TAMPA BAY ESTUARY: MONITORING LONG-TERM RECOVERY THROUGH REGIONAL PARTNERSHIPS

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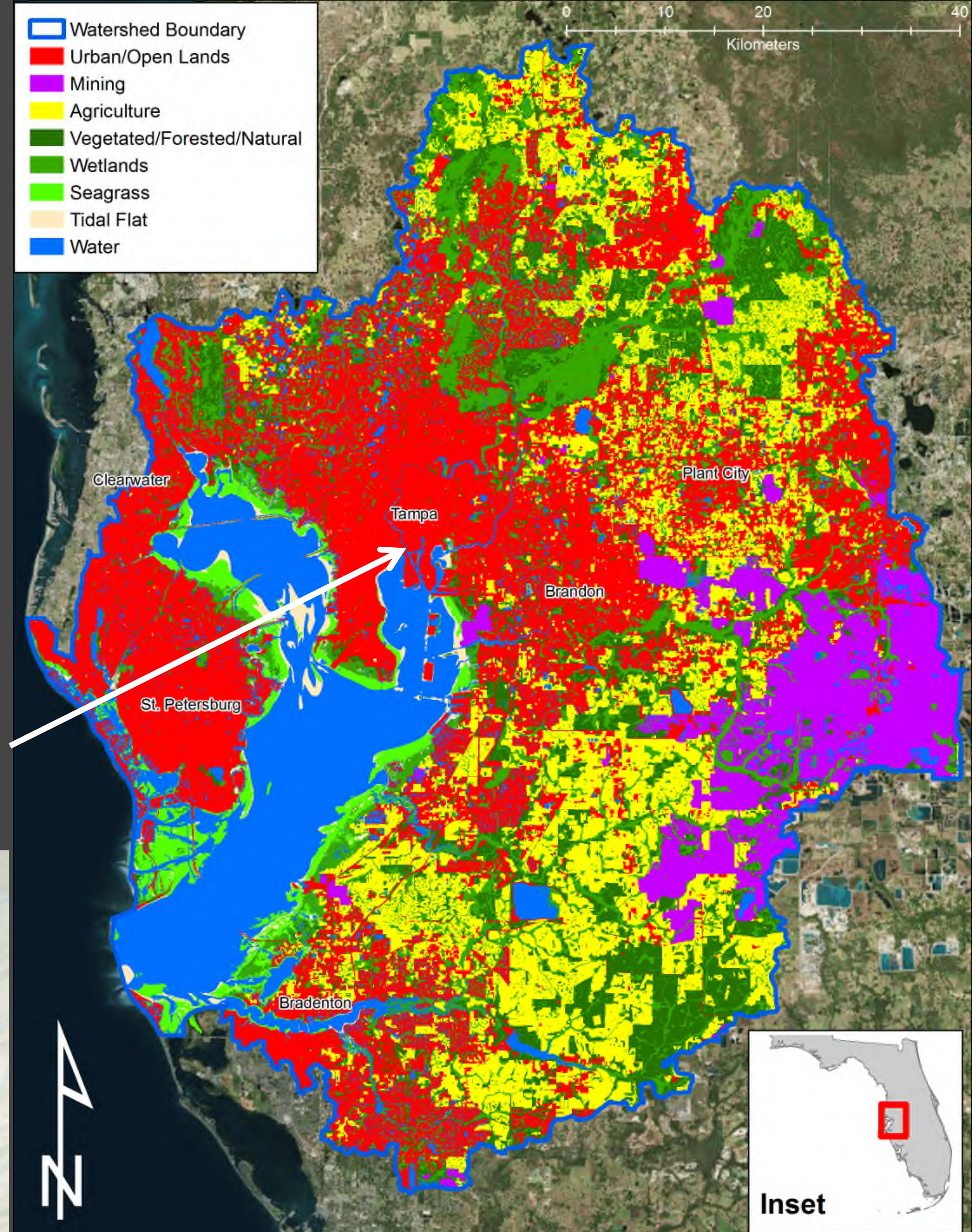
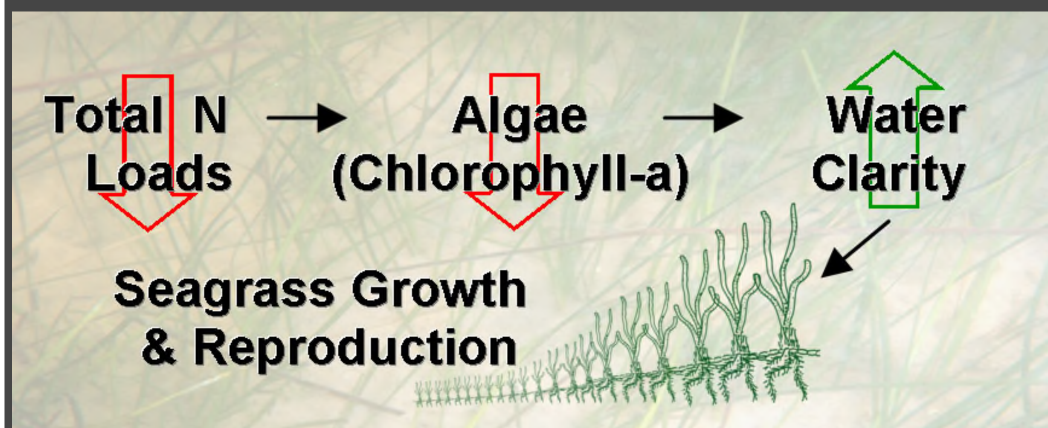


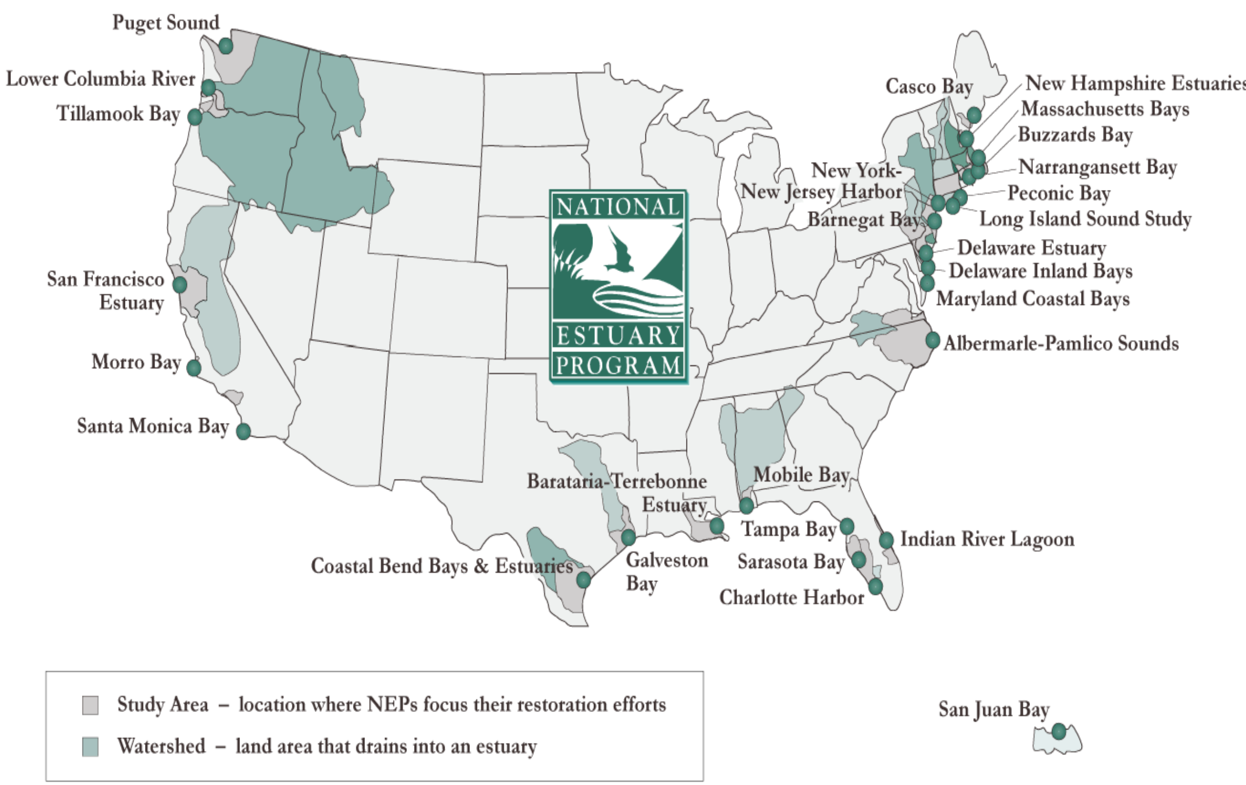


Ed Sherwood
Tampa Bay Estuary Program

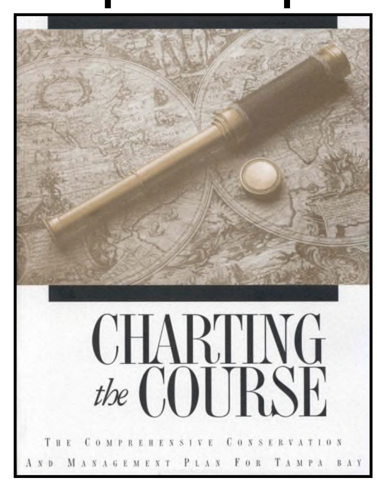
May 5, 2016: NWQMC

National Estuary Programs (NEP)

Local watershed programs making a difference



- Focus on the watershed or ecosystem
- Collaborative problem solving
- Integrate good science with sound decision making
- Public participation



