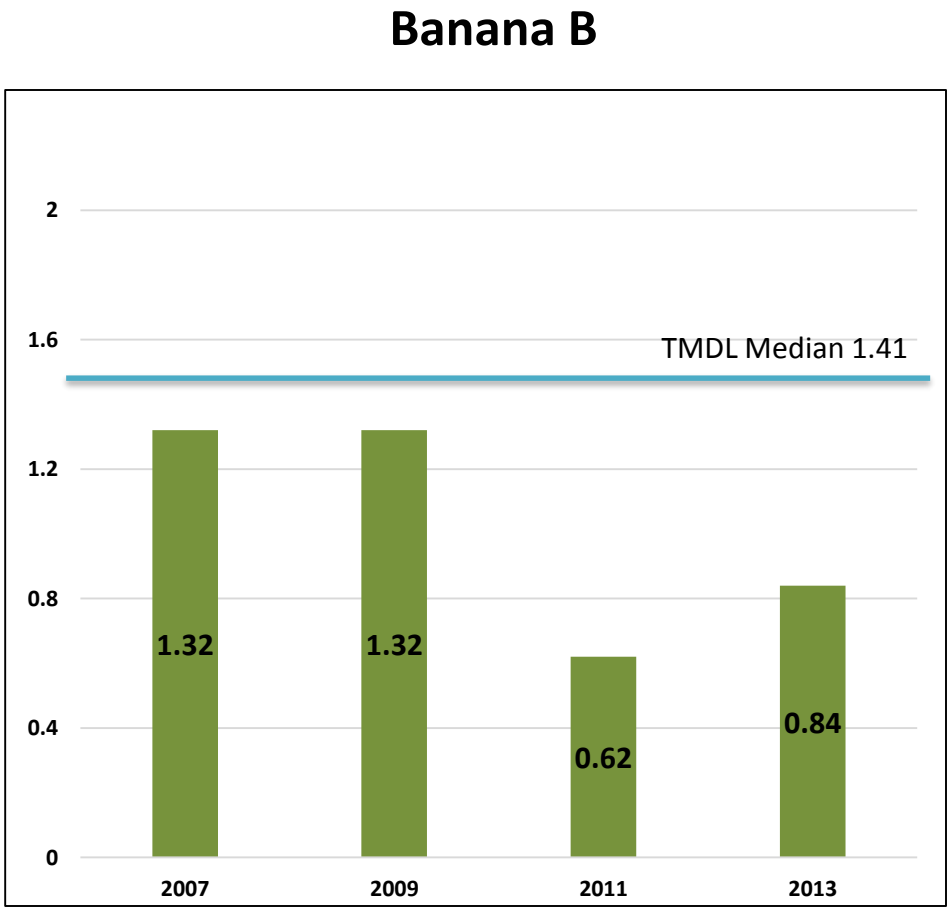


Step 2 Assessment Summary

Year	Banana A	Banana B	North A	North B	Central A	Central SEB	Central B
TMDL Median	1.58	1.41	1.44	1.51	1.27	1.20	1.15
2007	1.81*	1.32	1.23	1.39	1.39*	1.27*	1.27*
2009	1.78*	1.32	1.17	1.39	1.32*	1.27*	1.34*
2011	0.71	0.62	1.05	0.93	0.96	0.89	0.97
2013	0.81	0.84	1.02	1.17	1.14	0.99	1.09
Compliant?	No	No	No	No	No	No	No

