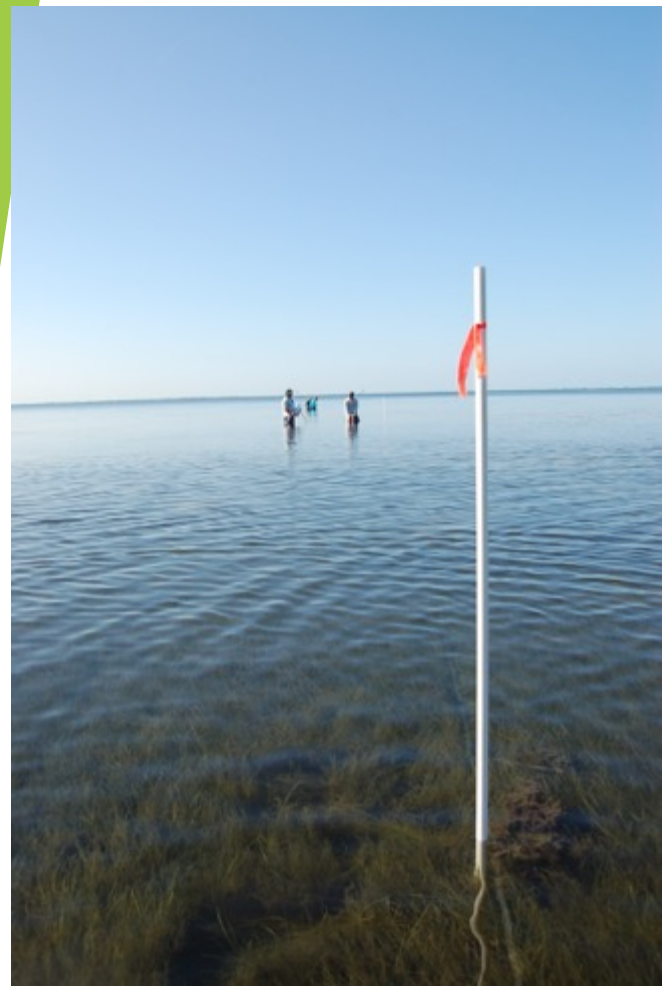
Seagrass, Water Quality and the Restoration of Tampa Bay



Gary Raulerson, Ecologist
Tampa Bay Estuary Program

November 9, 2017

Stetson University College of Law

Fifth Annual Stetson Wetlands Workshop

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What's the story??

- Tampa Bay environmental history
- Why seagrass
- Science, management and policy links
- Future issues

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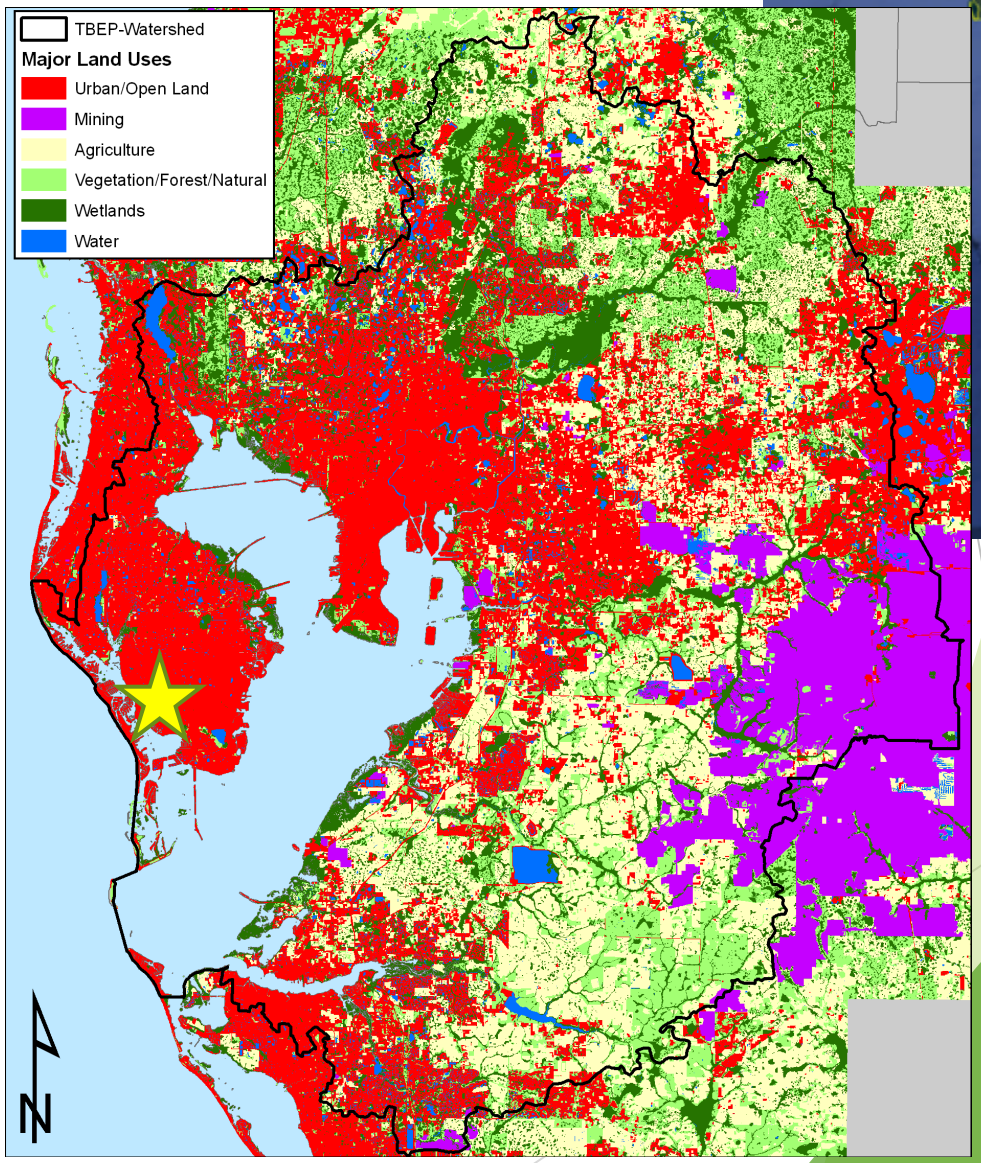
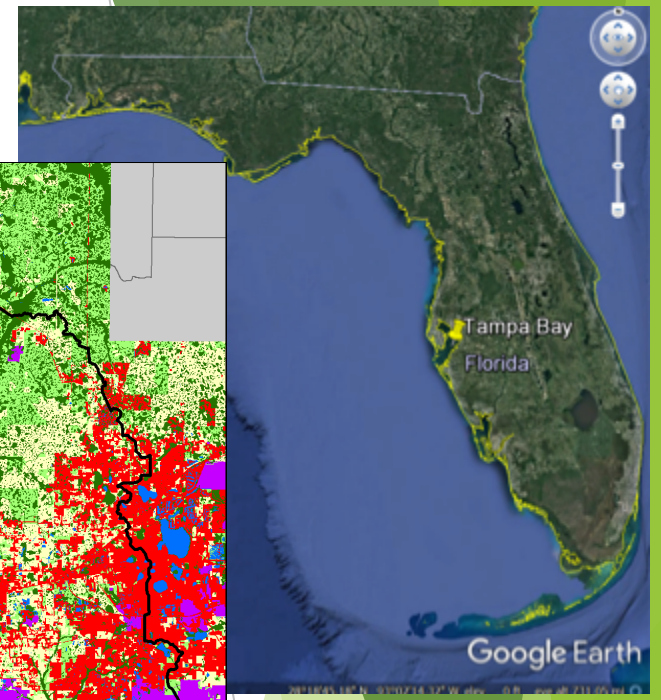
Tampa Bay Fast Facts

- Urbanized, 3 million people
- Open water – 400 sq. mi.
- Watershed – 2200 sq. mi.
- Avg Depth – 11 feet
- Max Depth – 43 feet
- Salinity – 1-35 ppt
- Economic driver - $22 Billion





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Tampa Bay in the 1970s-Early 1980s

- Phytoplankton and macroalgae dominated
- 50% loss of seagrass coverage between 1950 and 1980
- Newspapers and TV declared Tampa Bay “dead”
- Poorly-treated domestic point sources
- Untreated industrial point sources
- Stormwater
- Dredge & fill activities

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Citizens Demanded Action

- Hillsborough County Environmental Prot. Comm. (1967)
- Grizzle-Figg Act for Southwest Florida (1978) – WWTP reduction
- Aquatic Preserves - FDEP (1968-1984)
- SWIM Water Body - SWFWMD (1987)
- National Estuary Program (1991)
- Tampa Bay Watch (1993)
- TMDLs, BMAPs, and other Stormwater regulations

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TBEP's Role

- Facilitate scientific and technical work, discussions and evaluations
- Provide public education and communication
- Develop and convene partnerships to restore and protect Tampa Bay
- Link science to management