TBEP Policy Board

Hillsborough County Florida

Pinellas County

Manatee County FLORIDA

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

CITY OF Clearwater

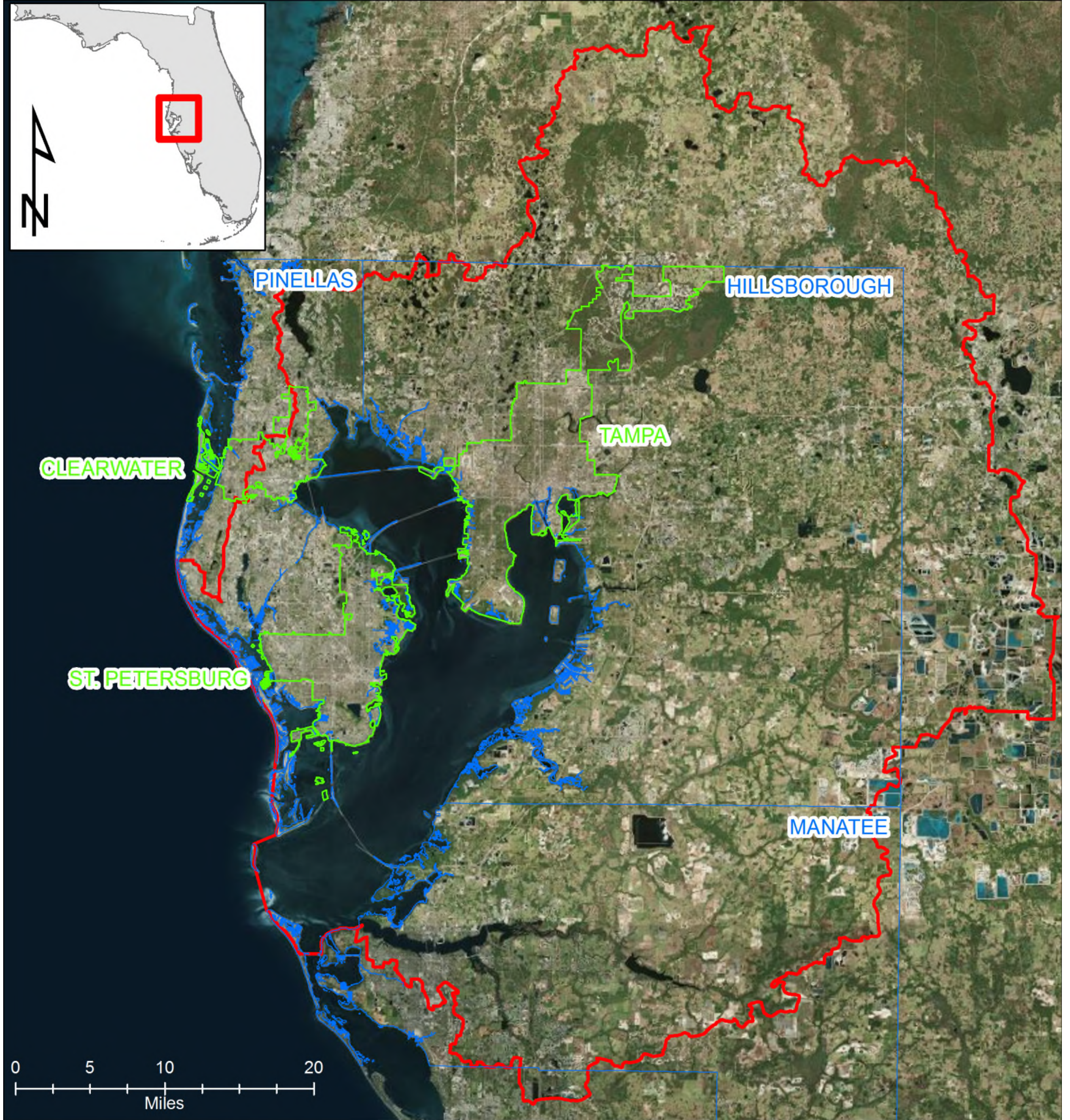
CITY OF TAMPA, FLORIDA ORGANIZED JULY 15, 1887 MASCOTTE

st.petersburg www.stpete.org

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TAMPA BAY Estuary Program



Overview

- Greening et al. 2014. Ecosystem responses to long-term nutrient management in an urban estuary: Tampa Bay, Florida. ECSS 151:A1-A16
  - http://dx.doi.org/10.1016/j.ecss.2014.10.003

Estuarine, Coastal and Shelf Science

Invited feature

Ecosystem responses to long-term nutrient management in an urban estuary: Tampa Bay, Florida, USA

H. Greening, A. Janicki, E.T. Sherwood, R. Pribble, J.O.R. Johansson

- Sherwood et al. 2015. Tampa Bay estuary: Monitoring long-term recovery through regional partnerships. Regional Studies in Marine Sciences 4:1-11.
  - http://dx.doi.org/10.1016/j.rsma.2015.05.005

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Regional Studies in Marine Science

Tampa Bay estuary: Monitoring long-term recovery through regional partnerships

Edward T. Sherwood, Holly S. Greening, Anthony J. Janicki, David J. Karlen

Tampa Bay in the 1970s - Early 1980s

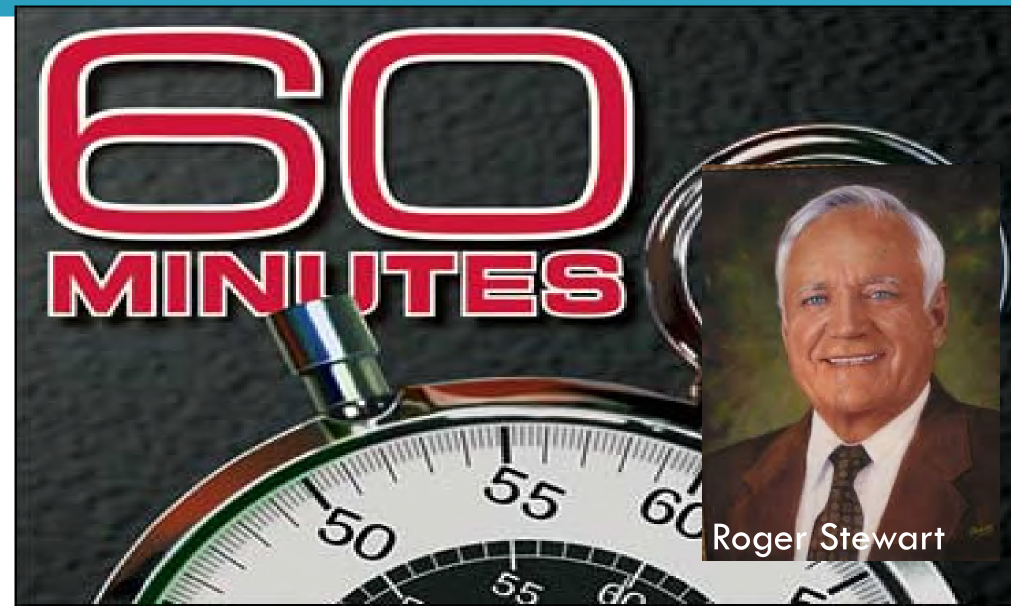
- Poorly-treated Domestic Point Sources, Untreated Industrial Point Sources & Stormwater, Rampant Dredge & Fill Activities
- Phytoplankton and macroalgae dominated
- 50% loss of seagrass coverage between 1950 and 1980
- Newspapers declared Tampa Bay “dead”





Citizens Demanded Action (1970s-1980s)

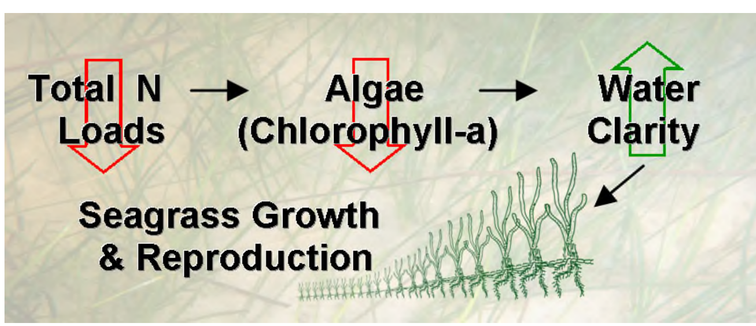
- Citizens in Tampa (w/ water views) demanded legislative action
- Led to Tampa Bay's first kick-start to recovery (Reduced DPS loads through FL Legislative Acts)
- Citizens desired a bay that resembled 1950s conditions, rather than the polluted condition of the 1980s

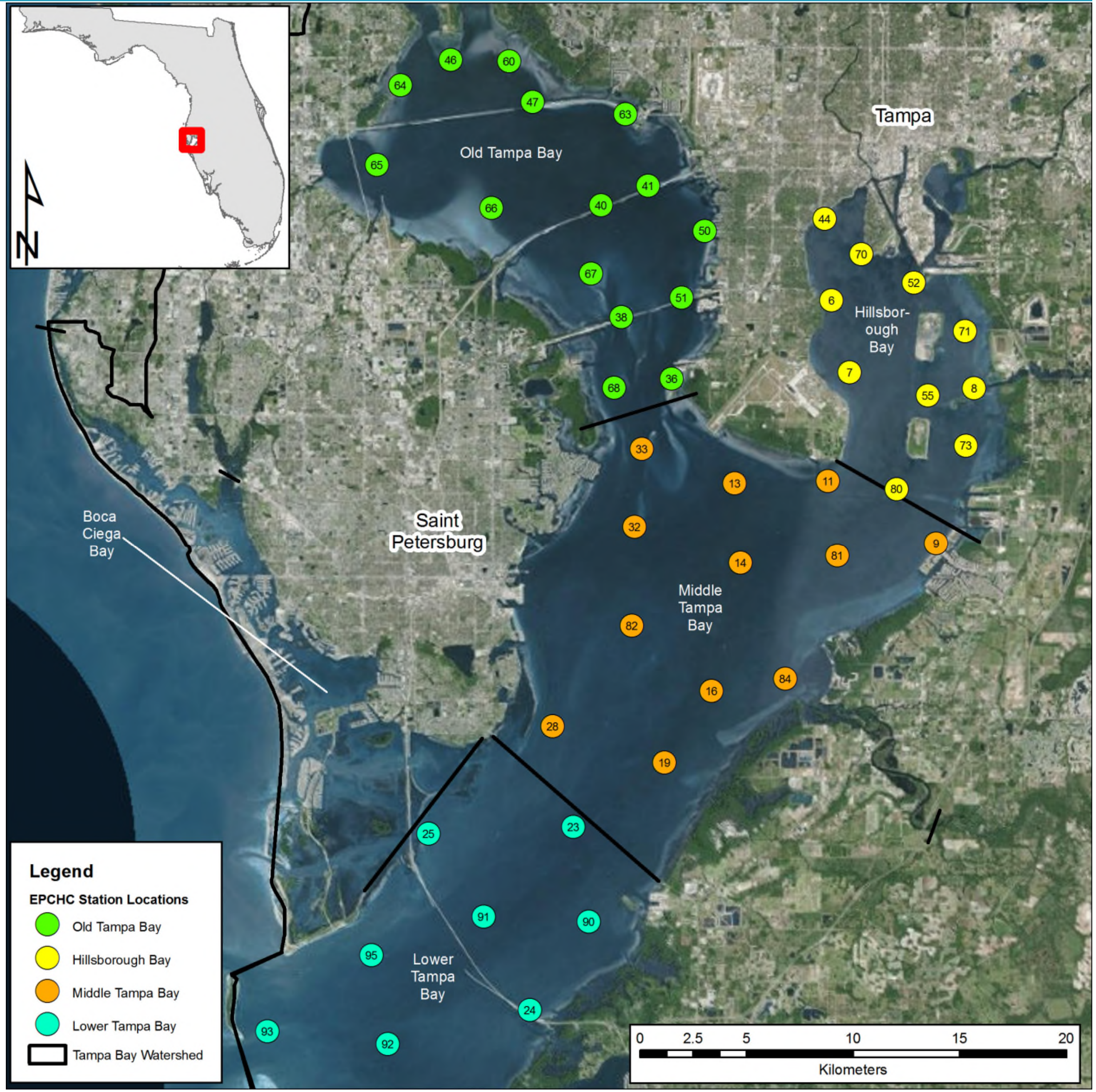


Early Monitoring Provides Foundation for WQ Target Development: Focus on Restoring Seagrass Coverage