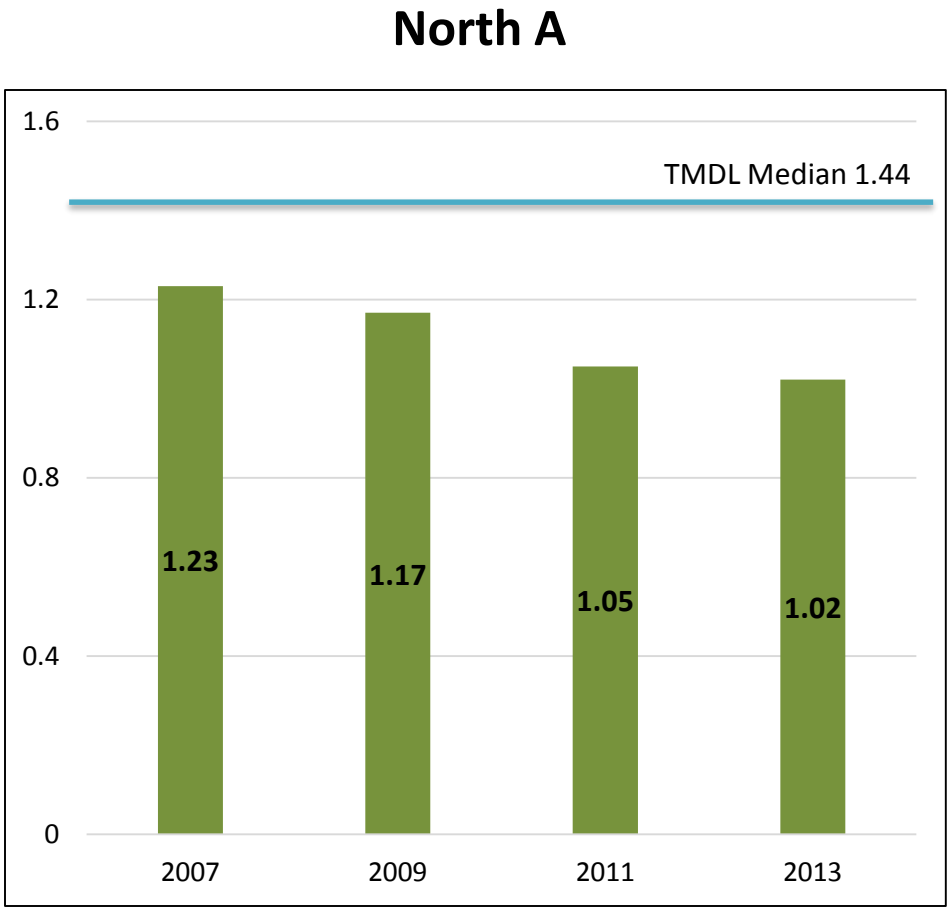
Step 2 Assessment – BRL A and BRL B

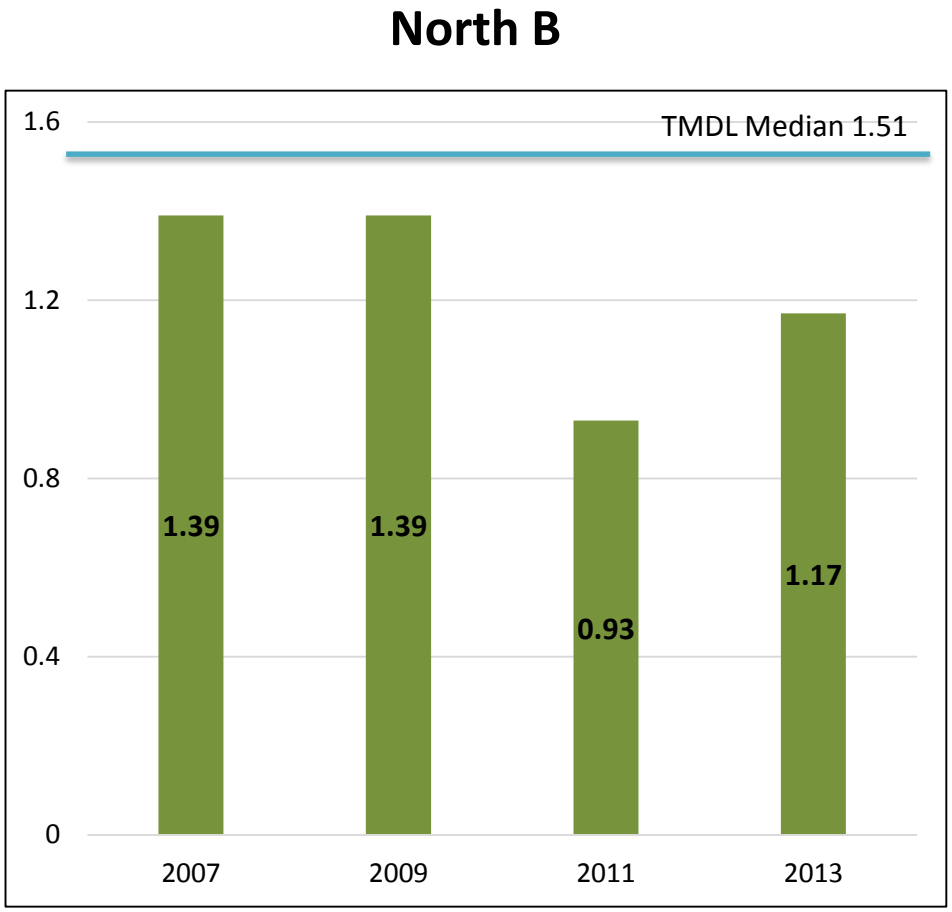




Median seagrass depth in meters

Step 2 Assessment – North A and North B

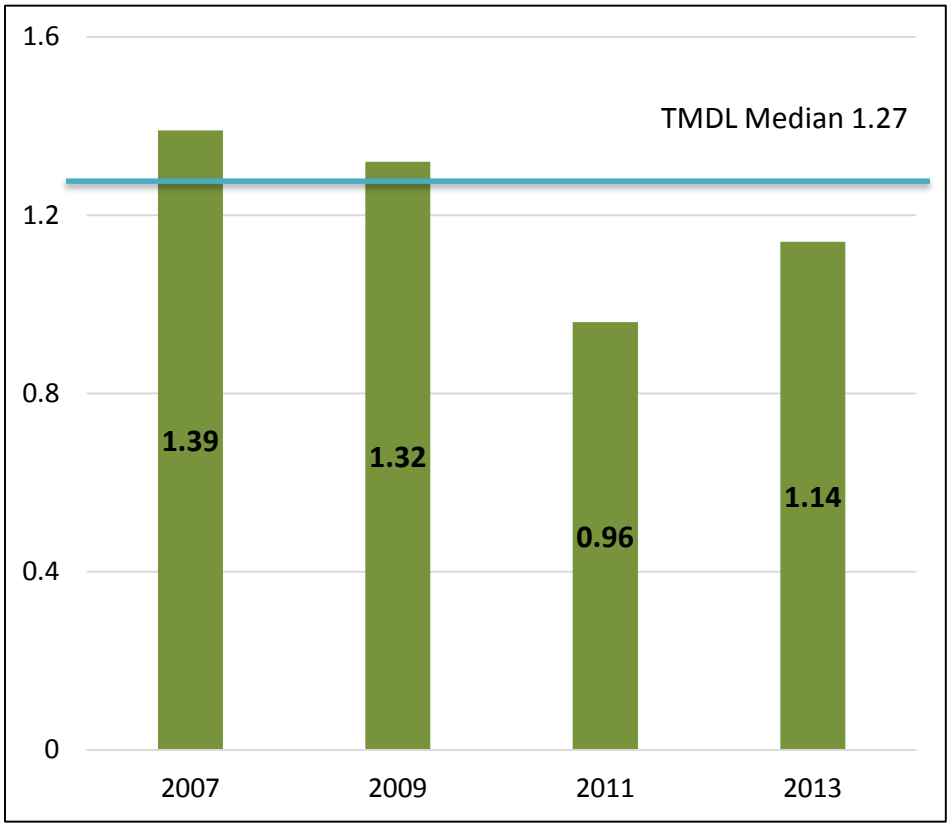




