Development of Water Quality Targets and Performance Measures for the Northern Estuaries

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Background

How do we measure effects of CERP on Water Quality?

- **ICU evaluation(produced every 5 years to check assumptions)**
  - **No WQ Performance Measures that could be modeled**
  - **The NE Performance Measures were not in final form**
  - **Regional models are not available for NE**
  - **Significant developmental period for the models**
- **Interim Solution**
  - **Water flow is used as a surrogate for water quality impacts**
- **Can we improve upon this for IG/IT, or even the next ICU ?**

Developed Nutrient Based Performance Measures

- Focus on TN and TP
- No universal targets for all NE components
- Systems are different and have different WQ
- Used DBHYDRO to develop trend of nutrients based on existing data
- Used other models where possible i.e.
  - "2X2" :SFWMM
  - Isolate the effects of CERP on WQ

Proposed Methodology

Methodology

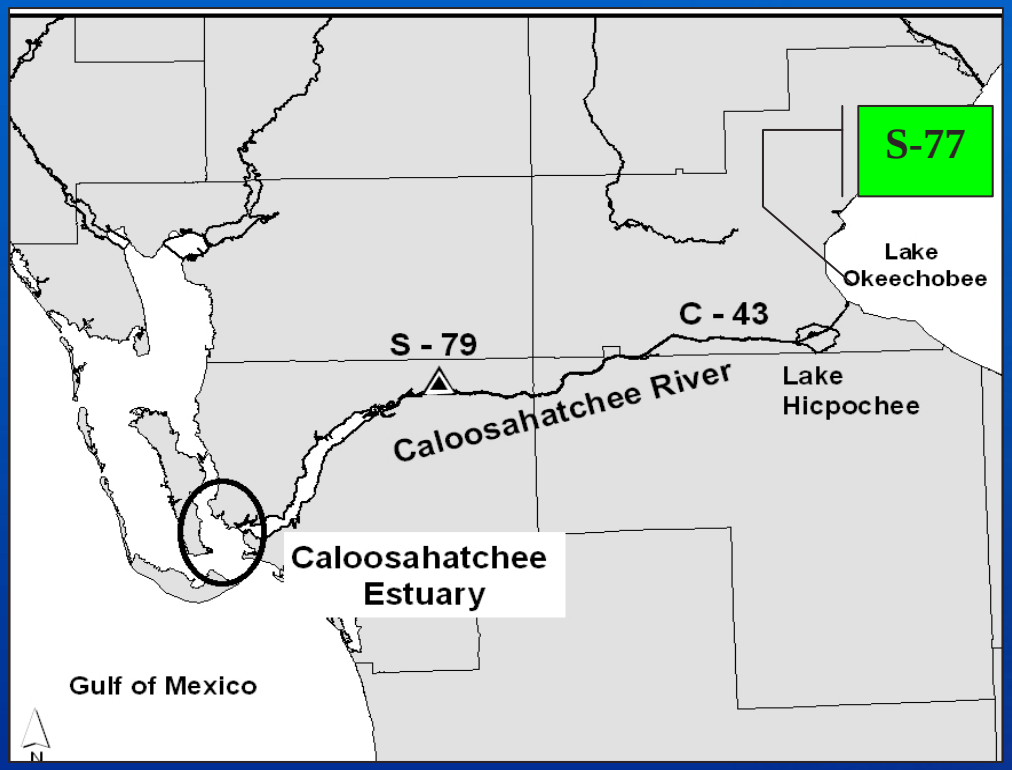
1. **Determine mean concentrations within the systems**
2. **Compare the data sets within the system**
3. **Couple results with 2X2 where possible**
4. **Quantify the direction of the change relative to a normalized scale**

1. Determine mean concentrations within the systems

- 5 Systems: Caloosahatchee, St. Lucie Estuary, Southern Indian River Lagoon, Loxahatchee and Lake Worth Lagoon
- Different background WQ in each system
- Different WQ parameters of concern, *i.e.*, TN or TP limited
- This may pose a problem for setting a single target across 5 different systems?
  - ➢Need individual targets for each estuary