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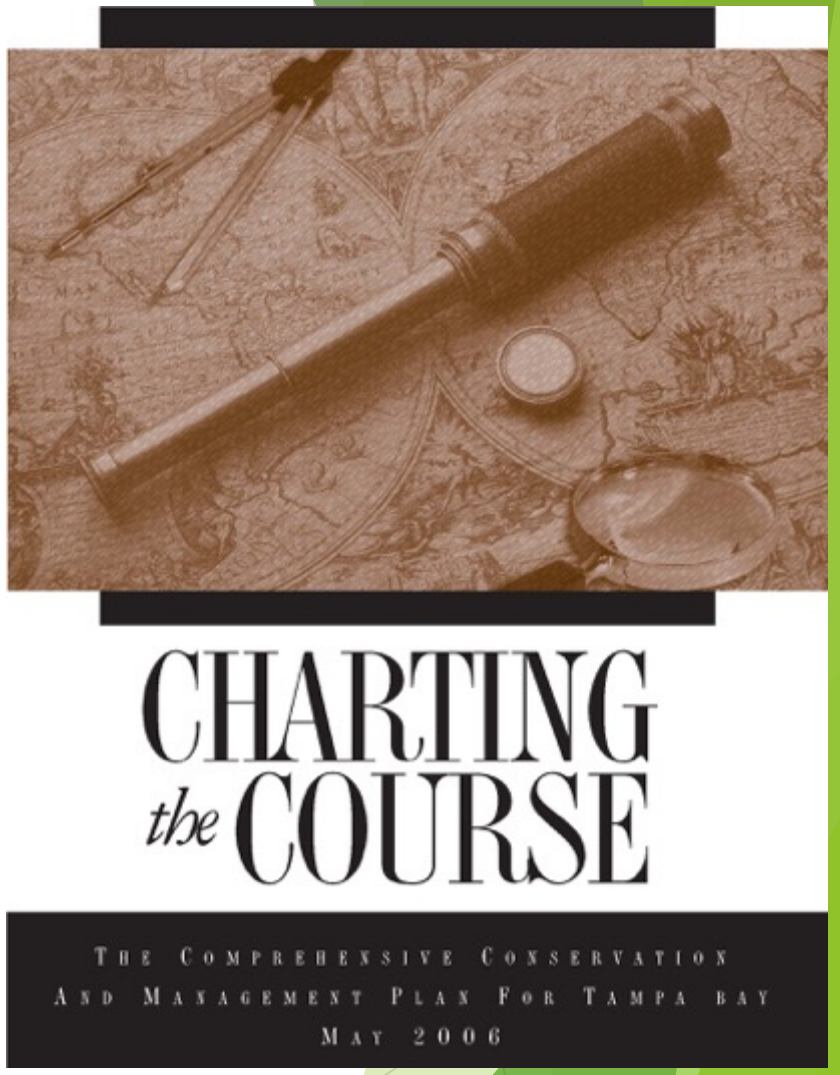
Key Indicator - Seagrass

- Habitat and economic value
- Straightforward indicator
- Science-based numeric goals & targets
- Long-term monitoring
- Ongoing assessment & adjustment



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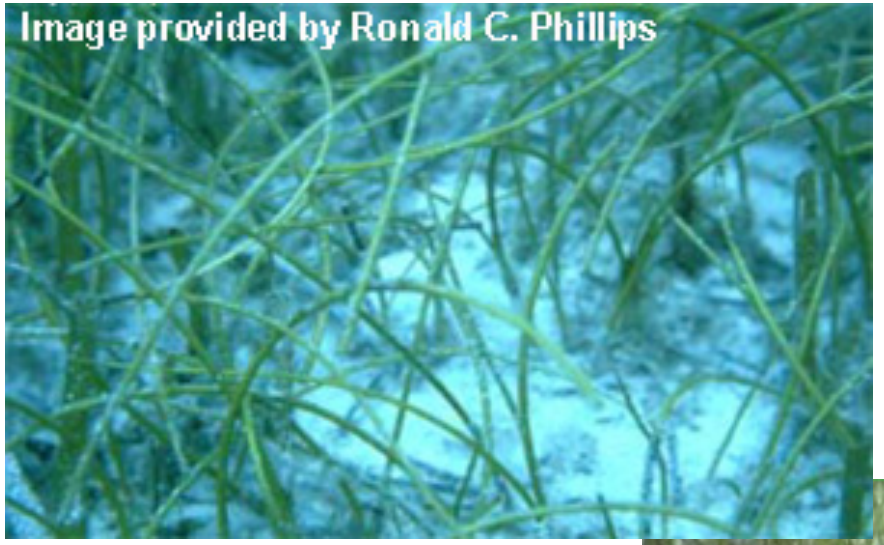
Seagrass Species

Syringodium filiforme
Manatee grass



Thalassia testudinum
Turtle grass

Halodule wrightii
Shoal grass

Ruppia maritima
Widgeon grass

Halophila engelmanii
Star grass

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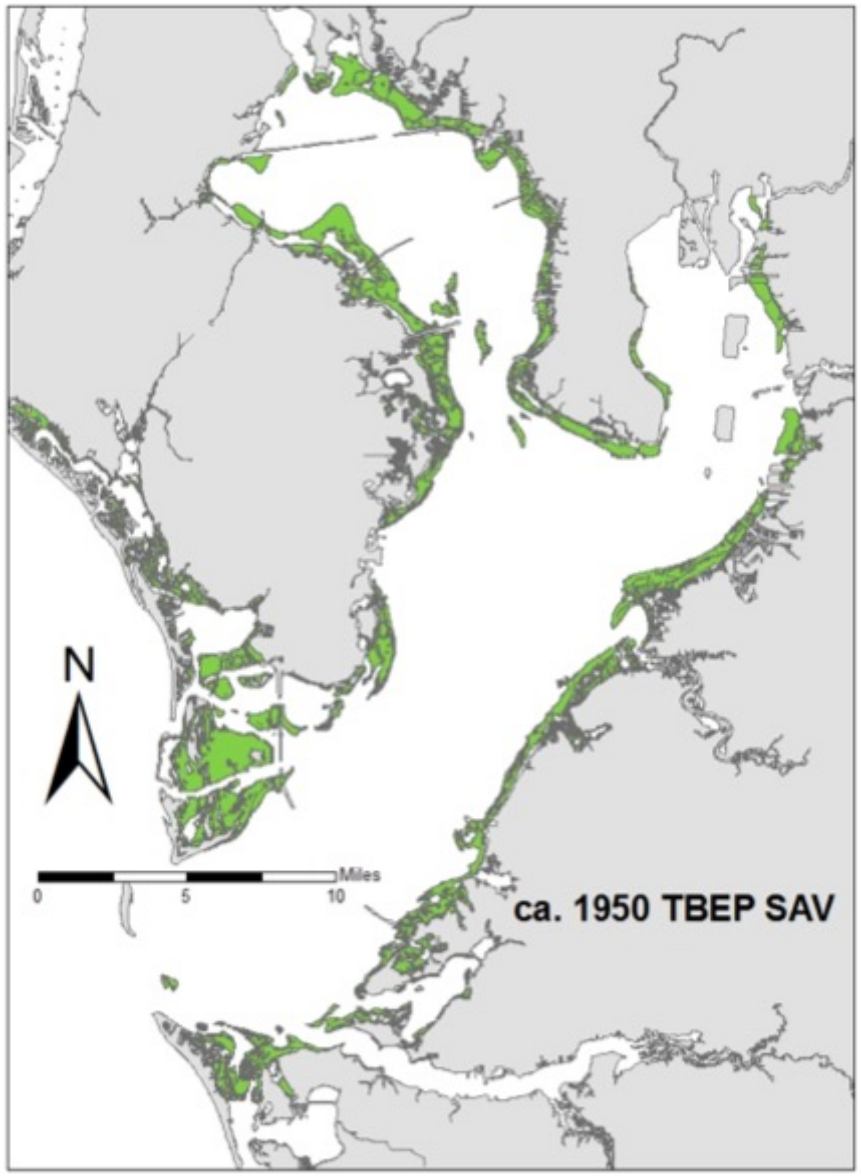
Setting Seagrass Restoration Goals – ca. 1950



Approximately 40,400 acres, however…

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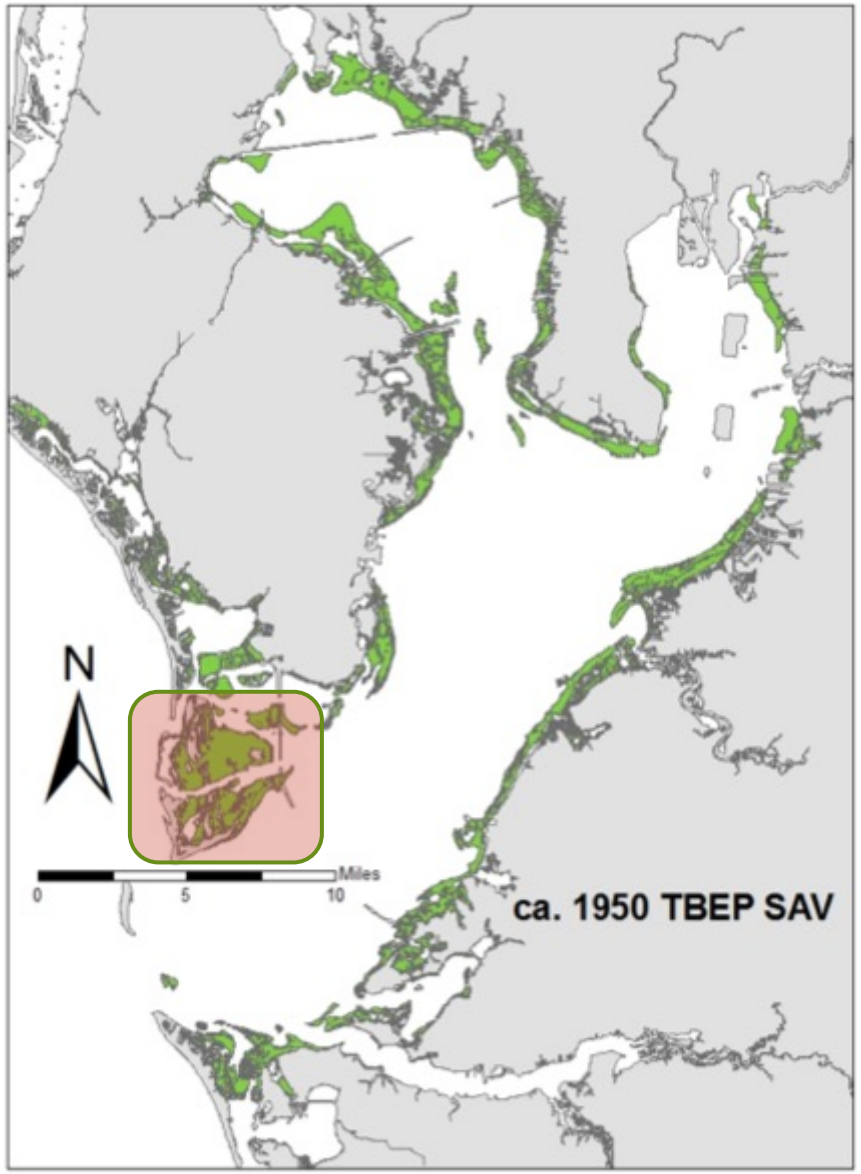
Setting Seagrass Goals – Dredge and Fill