- 1972: Hillsborough County establishes fixed station monitoring program throughout Tampa Bay

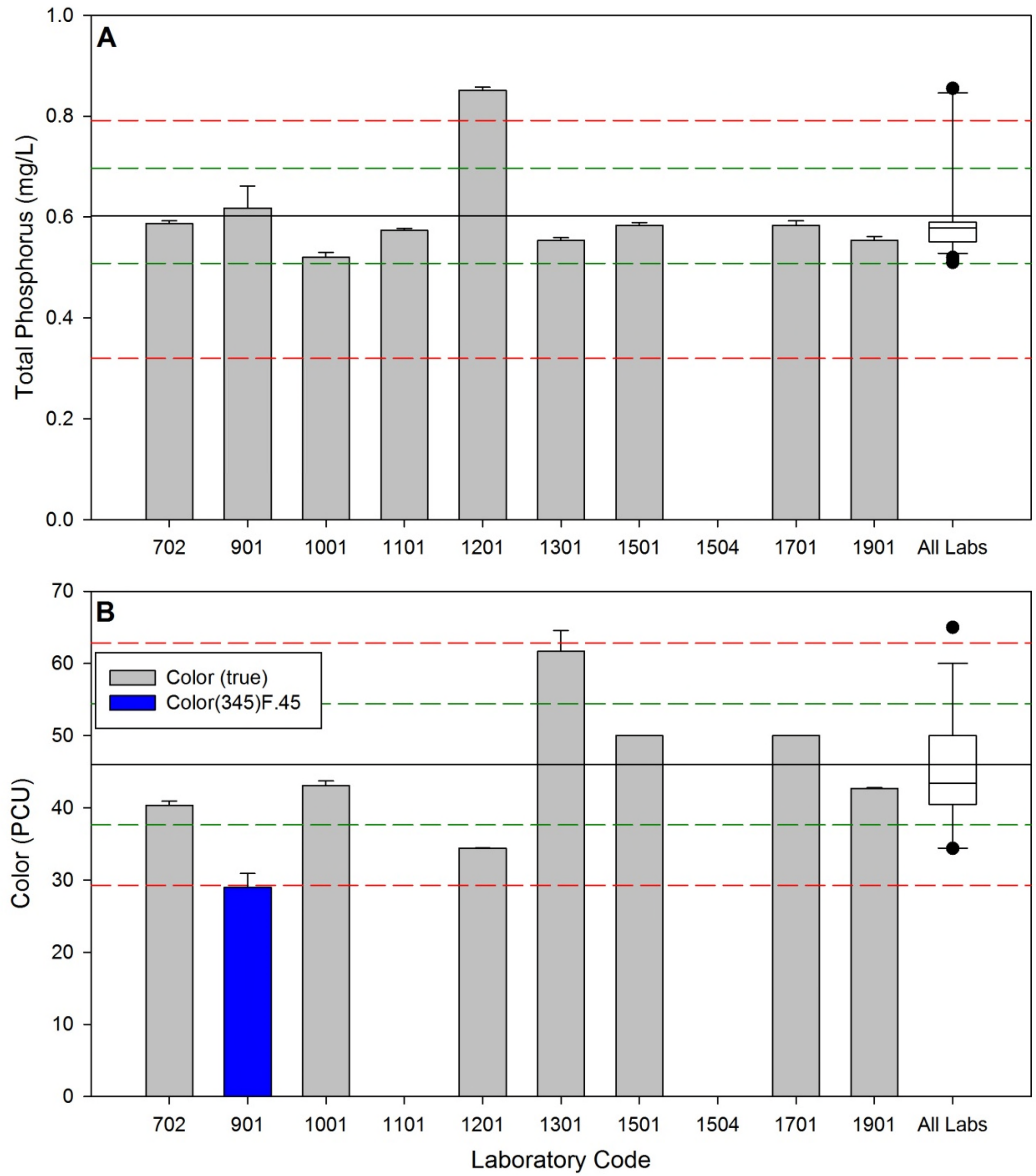
- Chlorophyll-a & Secchi Disk Depth Targets Defined for Each Bay Segment to Support Seagrass Restoration (mid-1990s)





Regional Monitoring Efforts Expanded

- 1990s: Other County programs established to fill-in spatial gaps (both fixed and stratified-random approaches employed)
- Regional Ambient Monitoring Program (RAMP) established to ensure data comparability among field & laboratory procedures
- To date, 79 quarterly round robins conducted http://www.tbeptech.org/committees/swfl-ramp



Adopted Water Quality Targets & Thresholds

	TBEP Management Targets Established ~2000 (Desired Conditions)		**Regulatory Threshold Adopted 2002 (Adverse Impacts Expected)**
Bay Segment	Chl-a Management Target (ug/L)	K_d (m^{-1}) Management Target	Chl-a Regulatory Threshold (ug/L)
Old Tampa Bay	8.5	0.83	9.3
Hillsborough Bay	13.2	1.58	15.0
Middle Tampa Bay	7.4	0.83	8.5
Lower Tampa Bay	4.6	0.63	5.1

Annual WQ Report Card

Assess Annual TN Load Reduction Effectiveness

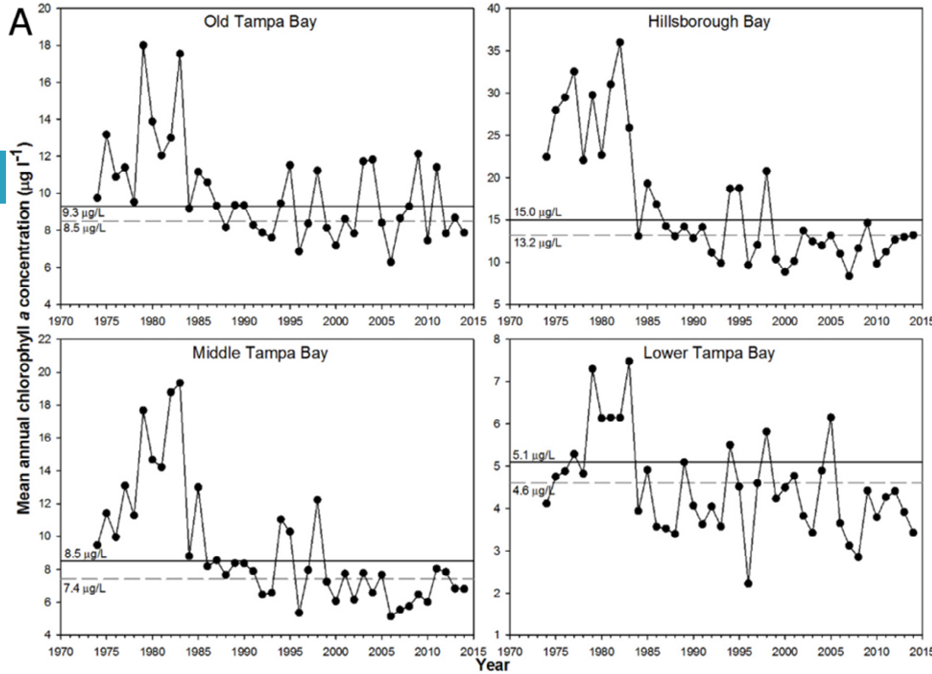
- "Hold the Line" on TN Loads: Preclude 17 tons/yr to offset for future growth in region (TBEP Tech Pub. #06-96)

Historical WQ Conditions

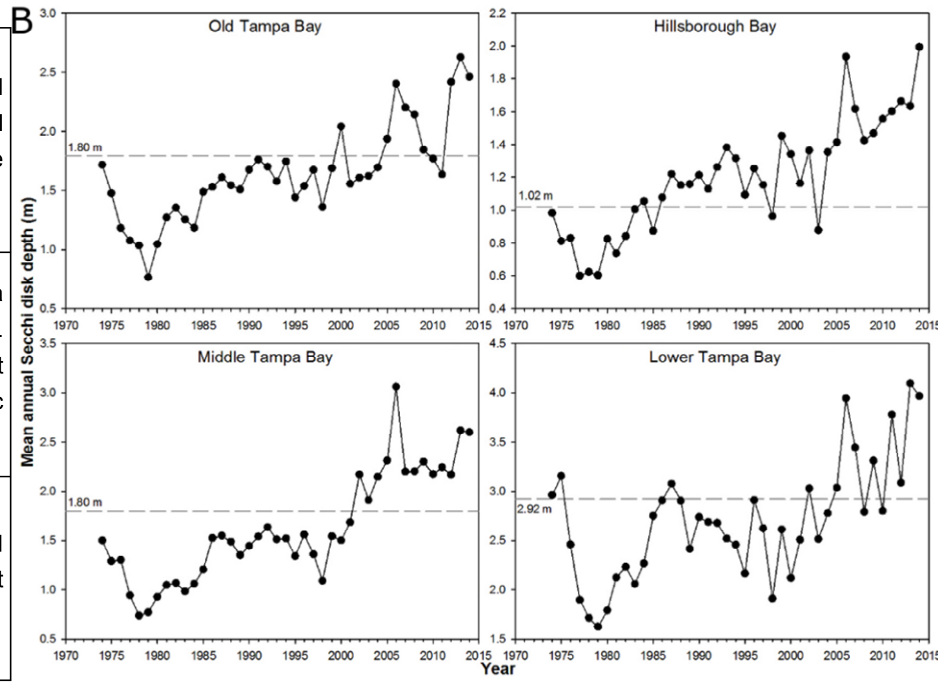
- Chl-a (A) and secchi disk depths (B) annually assessed relative to targets
- (C) Management Response Defined

Green	"Stay the Course." Continue planned projects. Report data via annual progress reports and Baywide Environmental Monitoring Report.
Yellow	"Caution Alert." Review monitoring data and nitrogen loading estimates. Begin/continue TAC and Management Board development of specific management recommendations.
Red	"On Alert." Finalize development and implement appropriate management actions to get back on track.