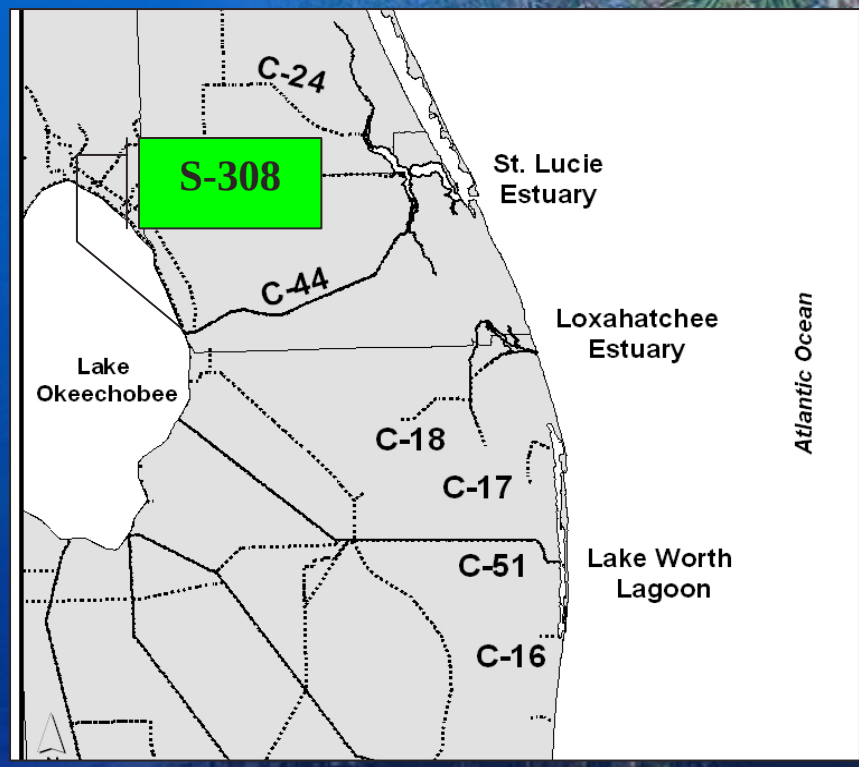
Northern Estuaries

West Coast



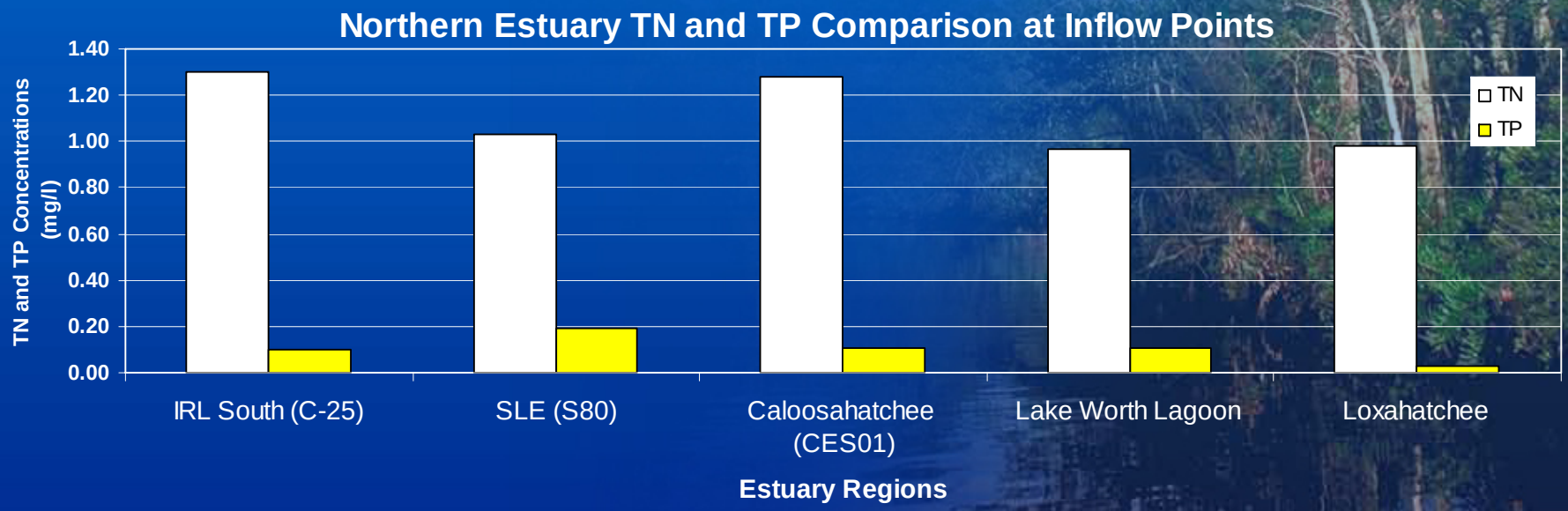
Caloosahatchee

East Coast



St. Lucie Estuary
Southern Indian River Lagoon
Loxahatchee
Lake Worth Lagoon

2. Compare the data sets within the system



2. Compare the data sets within the system

- Large difference in concentrations between the 5 Northern Estuaries systems
- Least impacted could be an interim target (Loxahatchee for TP, LWL for TN)
- Other possibility would be the median value for Florida Estuaries
- Load reduction from Lake Okeechobee (LO)

Table 7-5. Median nutrient values for all Florida estuaries and St. Lucie Estuary (1980-1998 combined FDEP and SFWMD data set). All units in ppb.

	All Florida Estuaries	St. Lucie Estuary
Total P	101	192*
Total N	630	927
Ammonia N	30	30
Nitrate/nitrite N	30	30
Color	73	52
Chlorophyll *a*	5	7.7

*Note: Median of annual median values presented to reduce bias from intensive sampling in some years.

Mean annual loads and flow-weighted mean concentrations to the St. Lucie Estuary (SLE) and Caloosahatchee River Estuary (CRE) over a 10 year period (1993-2003)

Basin	Structure	Discharge (acre-feet X 1000)	Total Phosphorus		Total Nitrogen	
			Load (metric tons)	FWMC (µg/L)	Load (metric tons)	FWMC (mg/L)
C-44 (SLE)	S-308C	400	83	169	881	1.78
	S-80	468	93	160	924	1.60
C-43 (CRE)	S-77	783	65	68	1,584	1.64
	S-78	1,025	123	97	1,794	1.42
	S-79	1,601	234	118	2,905	1.47

- Approximately 28% of the phosphorus load and 55% of the nitrogen load that are delivered to the CRE via the C-43 are contributed by Lake Okeechobee
- Greater than 90% of the load to the SLE via the C-44 is contributed by Lake Okeechobee
- Excerpted from RECOVER Presentation 2006 by SFWMD