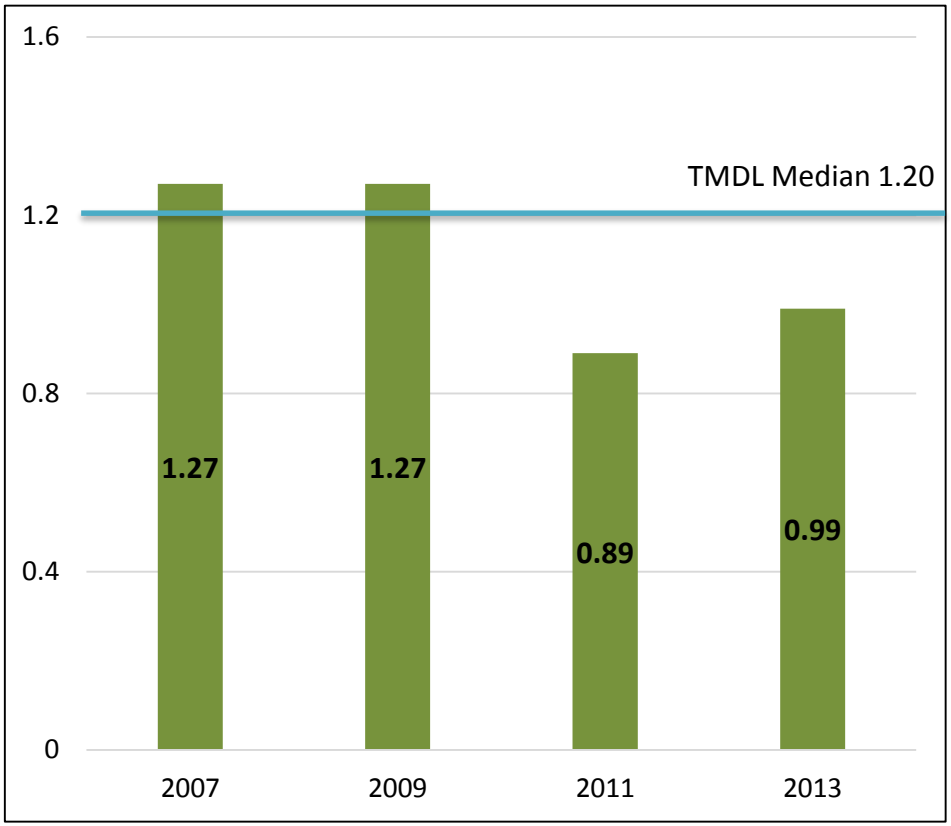
Median seagrass depth in meters

Step 2 Assessment – Central A and Central B

Central A

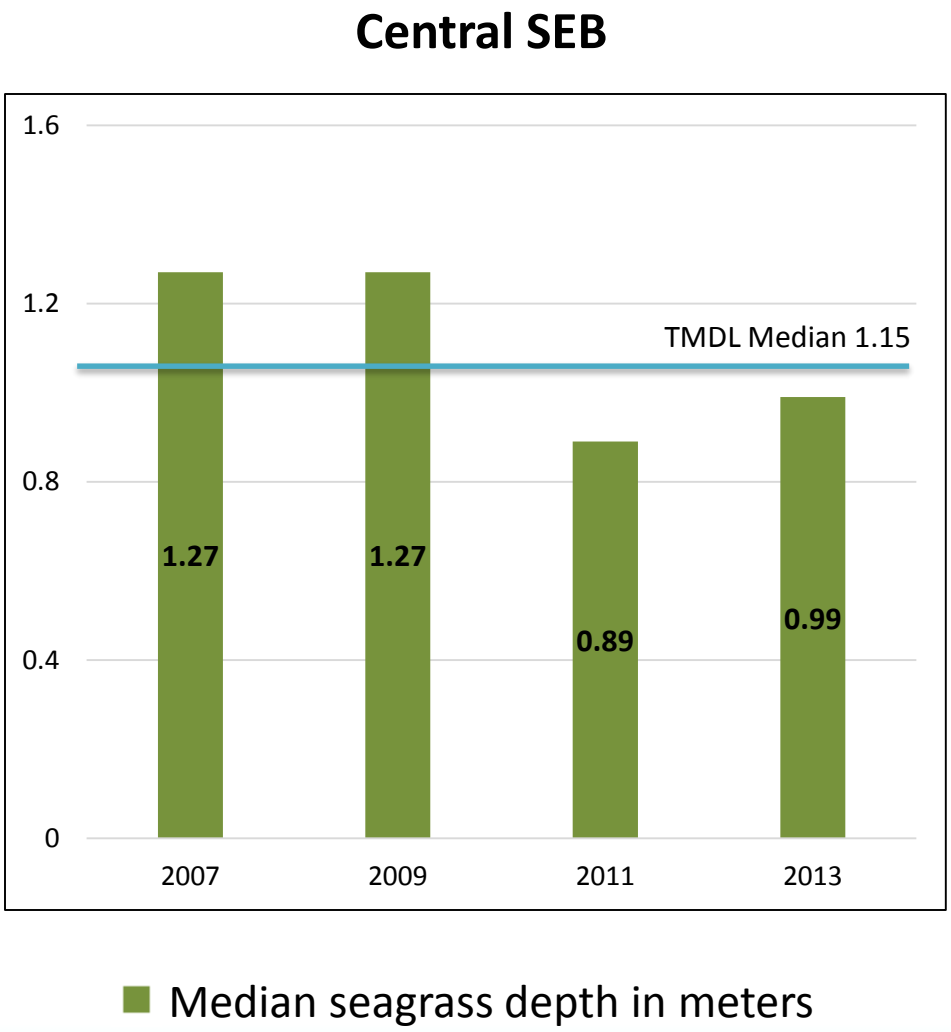


Central B



Median seagrass depth in meters

Step 2 Assessment – Central IRL SEB



Application of Seagrass Evaluation

- 2005-2011 seagrass evaluation - TN and TP reductions required for:
  - BRL B.
  - North A.
  - North B.

=Implementation will continue based on 2007-2013 seagrass..

- 2007-2013 seagrass evaluation - no longer Step 1 and Step 2 compliant:
  - BRL A.
  - CIRL A.
  - CIRL B.
  - CIRL SEB.

=Additional nutrient reductions are needed.

CIRL Reassessment

Methodology

- Apply the method used in the Banana River Lagoon BMAP:
  - Remove natural lands.
  - Focus on anthropogenic loading.