Adjusted From 40,400 to 38,000 acres

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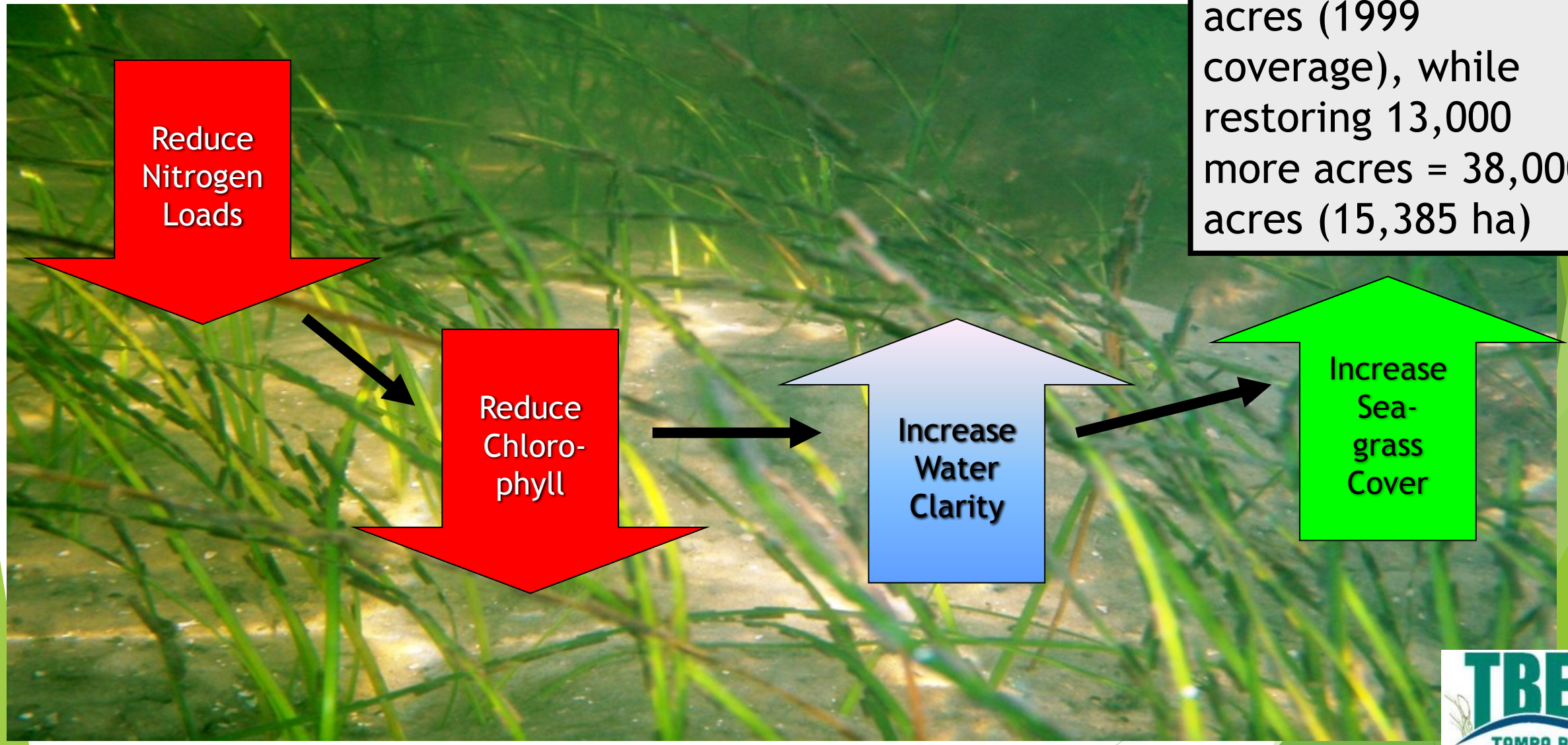
Nitrogen Management Paradigm

Seagrass Goal: Preserve 25,000 acres (1999 coverage), while restoring 13,000 more acres = 38,000 acres (15,385 ha)



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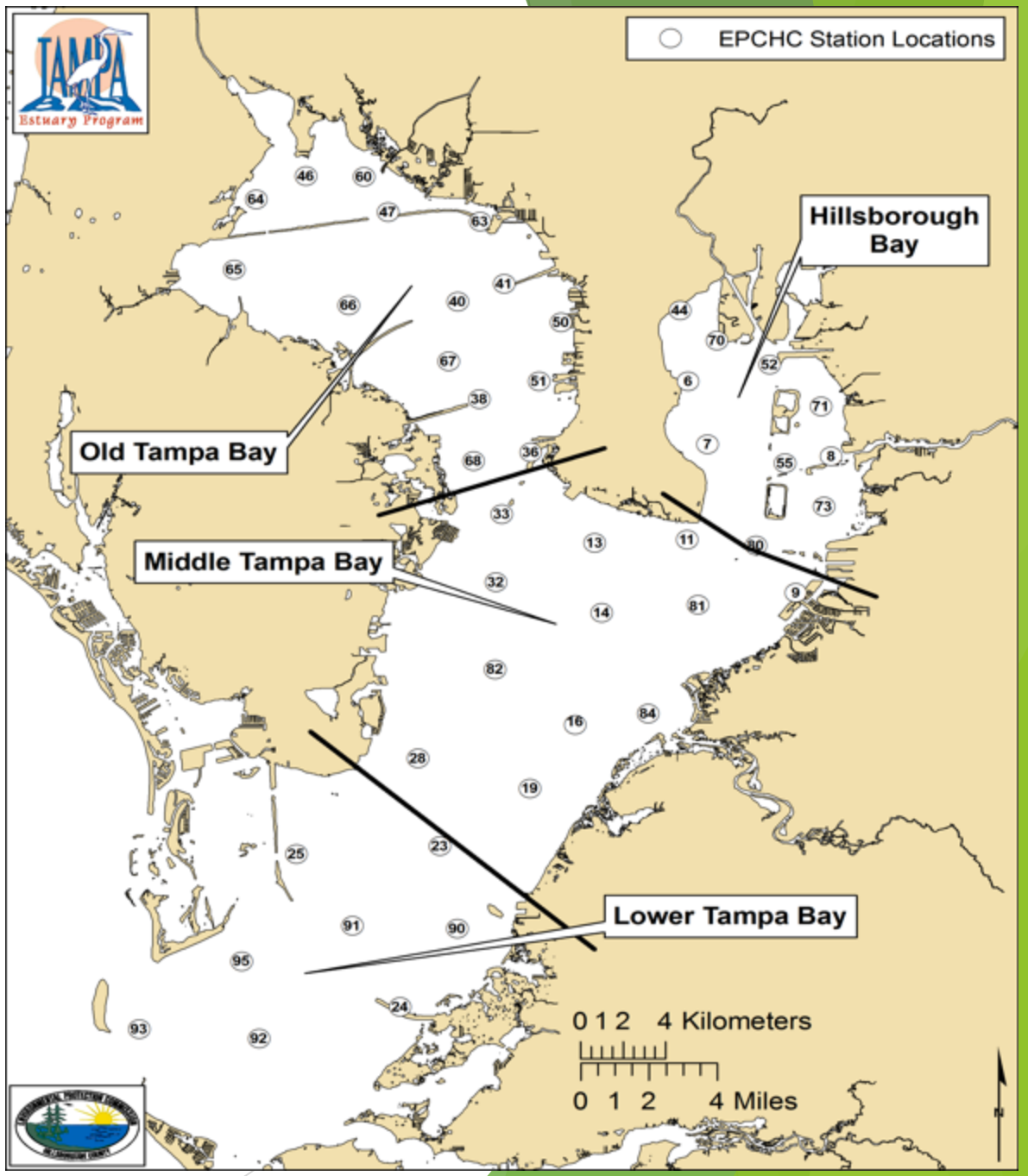
Water Quality Assessment

- Rely on long-term ambient water quality stations sampled by EPCHC
- 45 fixed stations have been monitored since 1974
- Annual averages developed from chlorophyll-a & secchi disk depth measurements



Site Specific Thresholds for Chlorophyll-a

- Hillsborough Bay: 15.0 ug/L
- Old Tampa Bay: 9.3 ug/L
- Middle Tampa Bay: 8.5 ug/L
- Lower Tampa Bay: 5.1 ug/L

Nitrogen Management Goal:
"Hold the line" on nitrogen loading at 1992-1994 average level. To compensate for expected increase in load with population growth, reduce or preclude an additional 17 tons per year.