3. Couple with 2x2 SFWMM Structure Trend Data

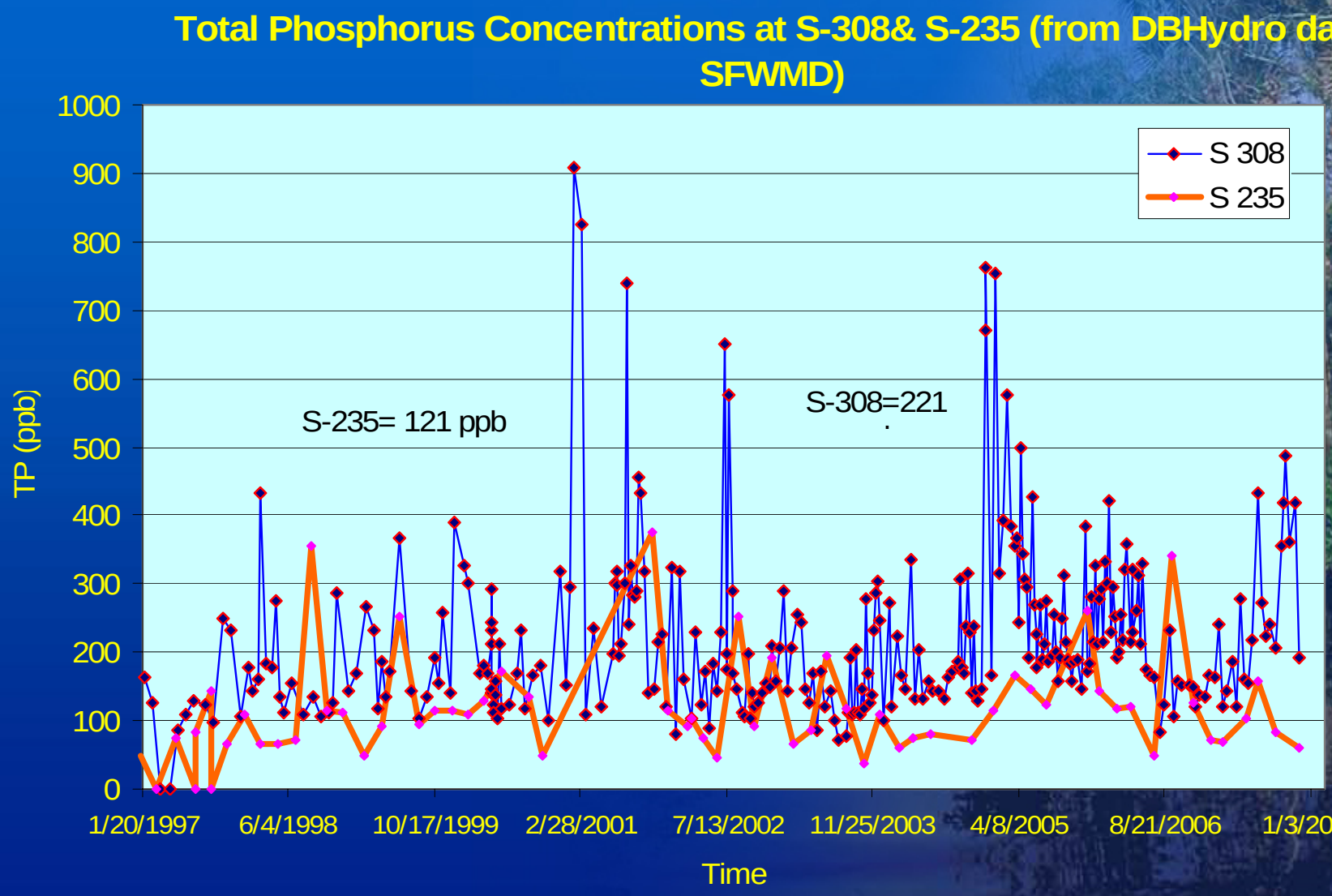
Model Output

- 2x2 Runs will provide LO releases to S-79
- Product of these would produce theoretical loads