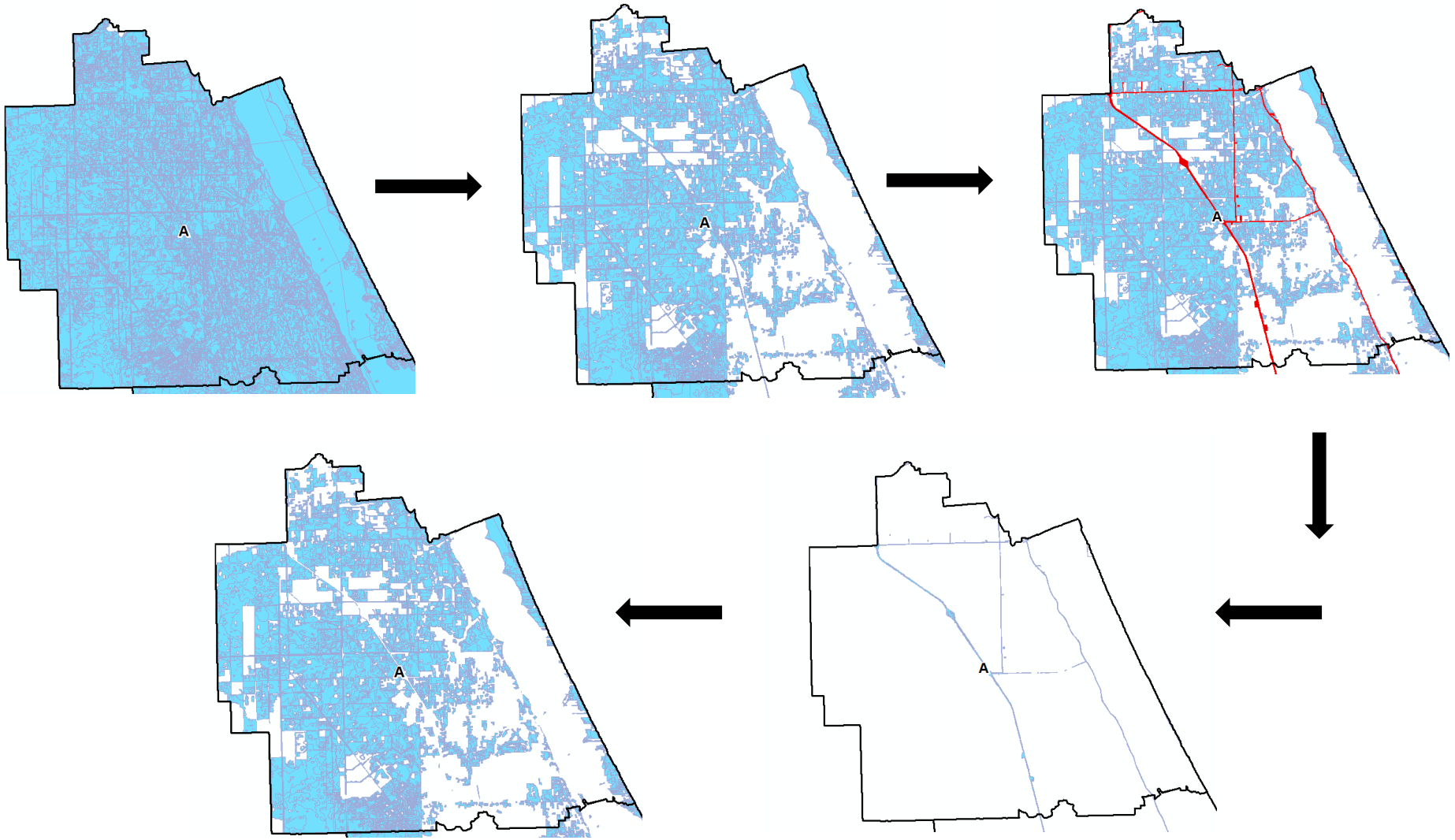
Methodology

- Geographic Information System (GIS) based process.
- Pollutant Loading Screening Model (PLSM) shapefile per sublagoon.
- PLSM shapefile contains:
  - the land use-soil acreage.
  - rainfall data.
  - runoff coefficients.
  - event mean concentration (EMC).

Methodology

- Baseline loads based on TMDL.
- Natural lands are removed - only anthropogenic loads are assigned reductions.
- Clipped from PLSM Model (in the following order):
  - Florida Department of Transportation (FDOT) roads and right-of-ways.
  - Agricultural land use areas.
  - Municipalities.
  - Water control districts.
  - Remaining area assigned to the counties.

Methodology



Entity Baseline Loads & De minimus

- Baseline load based on the land uses and associated loading from PLSM within each entity's jurisdiction.

- *De minimus* loads are those that are less than 1% of the total load cumulatively.

Target Loads per Project Zone

- Target loads per project zone was estimated by summing WBID TMDL targets within each project zone.

WBID	Segment	TN Load	TP Load
	Central A		
2963A	IR12 + IR13	304,223	47,518
	Central SEB		
5003D	IR14-15	380,491	64,076
	Central B		
500B +5003C	IR16-20+21	278,273	53,599

Per Acre Target Loads

- The per acre target load was estimated by dividing the anthropogenic target load by the total anthropogenic acres in each project zone.

Project Zone	Project Zone Acres	TN Target	Natural Lands TN Load	Adjusted TN Target	Adjusted TN per Acre Target	TP Target	Natural Lands TP Load	Adjusted TP Target	Adjusted TP per Acre Target
A	60,963	304,223	90,679	213,544	3.50	47,518	7,619	39,899	0.65
B	51,569	278,274	43,784	234,490	4.55	53,599	3,961	49,638	0.96
SEB	63,361	380,491	170,951	209,540	3.31	64,076	14,087	49,989	0.79

Future Discussions

- Draft nutrient reductions per entity.
- New model.
- Seagrass depth limit targets.
- Timeframe.

Questions on Seagrass Mapping

Yesenia Escribano
Yesenia.Escribano@dep.state.fl.us
850-245-8446