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Tampa Bay NMC

A Public – Private Partnership

Tampa Bay Nitrogen Management Consortium

- Formed in 1998, now includes 40+ 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
- 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

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Voluntary Actions Become Regulatory Requirements

- Clean Water Act and Total Maximum Daily Loads
- Goal to “hold the line” on TN loadings to the bay & preclude 17 tons TN / yr (offset growth)
- 1998 – TMDL for TN first established by EPA (based on 1992-1994 TN loads to Tampa Bay)
- 2002 – NMC and TBEP granted “Reasonable Assurance” that TB will meet State WQ Criteria for Nutrients
- 2007 – FDEP and EPA require allocations to be developed to meet federal TMDL and continue State “Reasonable Assurance” determination
- 2009 – NMC voluntarily developed TN load allocations to 189+ sources in the bay; Effectively capping TN loads

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TN Loads Capped & Reductions Documented

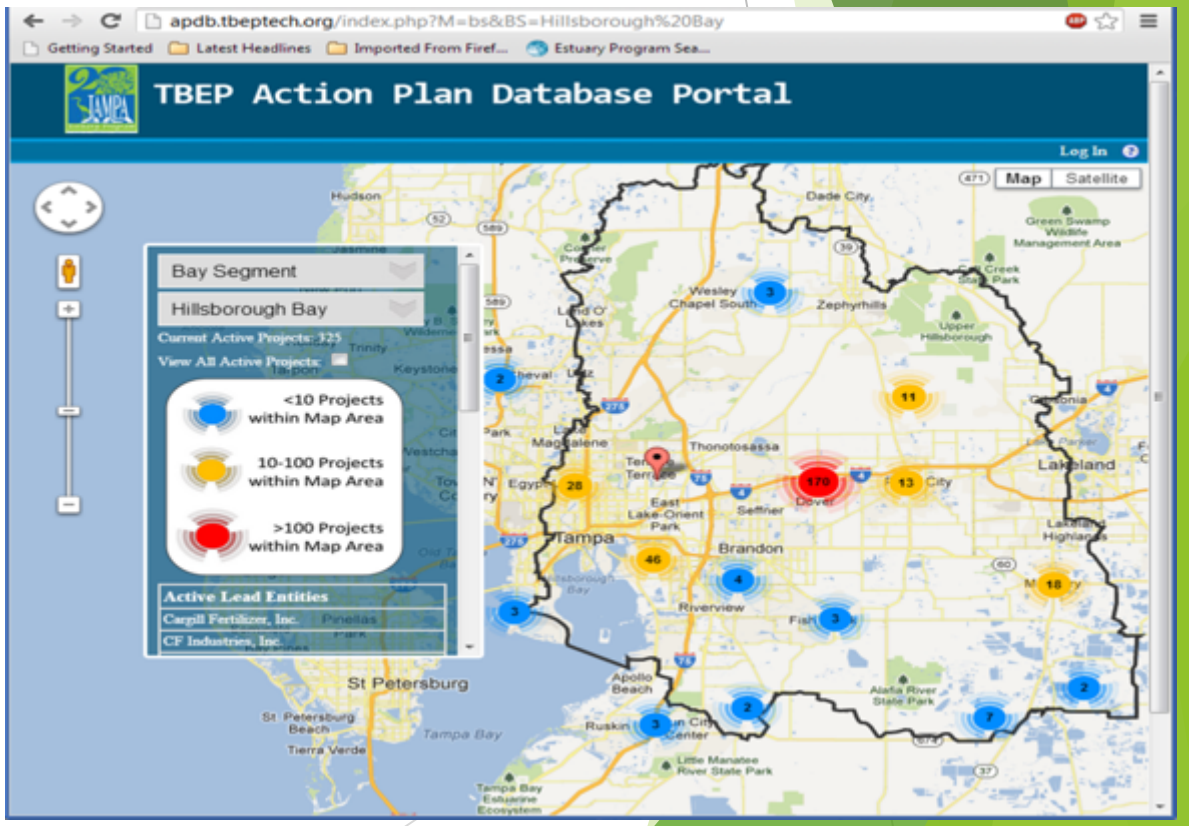
- All TN Loads Apportioned to Sources
- Future loads will require offsets/transfers
- Calculations and BMP efficiencies used based on land use, subbasin, and treatment method
- User-defined efficiencies & reductions can also be entered
- TBEP collates and reports to FDEP/EPA on a 5-yr basis by major bay segment

Table IX-3: Proposed allowable, transferable nitrogen allocations for 2008-2012 for Middle Tampa Bay. SW=Surface water discharge, RE=Reuse discharge.

Entity	Source	Proposed MS4 and Point Source Permit Limit (%)	TMDL Load (tons/year)
Harbor Bay	NPS	<0.1%	0.2
Hillsborough County	MS4	9.9%	70.9
	Point Source - South County RE		0.5
MacDill Air Force Base	MS4	1.0%	7.0
	Point Source - WWTP RE		0.7
Manatee County	MS4	3.0%	21.8
Pinellas County	MS4	0.5%	3.2
City of Pinellas Park	MS4	0.7%	5.3
City of St. Petersburg	MS4	6.5%	46.5
	Point Source - St. Pete Facilities RE		20.8
Mosaic	Point Source - Four Corners SW	4.1%	29.3
TECO Big Bend*	Point Source – SW*		56.5*
	Point Source - RE		2.1
Non-MS4/Non-Ag NPS		0.5%	3.8
Atmospheric Deposition		35.2%	252.1
Other (Groundwater, Springs, Conservation)		5.1%	36.7
FDACS (Agriculture)		33.4%	239.2
Small Sources			2.4
Total			**799**

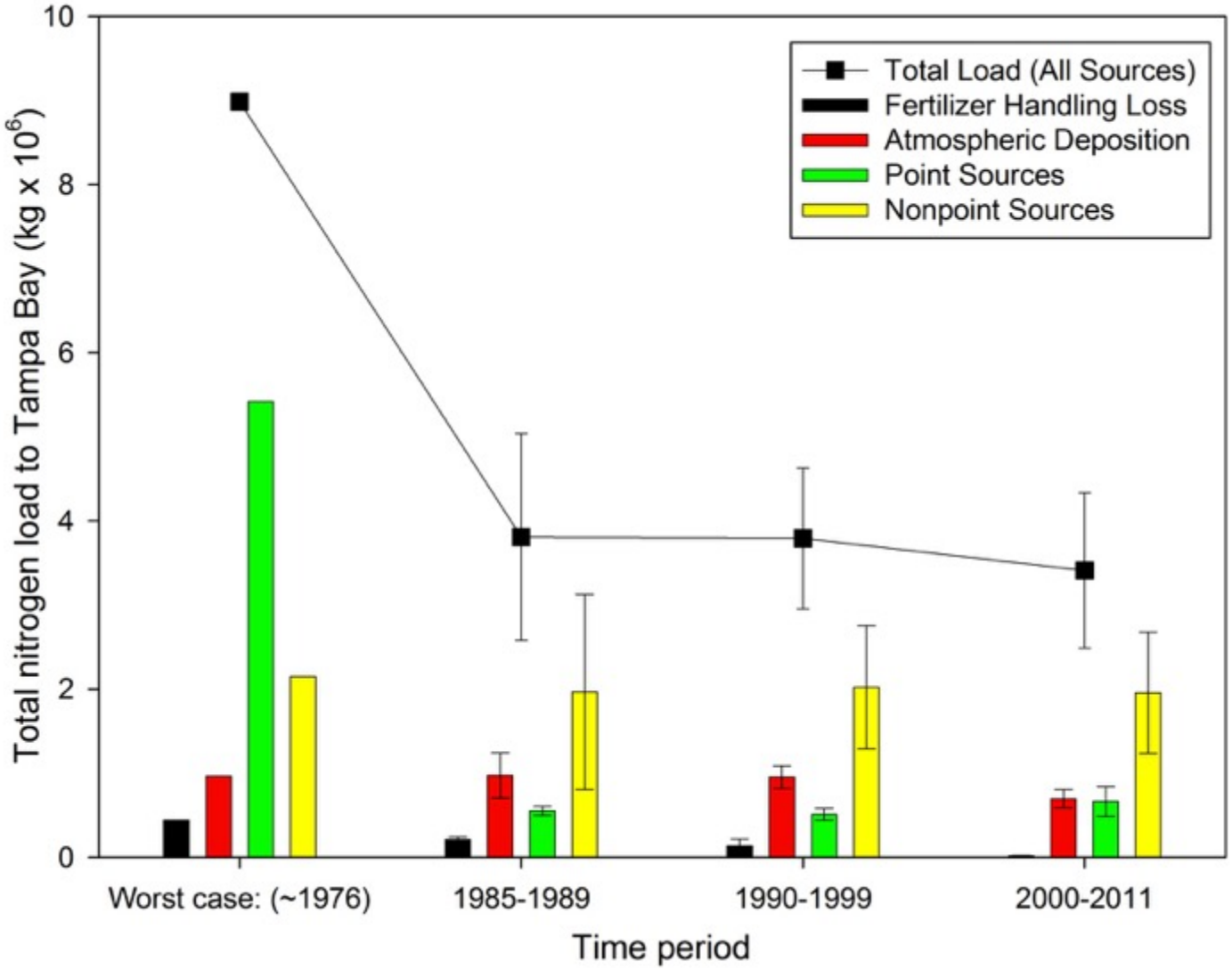
Note: The resulting MS4 and point source TMDL loads based on percent allocations are not proposed as permit limits.