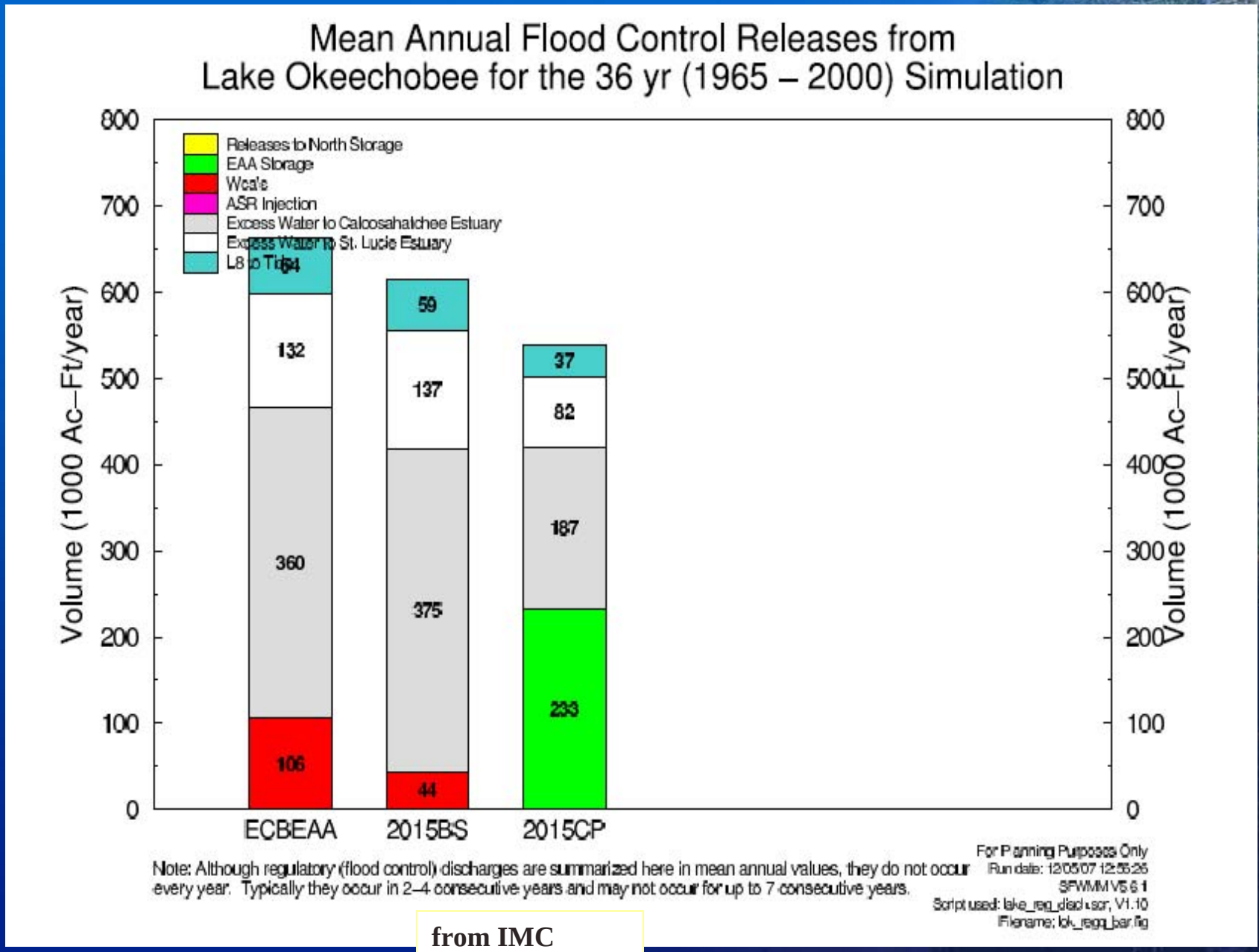
Establish Goals

- Goal = eliminate loads from LO
- Compare with reduction of load (flow & concentration) at S-79 structure
- Score load reductions of both TP and TN as a percent towards reaching the goal