A



B



C

Year	Old Tampa Bay	Hillsborough Bay	Middle Tampa Bay	Lower Tampa Bay
1975	Red	Red	Red	Green
1976	Red	Red	Red	Yellow
1977	Red	Red	Red	Red
1978	Red	Red	Red	Yellow
1979	Red	Red	Red	Red
1980	Red	Red	Red	Red
1981	Red	Red	Red	Red
1982	Red	Red	Red	Red
1983	Red	Yellow	Red	Red
1984	Red	Green	Red	Yellow
1985	Red	Red	Red	Yellow
1986	Red	Yellow	Red	Green
1987	Red	Yellow	Red	Green
1988	Yellow	Green	Yellow	Green
1989	Red	Yellow	Red	Yellow
1990	Red	Green	Red	Yellow
1991	Green	Yellow	Yellow	Yellow
1992	Yellow	Green	Yellow	Yellow
1993	Yellow	Green	Yellow	Yellow
1994	Yellow	Yellow	Red	Red
1995	Red	Yellow	Red	Yellow
1996	Yellow	Green	Yellow	Green
1997	Yellow	Green	Red	Yellow
1998	Red	Red	Red	Red
1999	Yellow	Green	Yellow	Yellow
2000	Green	Green	Yellow	Yellow
2001	Yellow	Green	Yellow	Yellow
2002	Yellow	Green	Green	Green
2003	Red	Yellow	Green	Yellow
2004	Red	Green	Green	Yellow
2005	Green	Green	Yellow	Yellow
2006	Green	Green	Green	Green
2007	Green	Green	Green	Green
2008	Yellow	Green	Green	Yellow
2009	Yellow	Yellow	Green	Green
2010	Green	Green	Green	Green
2011	Red	Green	Yellow	Green
2012	Green	Green	Green	Green
2013	Green	Green	Green	Green
2014	Green	Green	Green	Green

Tampa Bay Nitrogen Management Consortium

- Formed in 1998, now includes 50+ public/private partners
- Members include TBEP government and regulatory agency participants, local phosphate companies, agricultural interests and electric utilities
- Mid-1990s, collectively accepted responsibility for meeting nitrogen load reduction goals; Proactively developed TN load allocations in 2009/10 that have been subsequently integrated into permit conditions
- Consortium members may choose to implement any combination of projects to maintain loads to Tampa Bay at 1992-1994 levels

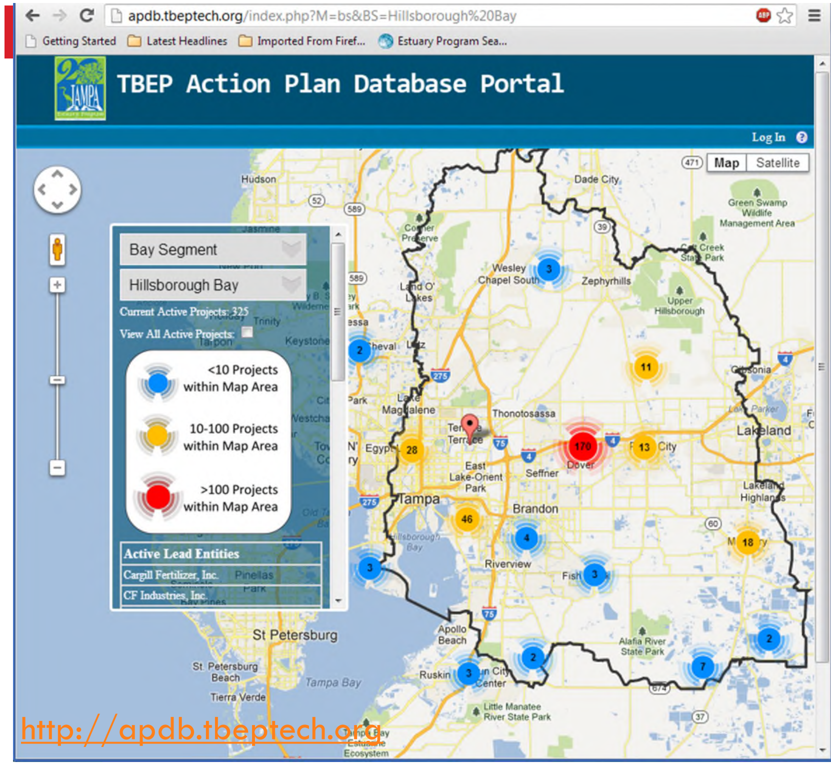
Public Partners:

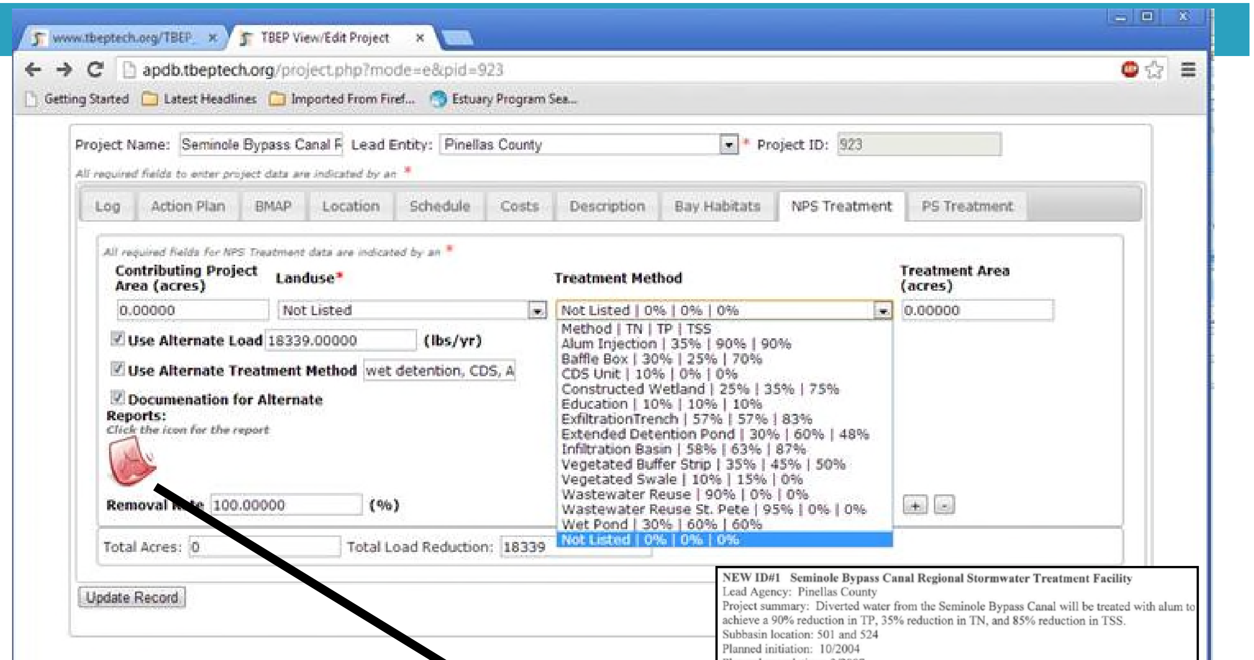
- Hillsborough County
- Manatee County
- Pinellas County
- Pasco County
- Polk County
- Sarasota County
- City of Tampa
- City of St. Petersburg
- City of Clearwater
- City of Palmetto
- City of Bradenton
- City of Largo
- City of Lakeland
- City of Oldsmar
- City of Gulfport
- City of Mulberry
- City of Plant City
- City of Safety Harbor
- SWFWMD
- US EPA
- FDEP
- FDACS
- FDOH
- FDOT
- MacDill AFB
- TBRPC
- Tampa Bay Water
- Tampa Port Authority
- EPC of Hillsborough County
- AEDC of Hills. County

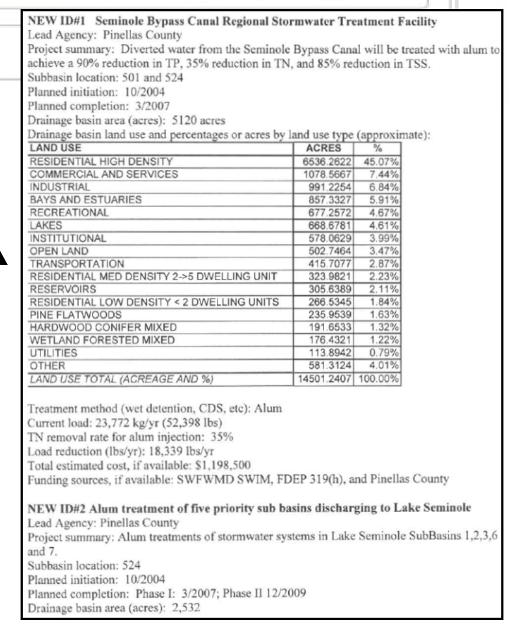
Private Partners:

- Eastern Terminals
- Mosaic
- CSX Transportation
- Florida Power & Light
- CF Industries
- Tampa Electric Co.
- Kinder Morgan Bulk T., Inc.
- Progress Energy
- Tropicana Products, Inc.
- Kerry I&F
- Trademark Nitrogen
- Yara N.A.
- Alafiia Preserve, LLC
- Eagle Ridge, LLC
- LDC Donaldson Knoll Investments, LLC

Partner-Driven Load Reduction Reporting







NEW ID#1 Seminole Bypass Canal Regional Stormwater Treatment Facility
Lead Agency: Pinellas County
Project summary: Diverted water from the Seminole Bypass Canal will be treated with alum to achieve a 90% reduction in TP, 35% reduction in TN, and 85% reduction in TSS.
Subbasin location: 501 and 524
Planned initiation: 10/2004
Planned completion: 3/2007
Drainage basin area (acres): 5120 acres
Drainage basin land use and percentages or acres by land use type (approximate):

LAND USE	ACRES	%
RESIDENTIAL HIGH DENSITY	6536.2622	45.07%
COMMERCIAL AND SERVICES	1078.5667	7.44%
INDUSTRIAL	991.2254	6.84%
BAYS AND ESTUARIES	857.3327	5.91%
RECREATIONAL	677.2572	4.67%
LAKES	668.6781	4.61%
INSTITUTIONAL	578.0629	3.99%
OPEN LAND	502.7464	3.47%
TRANSPORTATION	415.7077	2.87%
RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	323.9821	2.23%
RESERVOIRS	305.6389	2.11%
RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	266.5345	1.84%
PINE FLATWOODS	235.9539	1.63%
HARDWOOD CONIFER MIXED	191.6533	1.32%
WETLAND FORESTED MIXED	176.4321	1.22%
UTILITIES	113.8942	0.79%
OTHER	581.3124	4.01%
LAND USE TOTAL (ACREAGE AND %)	14501.2407	100.00%

Treatment method (wet detention, CDS, etc): Alum
Current load: 23,772 kg/yr (52,398 lbs)
TN removal rate for alum injection: 35%
Load reduction (lbs/yr): 18,339 lbs/yr
Total estimated cost, if available: $1,198,500
Funding sources, if available: SWFWMD SWIM, FDEP 319(h), and Pinellas County

NEW ID#2 Alum treatment of five priority sub basins discharging to Lake Seminole
Lead Agency: Pinellas County
Project summary: Alum treatments of stormwater systems in Lake Seminole SubBasins 1,2,3,6 and 7.
Subbasin location: 524
Planned initiation: 10/2004
Planned completion: Phase I: 3/2007; Phase II 12/2009
Drainage basin area (acres): 2,532