Includes a Set Allocation of 35.0 tons/year and an Interim Allocation through 2012 of an additional 21.5 tons/year to allow determination of new discharge loads.



http://apdb.tbeptech.org

Reducing TN Loads to Tampa Bay



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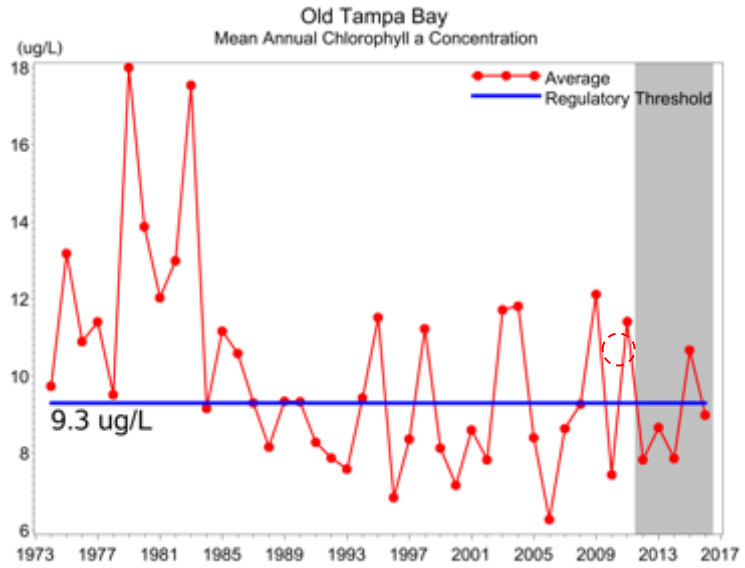
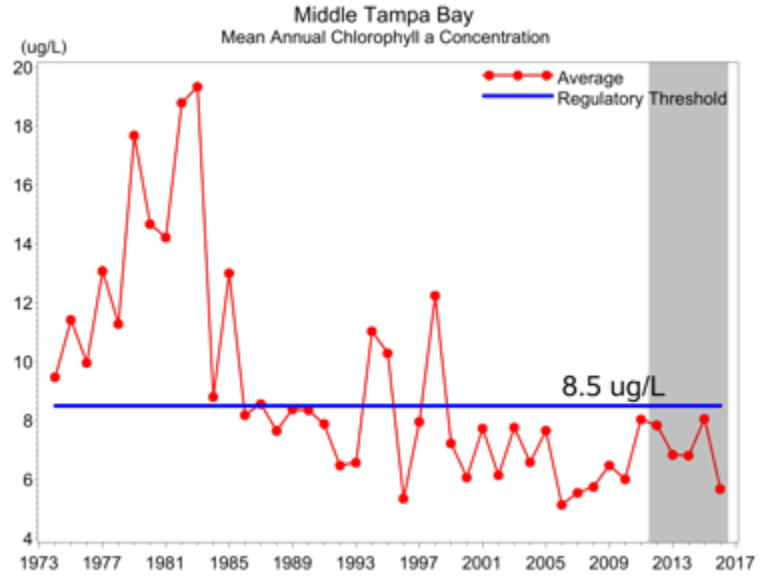
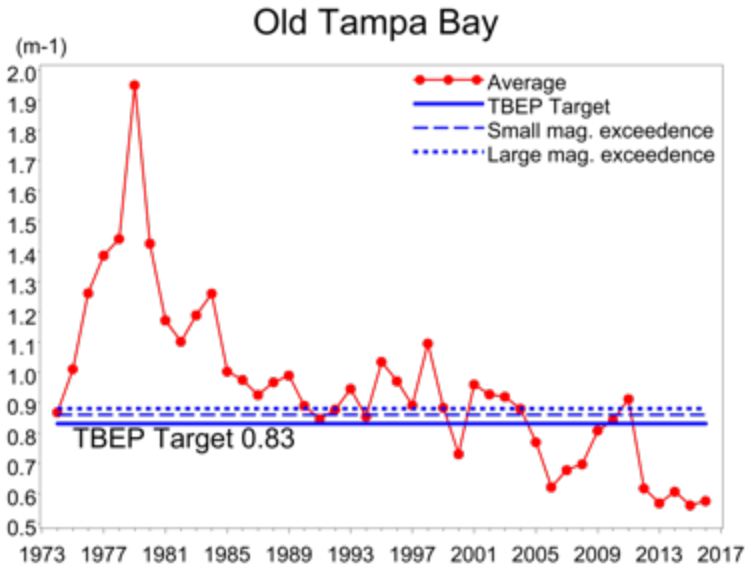
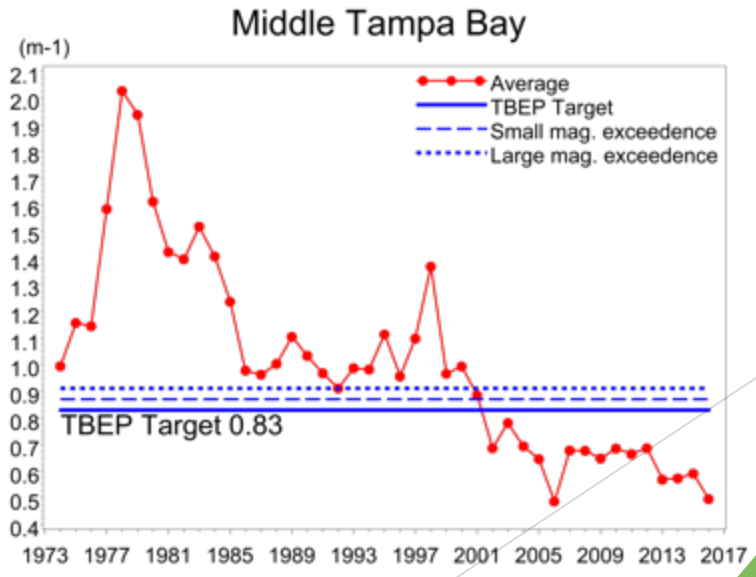
Chlorophyll-a





Light Attenuation





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Water Quality Assessment / Management Framework

- Bay segment observed values compared to established bay segment targets for chlorophyll-a and light attenuation
- Results of each comparison placed into a decision matrix framework
- Overall management response determined for each bay segment in a clear, “policy-level” format
- 2-year exceedence results in additional actions

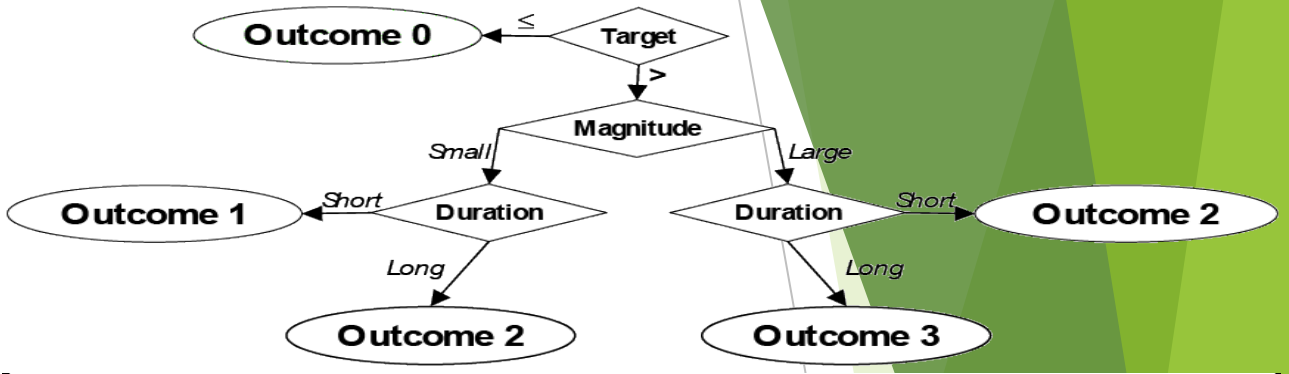

Table 1. Decision matrix identifying appropriate categories of management actions in response to various outcomes of the monitoring and assessment of chlorophyll–*a* and light attenuation data.

CHLOROPHYLL	LIGHT ATTENUATION			
↓	Outcome 0	Outcome 1	Outcome 2	Outcome 3
Outcome 0	GREEN	YELLOW	YELLOW	YELLOW
Outcome 1	YELLOW	YELLOW	YELLOW	RED
Outcome 2	YELLOW	YELLOW	RED	RED
Outcome 3	YELLOW	RED	RED	RED

Green	“Stay the course;” partners continue with planned projects to implement the CCMP. Data summary and reporting via the Baywide Environmental Monitoring Report and annual assessment and progress reports.
Yellow	TAC and Management Board on caution alert; review monitoring data and loading estimates; attempt to identify causes of target exceedences; TAC report to Management Board on findings and recommended responses needed.
Red	TAC, Management and Policy Boards on alert; review and report by TAC to Management Board on recommended types of responses. Management and Policy Boards take appropriate actions to get the program back on track.

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Water Quality Has Improved

Bay Segment	Chlorophyll-a (ug/L)	
	2016 Average	FDEP RA Thresholds
Old Tampa Bay	9.0	9.3
Hillsborough Bay	11.4	15.0
Middle Tampa Bay	5.7	8.5
Lower Tampa Bay	3.0	5.1