Structure Concentrations to Estuaries



Lets See How This Works…

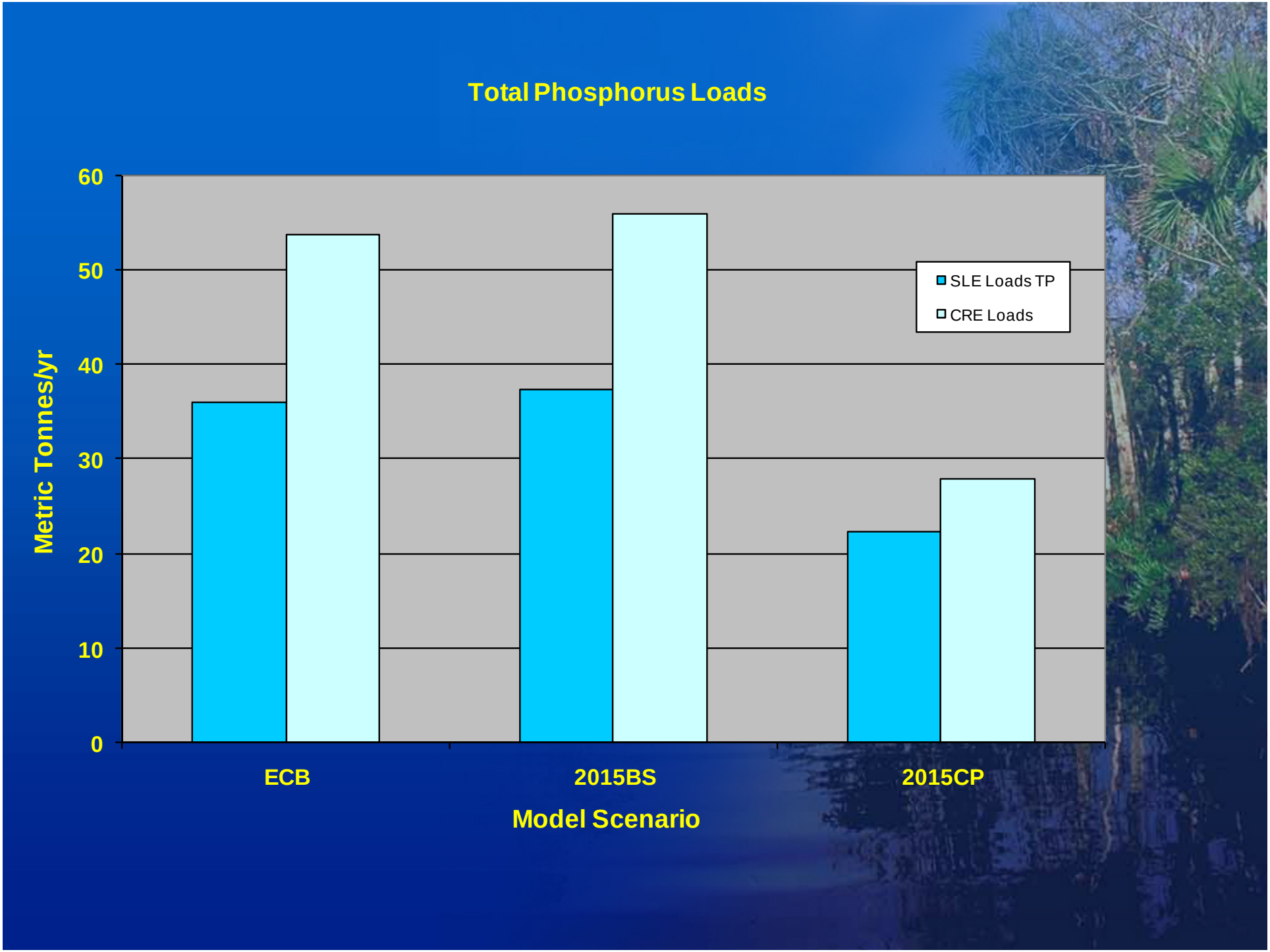