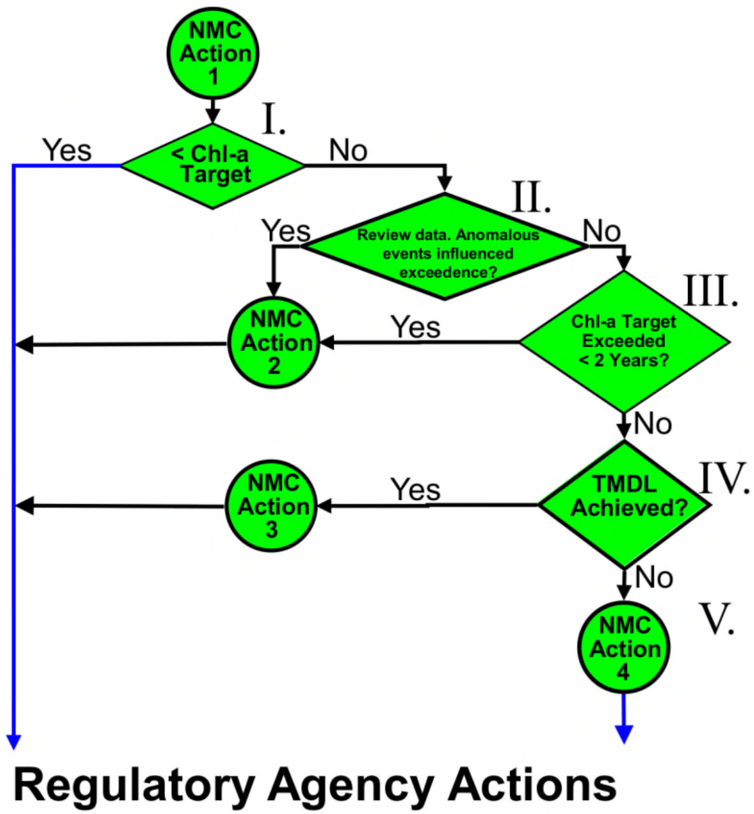
- Partners can enter either NPS or PS load reductions
- Default calculations and BMP efficiencies used based on land use, subbasin, and treatment method
- User-defined efficiencies & reductions can also be entered
- TBEP collates and reports to FDEP/EPA on a 5-yr basis by major bay segment
- **1992-2015: 450+ Projects, 537 Tons TN Precluded from TB, $0.6+ Bil**

- Guidelines for Calculating Nitrogen Load Reduction Credits. 1997. Technical Report #02-97 of the Tampa Bay National Estuary Program. Prepared by Coastal Environmental (H.W. Zarbock and A.J. Janicki).

Consequences for Not Meeting WQ Thresholds

- Annual chlorophyll-a concentrations drive entity allocation assessments

- If WQ is poor, nitrogen load responsibilities re-evaluated



NMC Action 1: Document annual bay segment specific chlorophyll-a levels relative to regulatory thresholds using the long-term EPCHC monitoring dataset.

NMC Action 2: A full report of the anomalous event(s) or data which influenced the annual bay segment chlorophyll-a exceedence will be delivered to regulatory agencies after TBNMC review.

NMC Action 3: Consider re-evaluation of the bay segment assimilative capacity based on nonattainment of bay segment chlorophyll-a threshold while meeting federally-recognized TMDL.

NMC Action 4: If federally-recognized TMDL not achieved, compile nitrogen load data for regulatory review and identify potential further actions needed to achieve reasonable assurance for bay segment nitrogen load allocations.

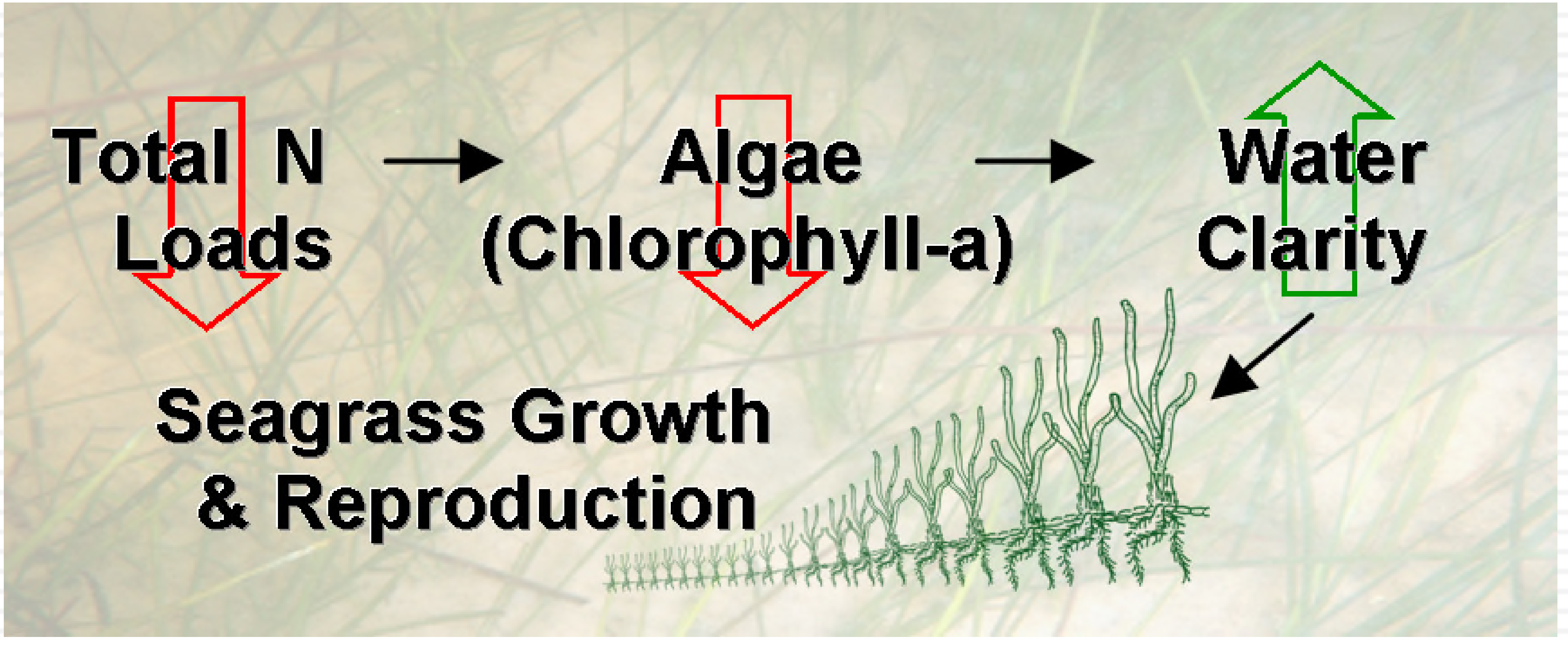
Assessment Step Linked to Roman Numerals of Figure Above	Result	Action
I. Determine annual bay segment specific chlorophyll-a regulatory threshold attainment.	Yes	NMC Action 1
	No	NMC Action 1
II. Review data and determine if an anomalous event(s) influenced non-attainment of the bay segment specific chlorophyll-a threshold.	Yes	NMC Action 2
	No	Go to III.
III. Determine if the chlorophyll-a thresholds have been exceeded for <2 consecutive years.	Yes	NMC Action 2
	No	Go to IV.
IV. Determine if the bay segment specific federally-recognized TMDL has been achieved.	Yes	NMC Action 3
	No	Go to V.
V. For a given year or for multiple years, compile and report entity-specific combined source loads in comparison to source allocations.	Compile & Report	NMC Action 4

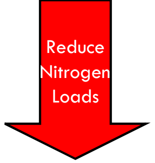
Example Compliance Assessment Steps

Bay Segment Reasonable Assurance Assessment Steps	EXAMPLE DATA USED TO ASSESS INTERIM REASONABLE ASSURANCE					Comment
	Year 1	Year 2	Year 3	Year 4	Year 5	
NMC Action 1: **Determine if observed chlorophyll-*a* exceeds hypothetical regulatory threshold of 10.0 µg/L**	12.0 µg/L (Yes)	14.0 µg/L (Yes)				Chlorophyll-a exceedences occurred during first 2 years of assessment period necessitating further NMC actions
NMC Action 2: **Determine if any observed chlorophyll-a exceedences occurred for 2 consecutive years**	No	Yes				Year 2 triggers additional NMC Action 3
NMC Action 3: **Determine if observed hydrologically-normalized total load exceeds hypothetical federally-recognized total maximum daily load (TMDL) of 1000 tons/year**	900 tons/yr (No)	1100 tons/yr (Yes)				Year 2 exceeds the TMDL after accounting for hydrology, NMC performs NMC Actions 4-5
NMC Actions 4-5: **Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period**						At end of 5-year period, facility/source-specific exceedences listed in this column ↓

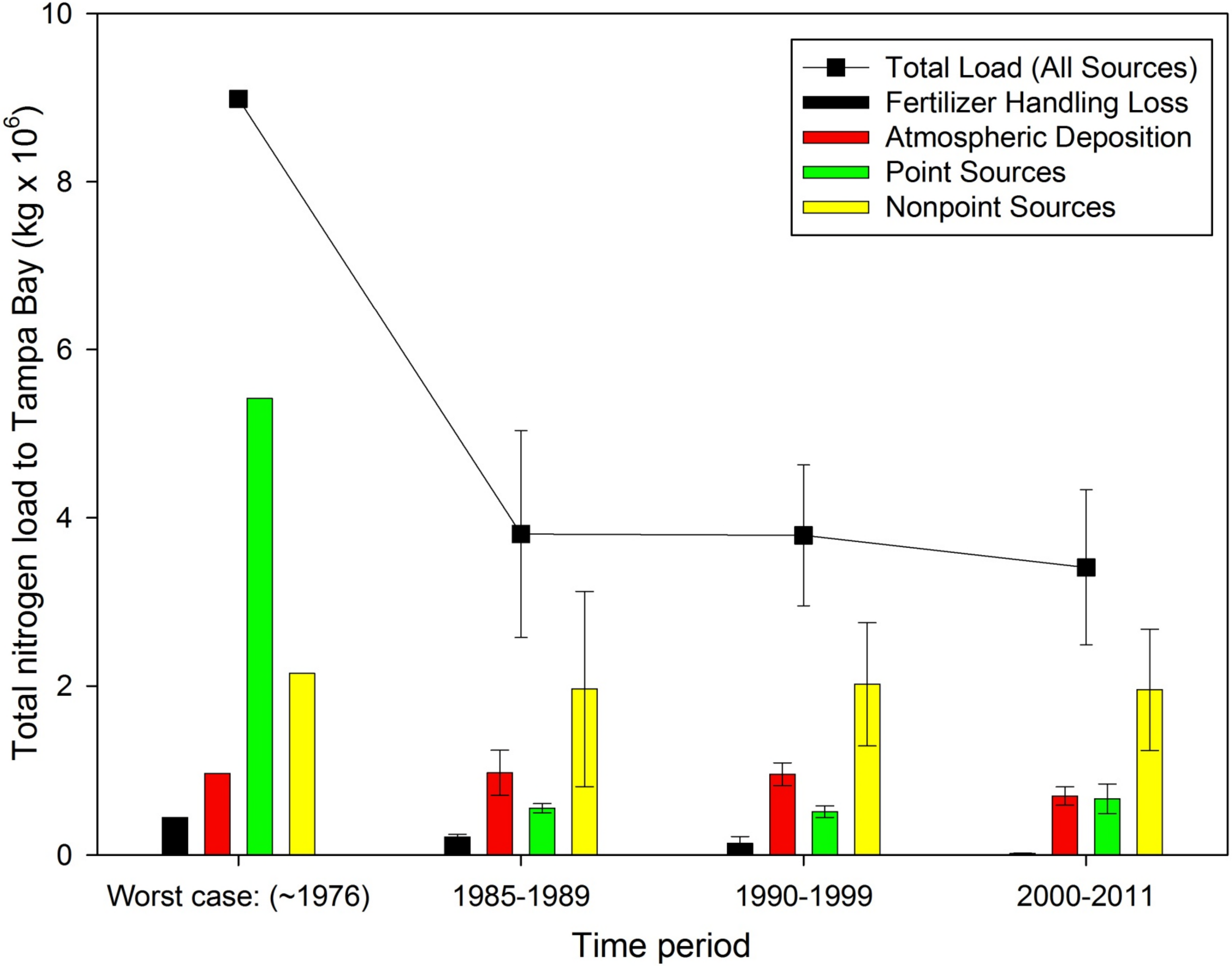
ENTITY	SOURCE	Allocation	EXAMPLE DATA USED TO ASSESS INTERIM REASONABLE ASSURANCE					
			Year 1	Year 2	Year 3	Year 4	Year 5	5-Yr Average
Entity A	Set Allocation – Domestic PS A	300 tons	290 tons	380 tons				
	NPS % Contribution (normalized tons)	30.0%	29.0%	38.0%				
Entity B	Set Allocation – Domestic PS B	200 tons	180 tons	190 tons				
	NPS % Contribution (normalized tons)	50.0%	48.0%	49.0%				
Entity C	Set Allocation – Industrial PS C	50 tons	45 tons	48 tons				
	NPS % Contribution (normalized tons)	20.0%	23.0%	13.0%				

So what, has it really worked?