AWT & Reuse Standards Implemented

Stormwater Regulations Enacted

85/86

2006: First-time All Segments Meet TBEP Water Quality Targets

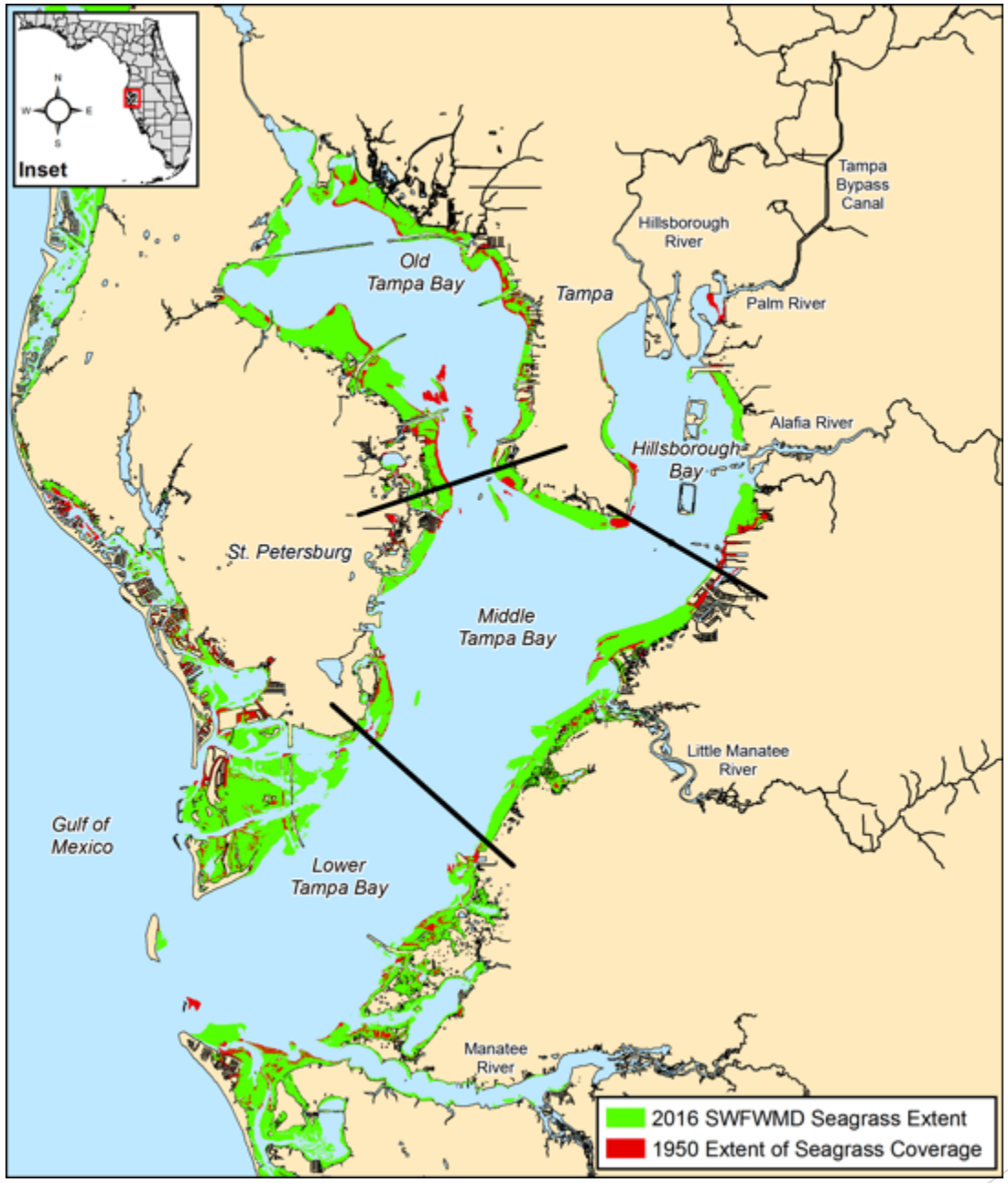
TBEP Partner & NMC Actions Implemented

1992

Year	Old Tampa Bay	Hillsbor-ough 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
2016	Yellow	Green	Green	Green

Results? Seagrass Coverage

SWFWMD



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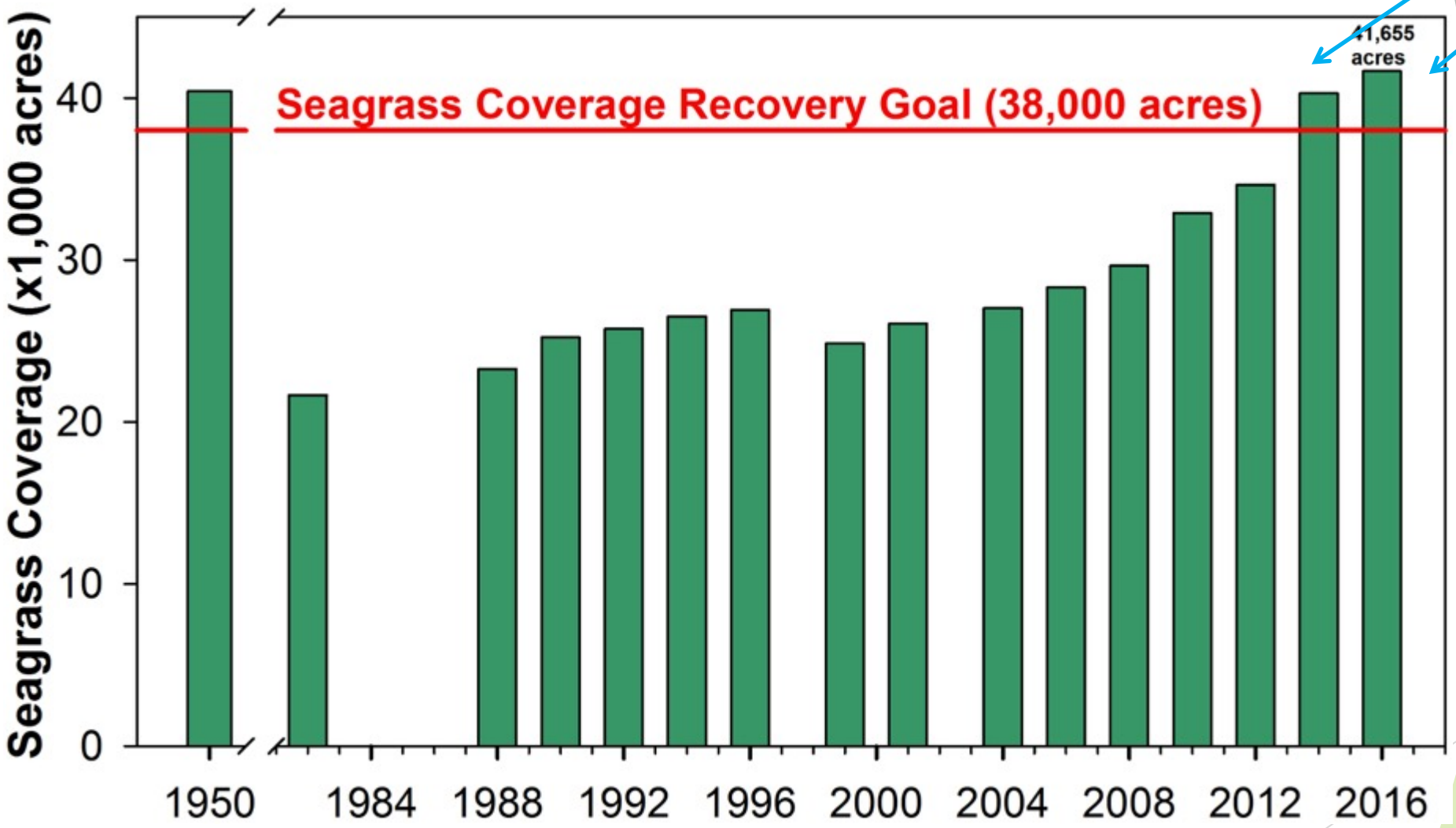
Seagrass Coverage Expands

Exceeded 1950s estimate of 40,400 acres!



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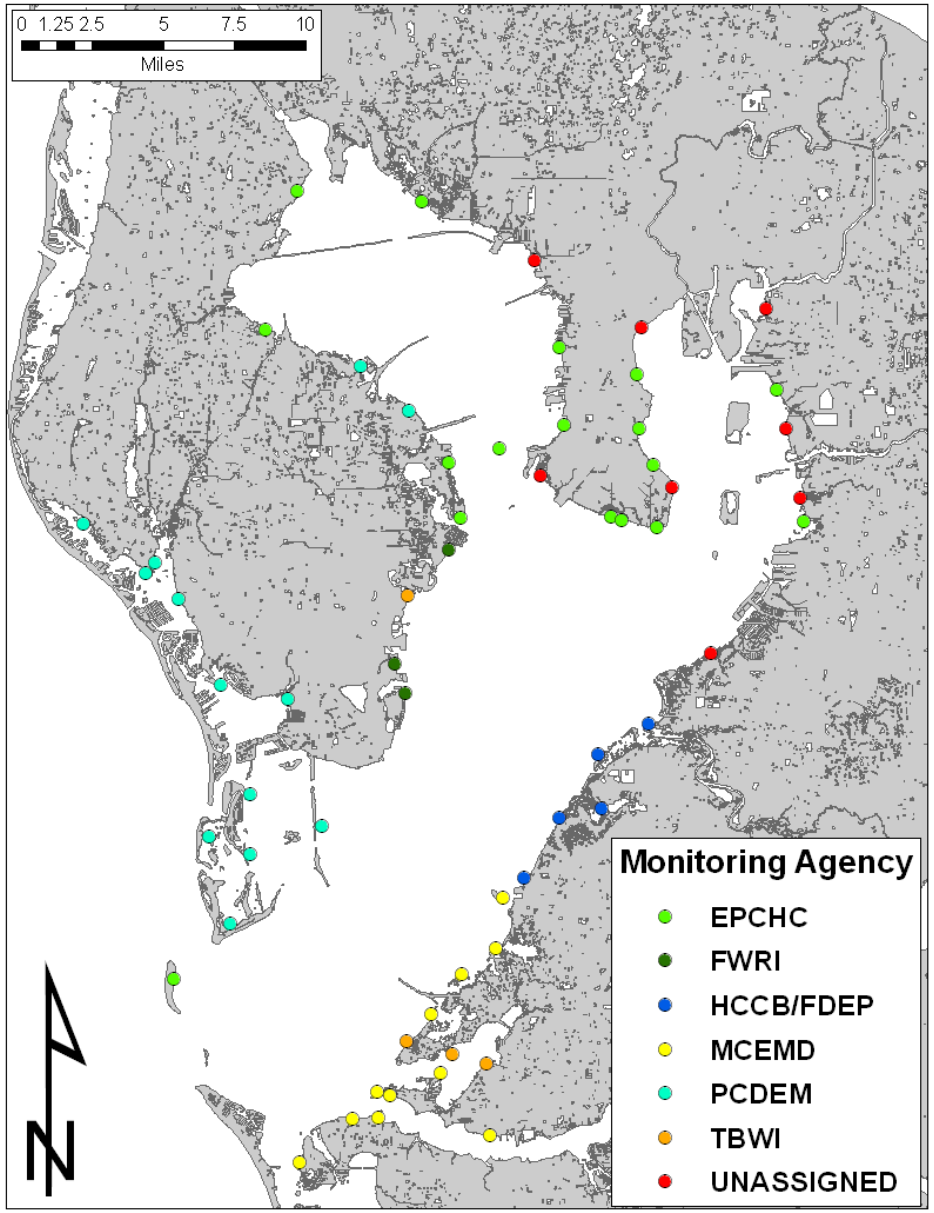
Seagrass Transect Monitoring