from IMC

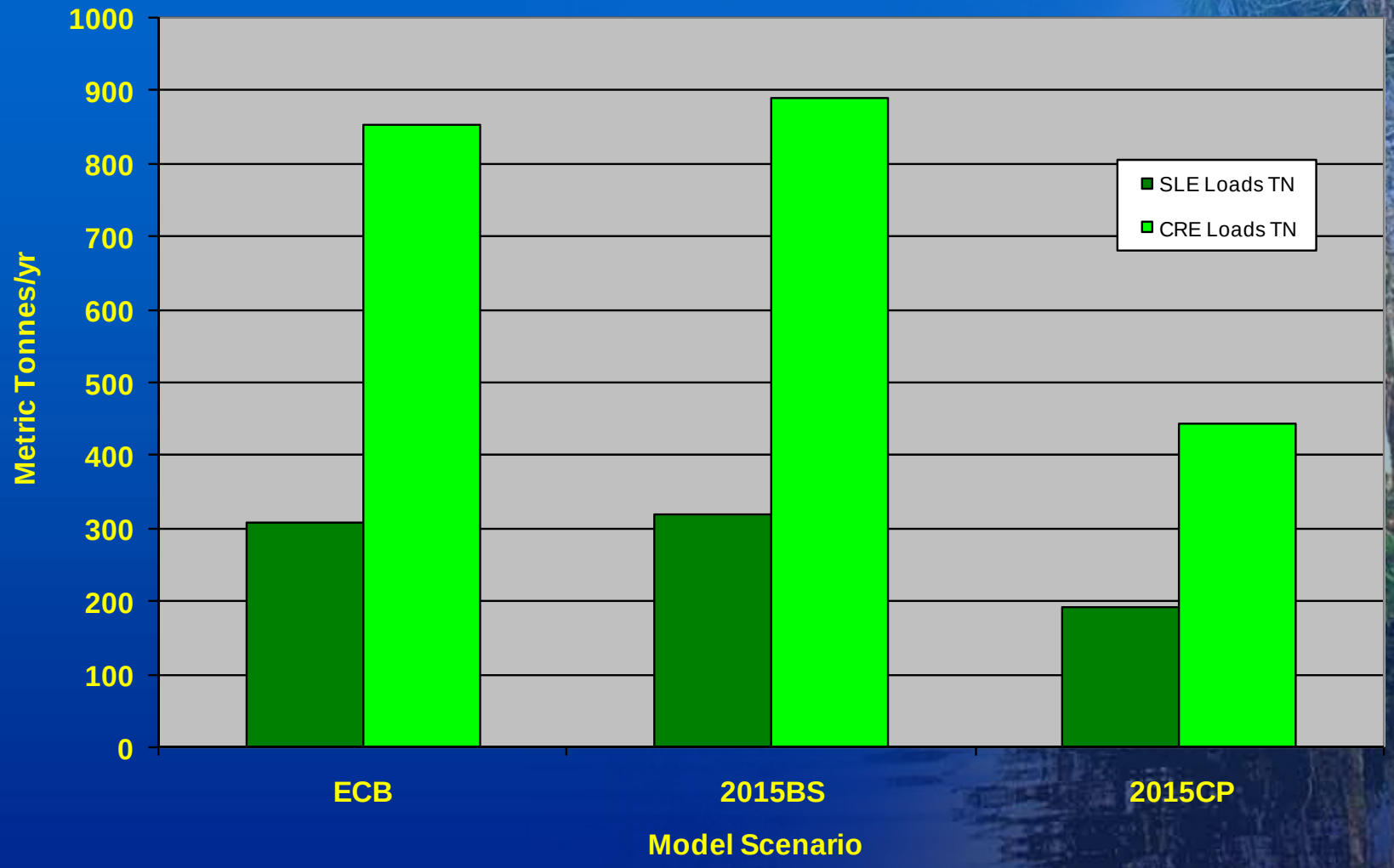
Loads from Lake Okeechobee to Caloosahatchee