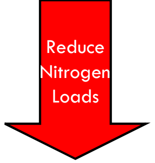


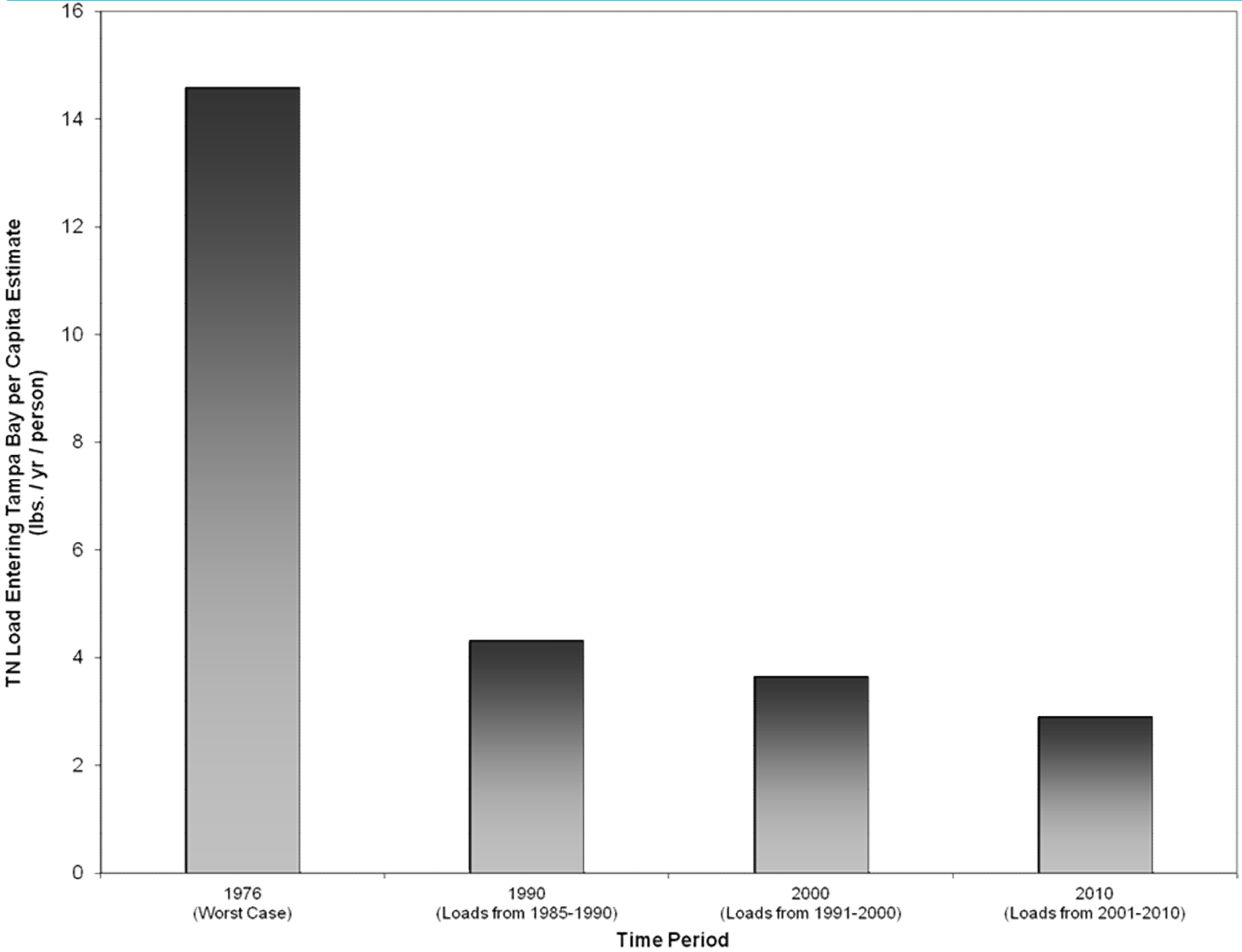


Reduced TN Loads to Tampa Bay



Per Capita TN Load Reduced by 80%

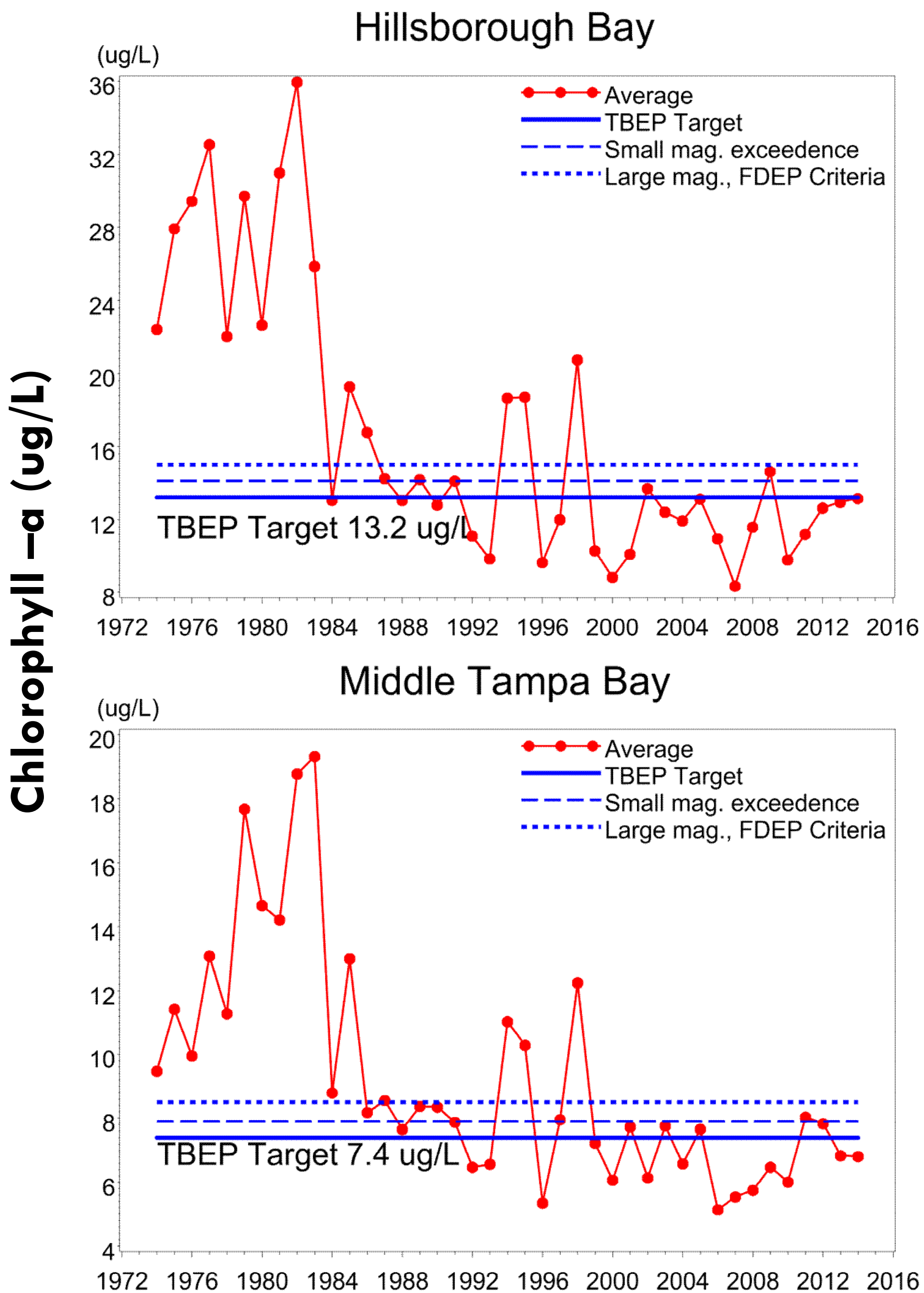




Reduce Chlorophyll

Water Quality Has Improved

Increase Water Clarity



AWT & Reuse Standards Implemented

Stormwater Regulations Enacted

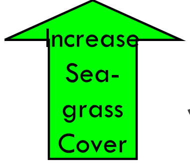
TBEP Partner & NMC Actions Implemented

Power Plant Upgrades

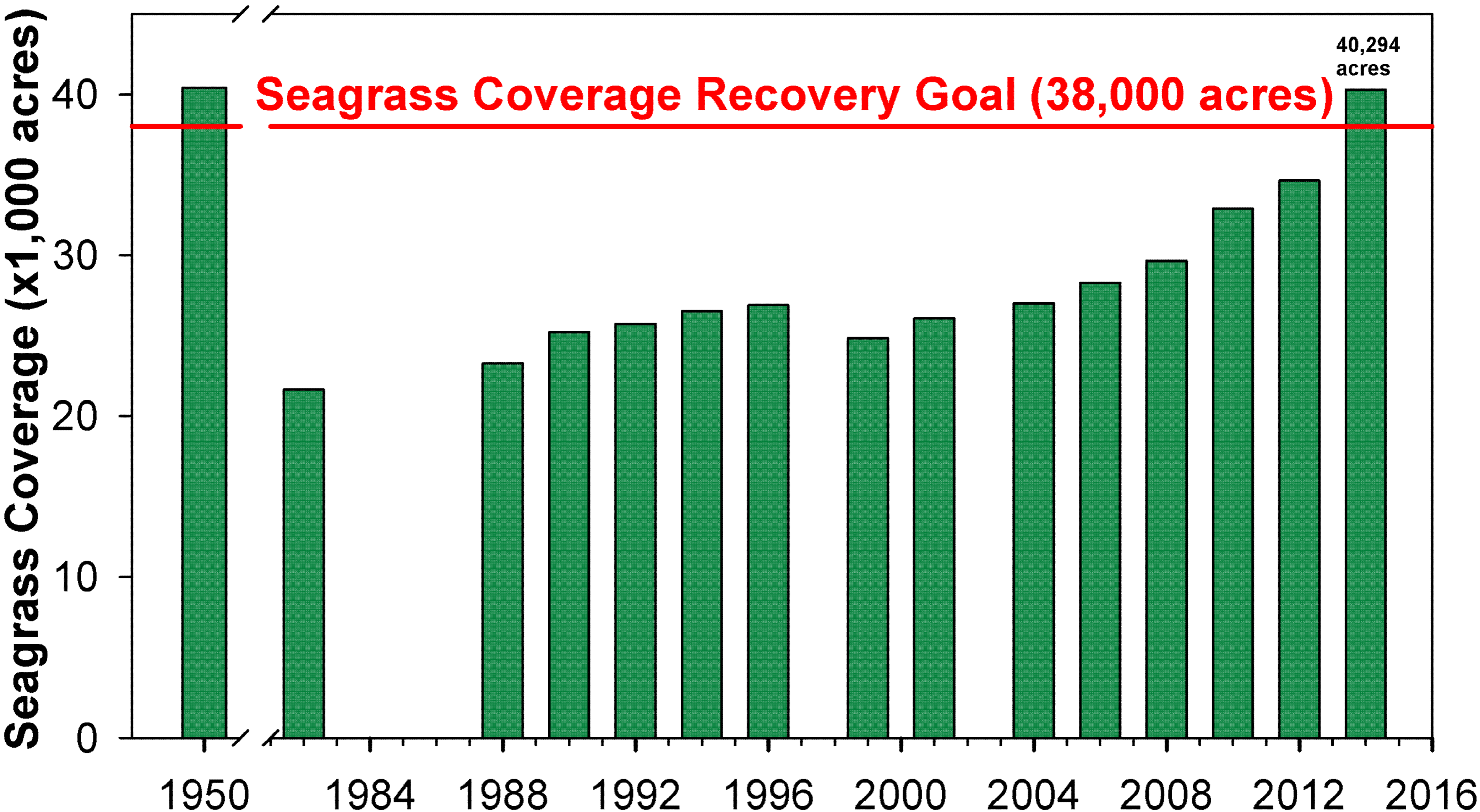
Port Facility Upgrades

Fertilizer Restrictions

Year	Old Tampa Bay	Hillsborough Bay	Middle Tampa Bay	Lower Tampa Bay
1975	Red	Red	Red	Green
1976	Red	Red	Red	Yellow
1977	Red	Red	Red	Red
1978	Red	Red	Red	Yellow
1979	Red	Red	Red	Red
1980	Red	Red	Red	Red
1981	Red	Red	Red	Red
1982	Red	Red	Red	Red
1983	Red	Yellow	Red	Red
1984	Red	Green	Red	Yellow
1985	Red	Red	Red	Yellow
1986	Red	Yellow	Red	Green
1987	Red	Yellow	Red	Green
1988	Yellow	Green	Yellow	Green
1989	Red	Yellow	Red	Yellow
1990	Red	Green	Red	Yellow
1991	Green	Yellow	Yellow	Yellow
1992	Yellow	Green	Yellow	Yellow
1993	Yellow	Green	Yellow	Yellow
1994	Yellow	Yellow	Red	Red
1995	Red	Yellow	Red	Yellow
1996	Yellow	Green	Yellow	Green
1997	Yellow	Green	Red	Yellow
1998	Red	Red	Red	Red
1999	Yellow	Green	Yellow	Yellow
2000	Green	Green	Yellow	Yellow
2001	Yellow	Green	Yellow	Yellow
2002	Yellow	Green	Green	Green
2003	Red	Yellow	Green	Yellow
2004	Red	Green	Green	Yellow
2005	Green	Green	Yellow	Yellow
2006	Green	Green	Green	Green
2007	Green	Green	Green	Green
2008	Yellow	Green	Green	Yellow
2009	Yellow	Yellow	Green	Green
2010	Green	Green	Green	Green
2011	Red	Green	Yellow	Green
2012	Green	Green	Green	Green