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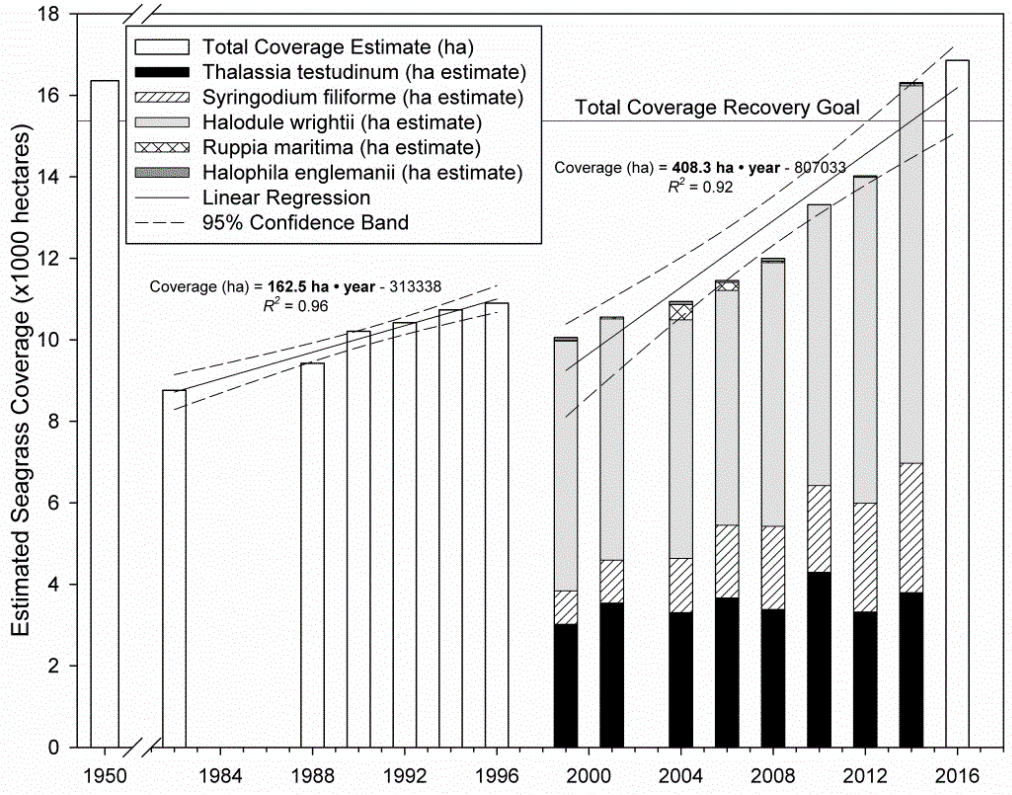
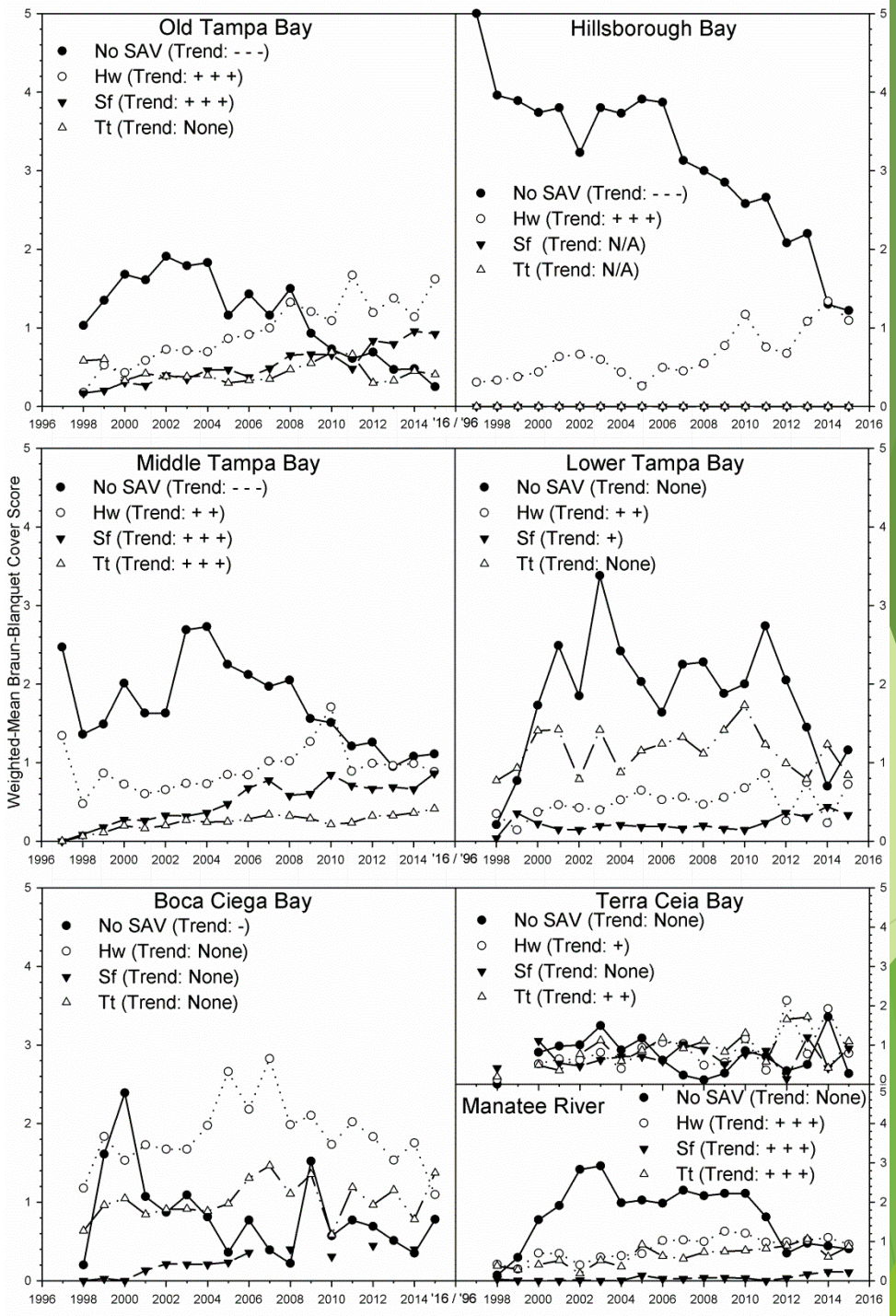
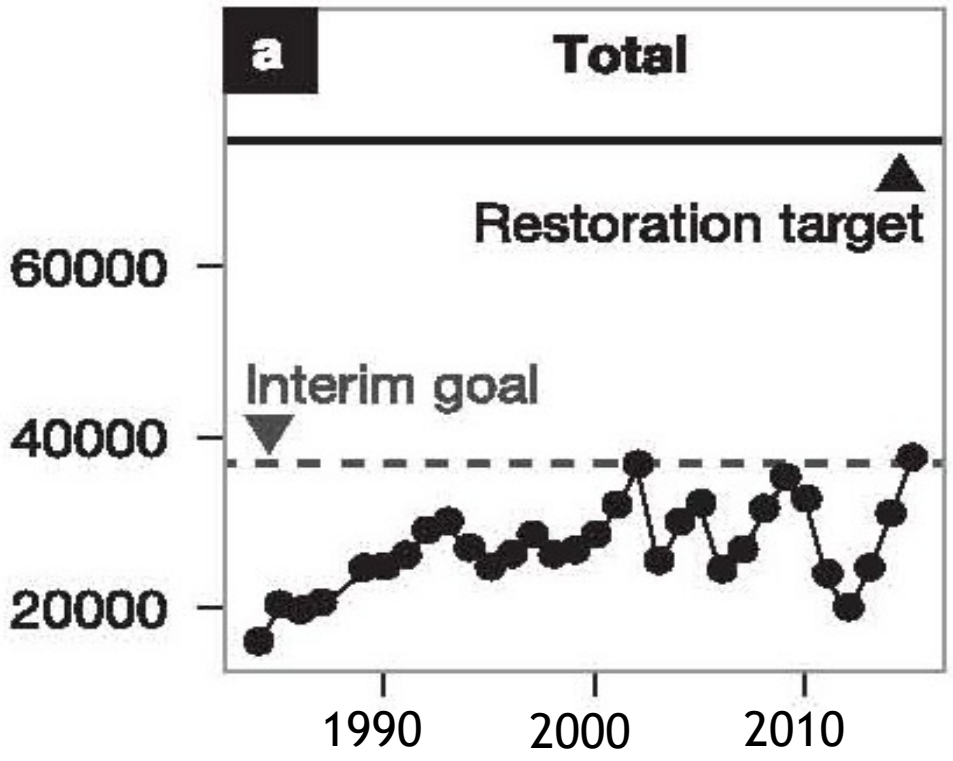
Seagrass Species Trends