	Flow (ac-ft/yr)	S-235/S-77 TP (ppb)	S-235/S-77 TN (ppb)	TP Load Metric tons	TN Load Metric tons
Existing Conditions Base (ECB)	360	121	1920	53.71	852.21
2015 Base (2015BS)	375	121	1920	55.94	887.72
CERP Band 1 (2015CP)	187	121	1920	35.96	442.68

Metric tons = 1000 ac-ft/yr X Conc. X 1. 233


Total Phosphorus Loads
Metric Tonnes/yr
60
50
40
30
20
10
0
SLE Loads TP
CRE Loads
ECB
2015BS
2015CP
Model Scenario

Total Nitrogen Loads



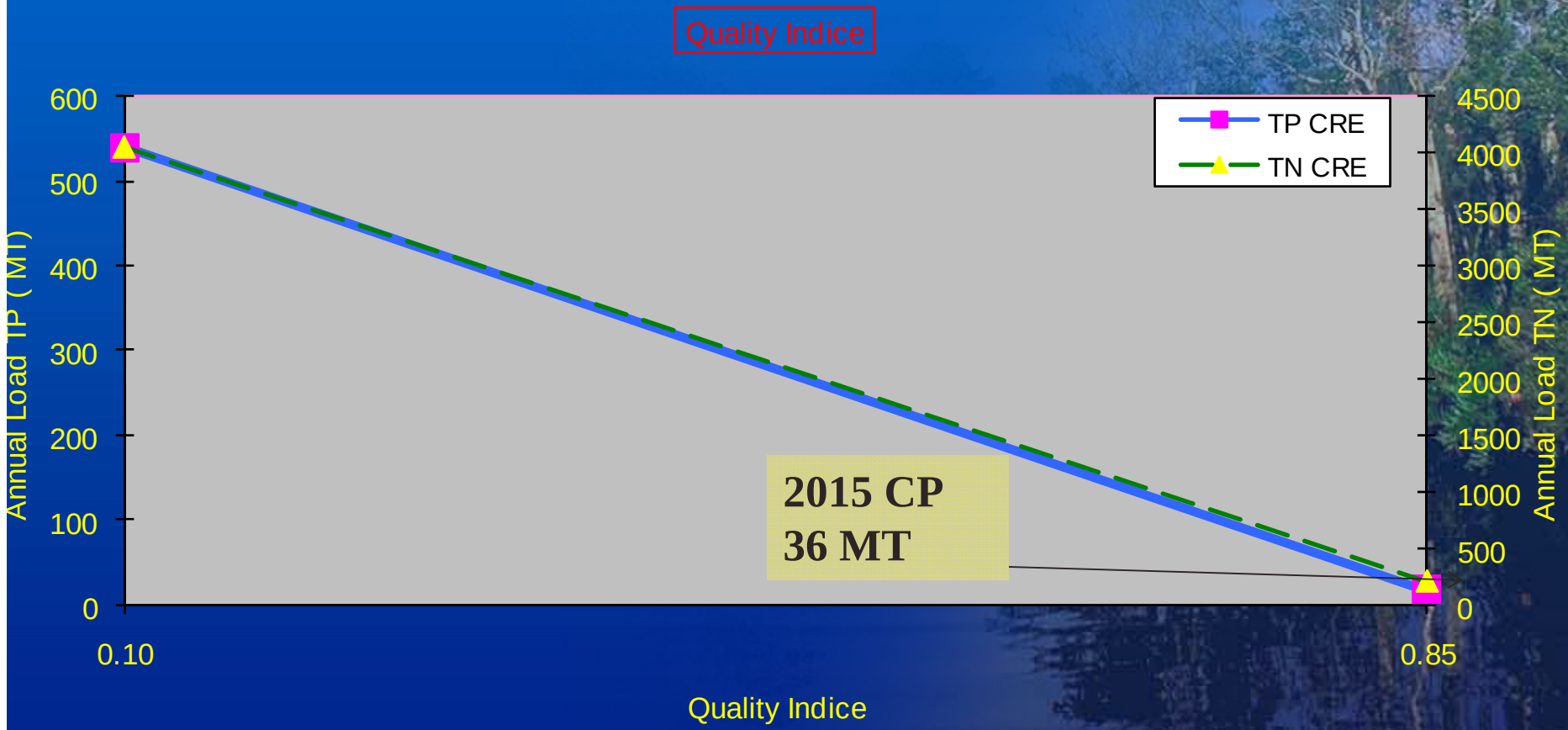
Developing a scale (from SSSR 2007 RECOVER)