2013	Green	Green	Green	Green
2014	Green	Green	Green	Green
2015	Yellow	Green	Yellow	Green

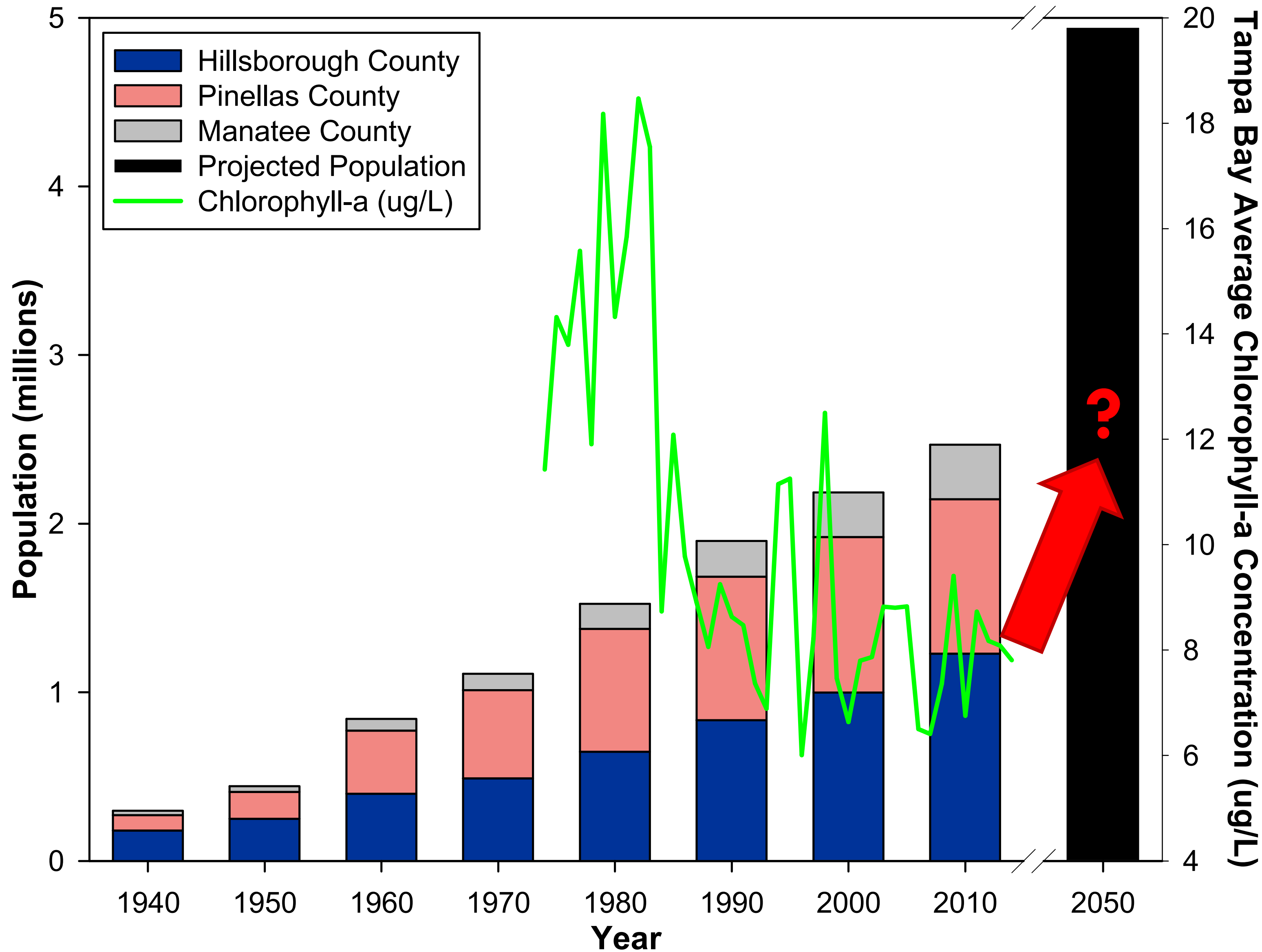


Seagrass Coverage Now Exceeds Recovery Goal



Sustaining Success: Adaptively Managing TB

- Can recovery be maintained w/ increasing population?
- Expected to double by 2050
- New Actions / Offsets will be Needed



Key Elements in Tampa Bay's Recovery

- Target resources identified by both public and scientists as "worthwhile" indicators (seagrass)
- Long-term monitoring
- Science-based numeric goals & targets
- Multiple tools: Regulation; Public/private collaborative actions; Citizen actions
- Recognized "honest broker" to track, facilitate, assess progress
- Ongoing assessment & adjustment through active regional monitoring partnerships
- Recently, estuarine health linked to *Regional Economic Value/Output & Climate Change* Benefits

New Management Actions That Will Make a Future Difference for Water Quality

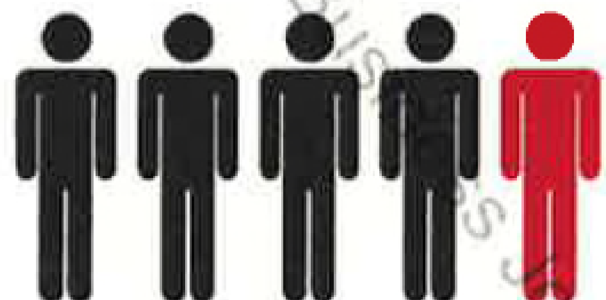
- Reduce Residential Fertilizer Contributions to Stormwater Runoff
- Continue to Reduce Wastewater & Stormwater Inputs Through Expansion of Reuse / Aquifer Storage Recovery & Recharge Projects
- Develop & Fund Localized Research & Management Actions for Problematic Areas (e.g. Old Tampa Bay) – Integrated Model Completed in 2015
- Improve and Restore Other Coastal Habitats

COVER STORY

CLEAN WATER MEANS MORE THAN YOU THINK

Despite massive growth, water quality in Tampa Bay has improved dramatically in 20 years

LATEST ISSUE
July 2015



HEALTHY BAY

1 out of every 5 jobs in the TBEP Watershed depend on a healthy bay.