Table 5A-4: Summary of Annual Freshwater Inflows, Nutrient Loads and Flow Weighted Mean Concentrations from S-79 to the CRE

Water Year[a]	Inflow Volume (m^3 X 10^6)	Nutrient Loads (metric tons)		Flow Weighted Mean	
		Phosphorus	Nitrogen	Total Phosphorus (µg/L)	Total Nitrogen (mg/L)
1991	120.9	17.5	208.8	145	1.73
1992	1126	197	1828	175	1.62
1993	1783	445	3064	250	1.72
1994	957.9	139	1968	145	2.05
1995	2815	264	4521	93.6	1.61
1996	3497	274	4097	78.3	1.17
1997	954.3	115	1384	120	1.45
1998	3077	262	4076	85.3	1.32
1999	1105	154	1665	139	1.51
2000	2020	335	3129	166	1.55
2001	593.2	97.1	850.1	164	1.43
2002	1153	245	1852	212	1.61
2003	2232	353	3798	158	1.70
2004	3039	316	4169	104	1.37
2005	2503	279	3303	111	1.32
2006	4331	540	6251	125	1.44
2007	856.2	156	1277	182	1.49

TP & TN Scaled

WQ Quality Indice for CRE



4. Quantify the direction of the change relative to a percent scale

Average Load from LO to CRE from 1991-2007

TP = 65 metric tons

TN = 1584 metric tons

Restoration Goal

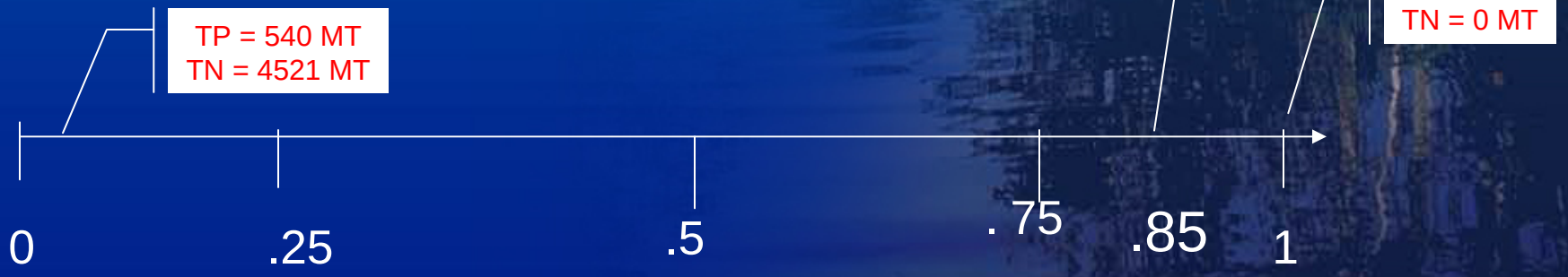
TP = 0 metric tons

TN = 0 metric tons

CERP Band 1

TP = 36 metric tons

TN = 442 metric tons



Conclusions

- This methodology serves as an interim tool for water quality
- Shows the impact of CERP projects on Lake Okeechobee and the Northern Estuaries
- Leverages existing models
- Is a predictive tool that we can employ for Adaptive Management