$22B

within all six counties

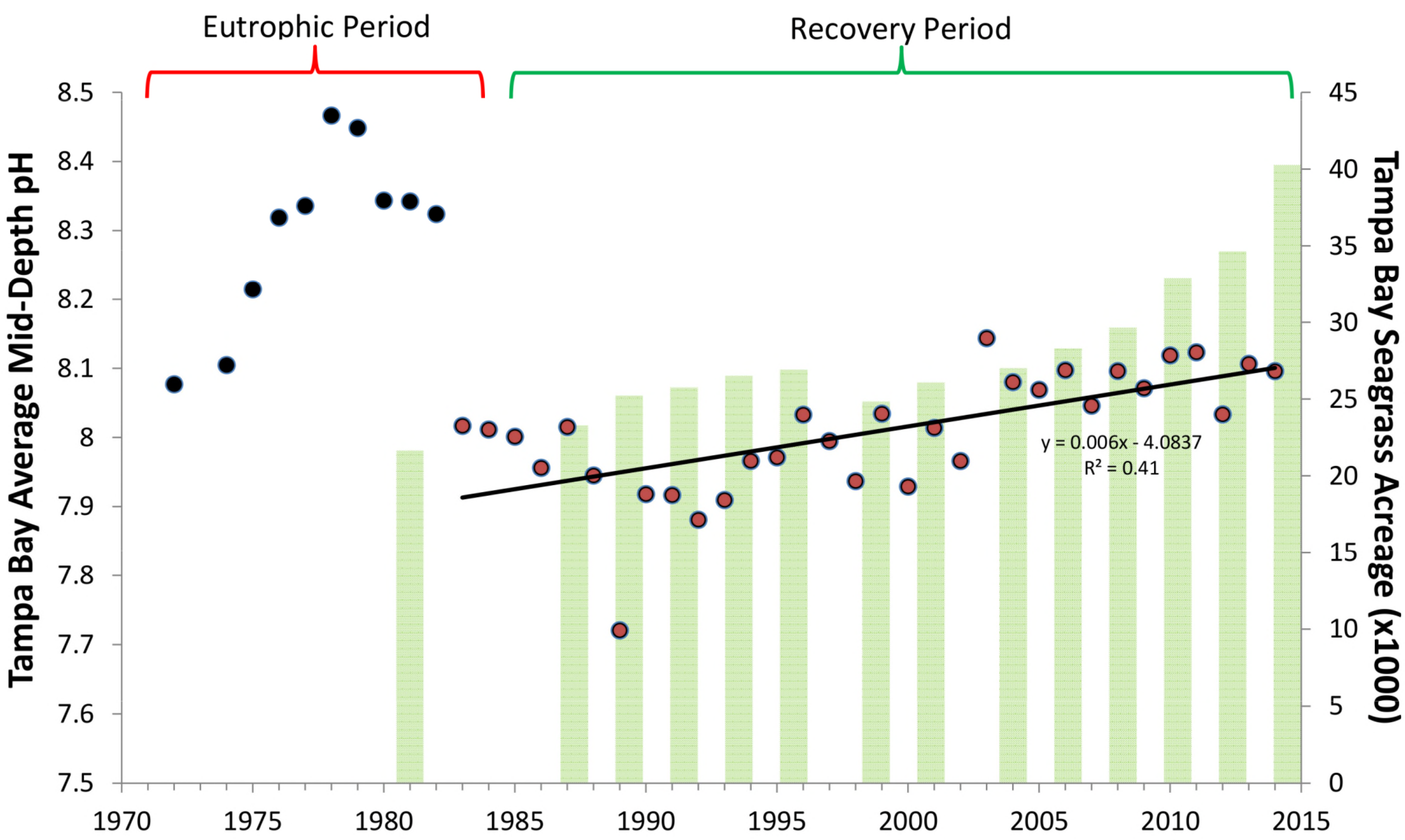
13%

of economy for all six counties

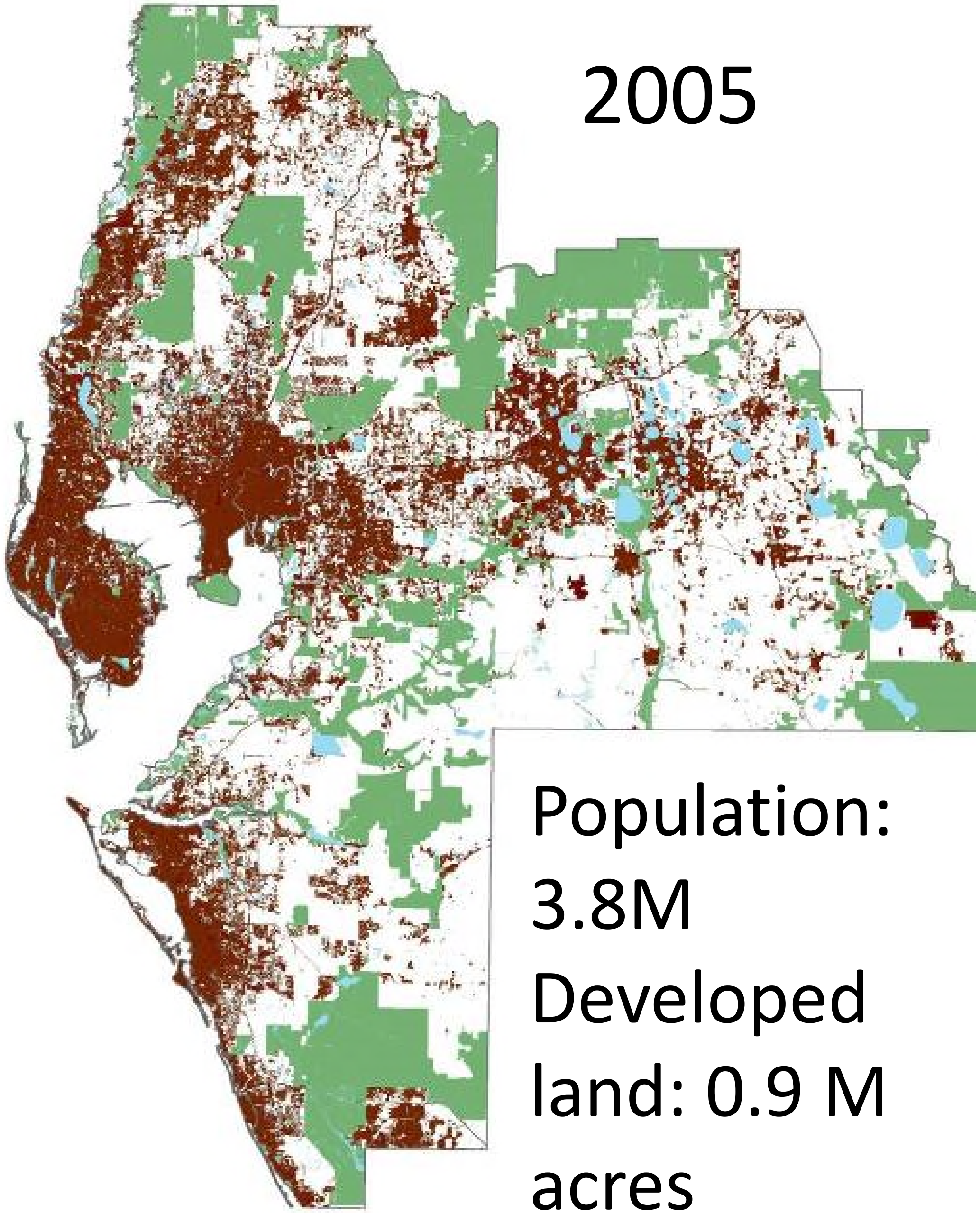
Dorian Photography Inc.

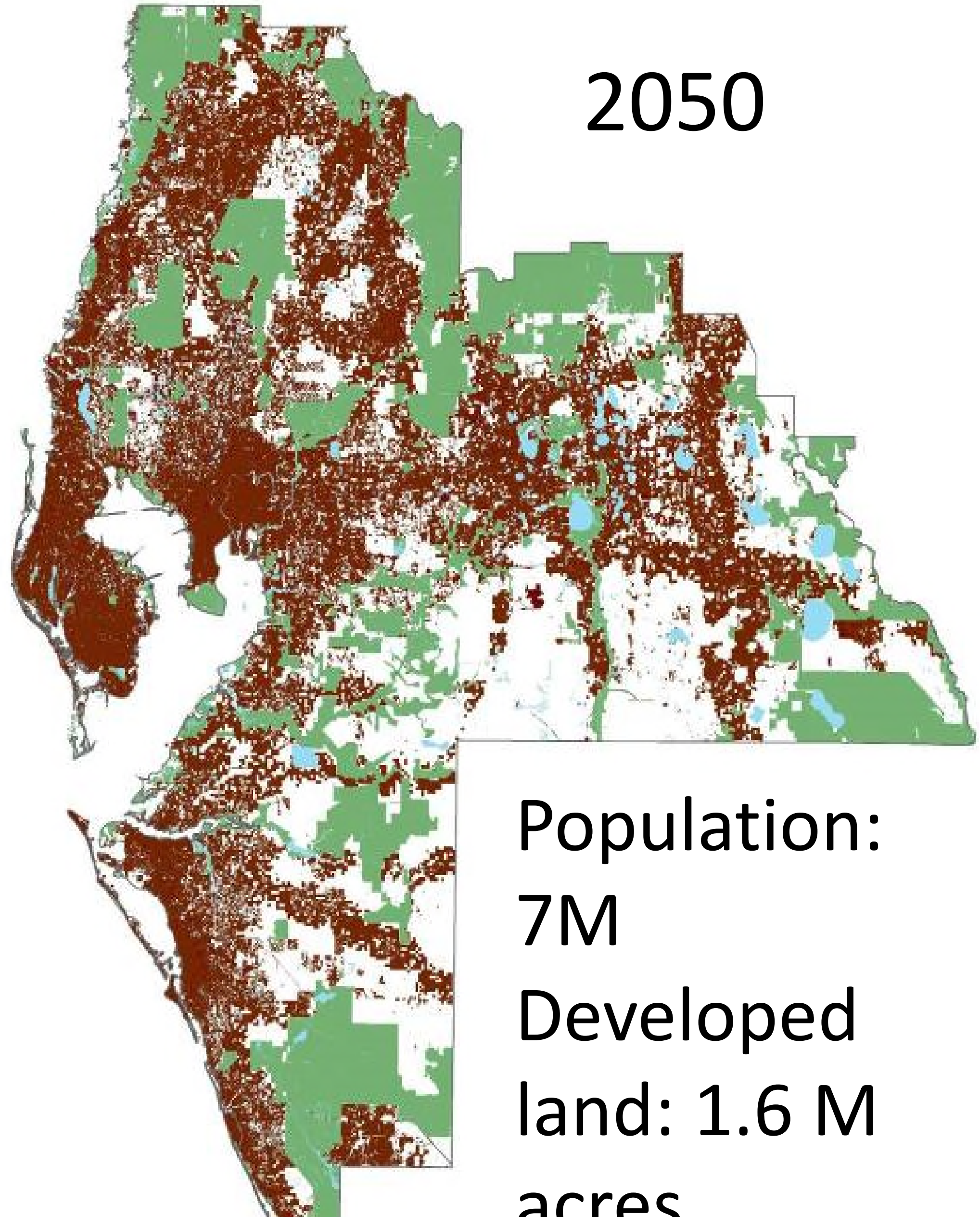
Ancillary Climate Change Benefits?

- Greenhouse Gas Sequestration → Coastal Blue Carbon
- Ocean Acidification Buffering / Refugia



Population expected to double





Source: One Bay 2010