- Acreage increases primarily attributed to shoal & manatee grass expansion

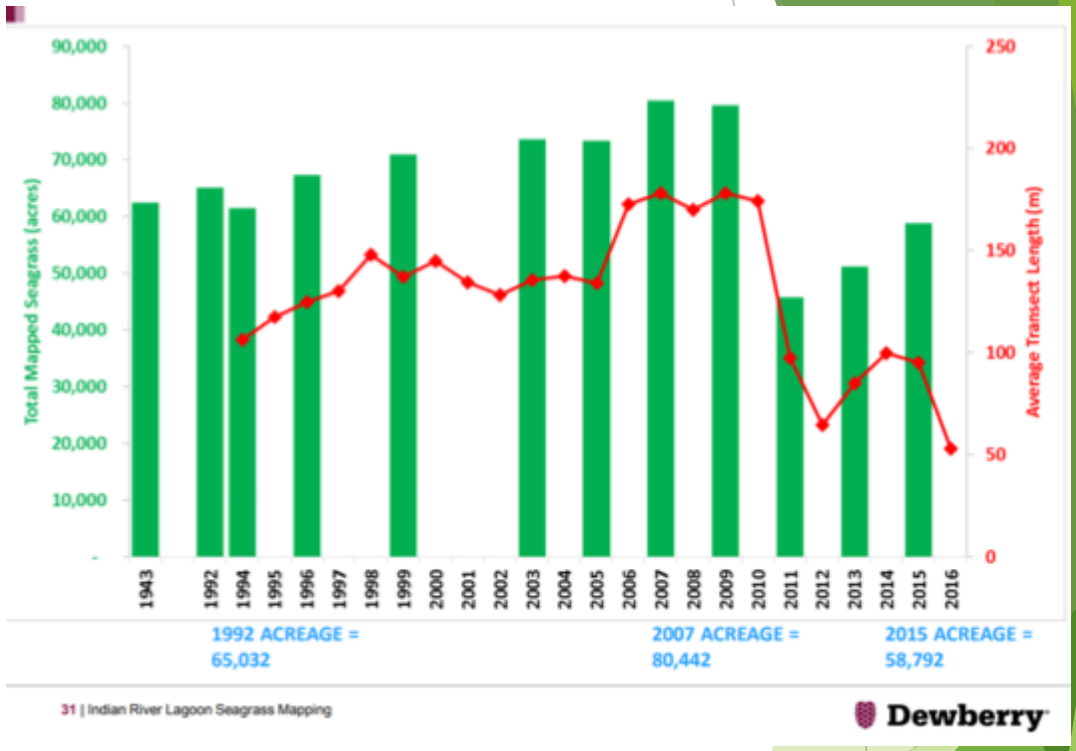




Other Seagrass Systems

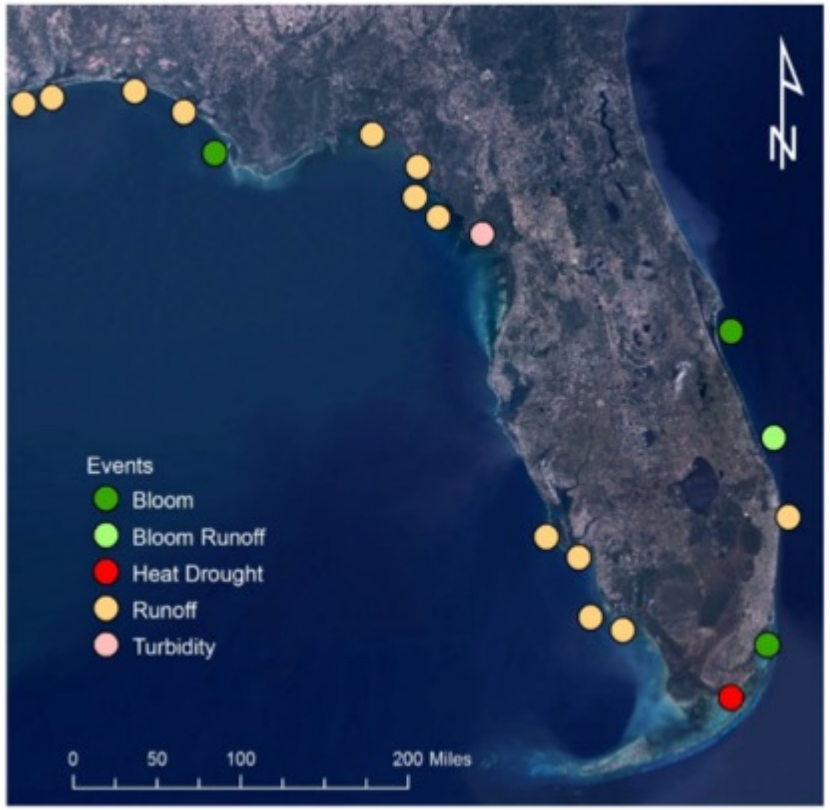


Chesapeake Bay
(Orth et al. 2017)

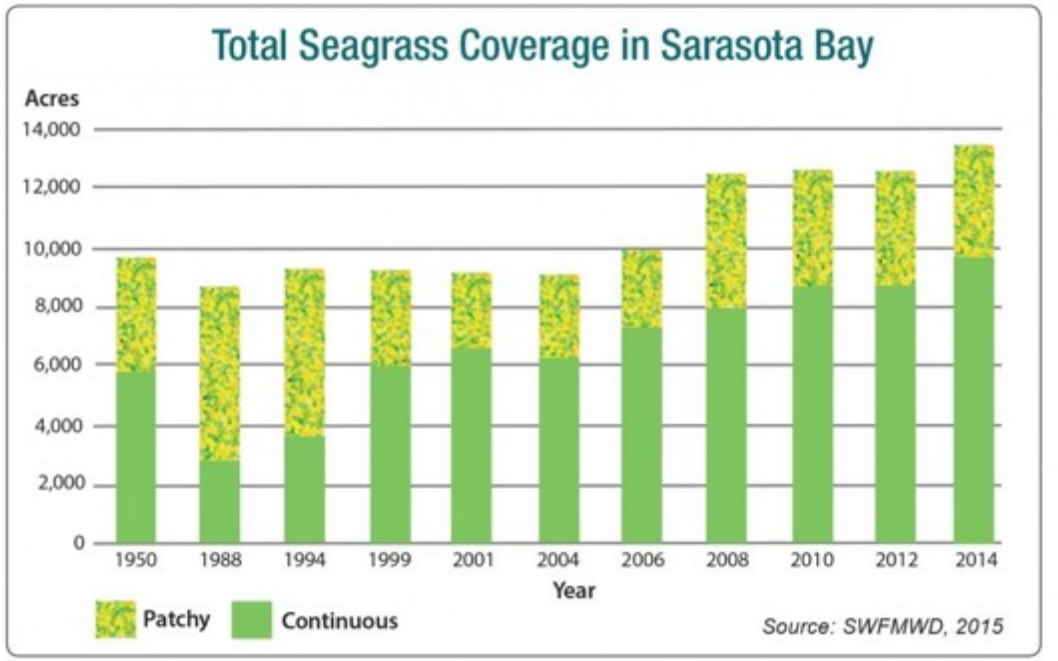


Indian River Lagoon
(Patterson, 2017)

Other Seagrass Systems



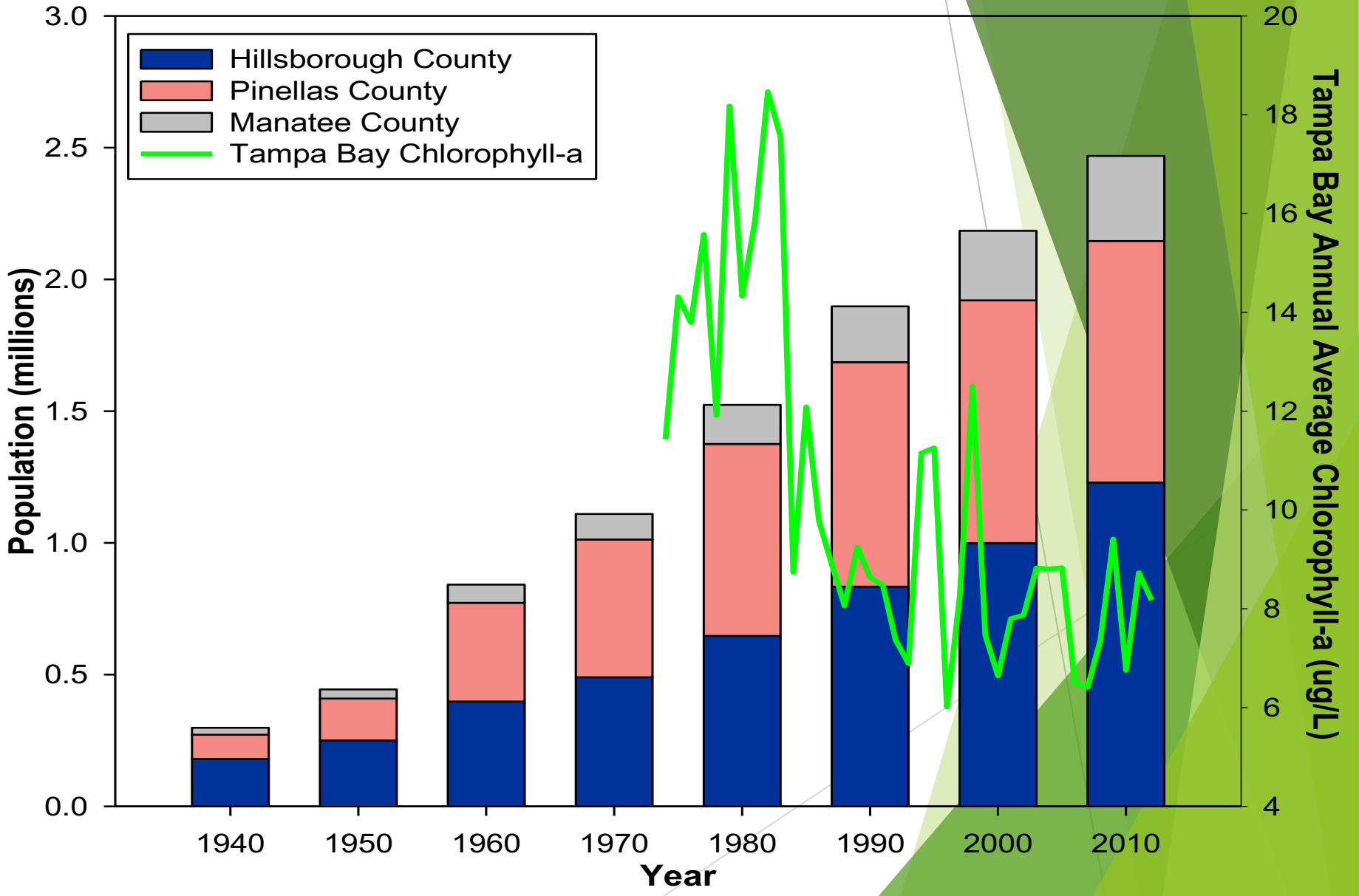
Threats to Florida Seagrass, 2012-16
(Yarbro and Carlson, 2016)

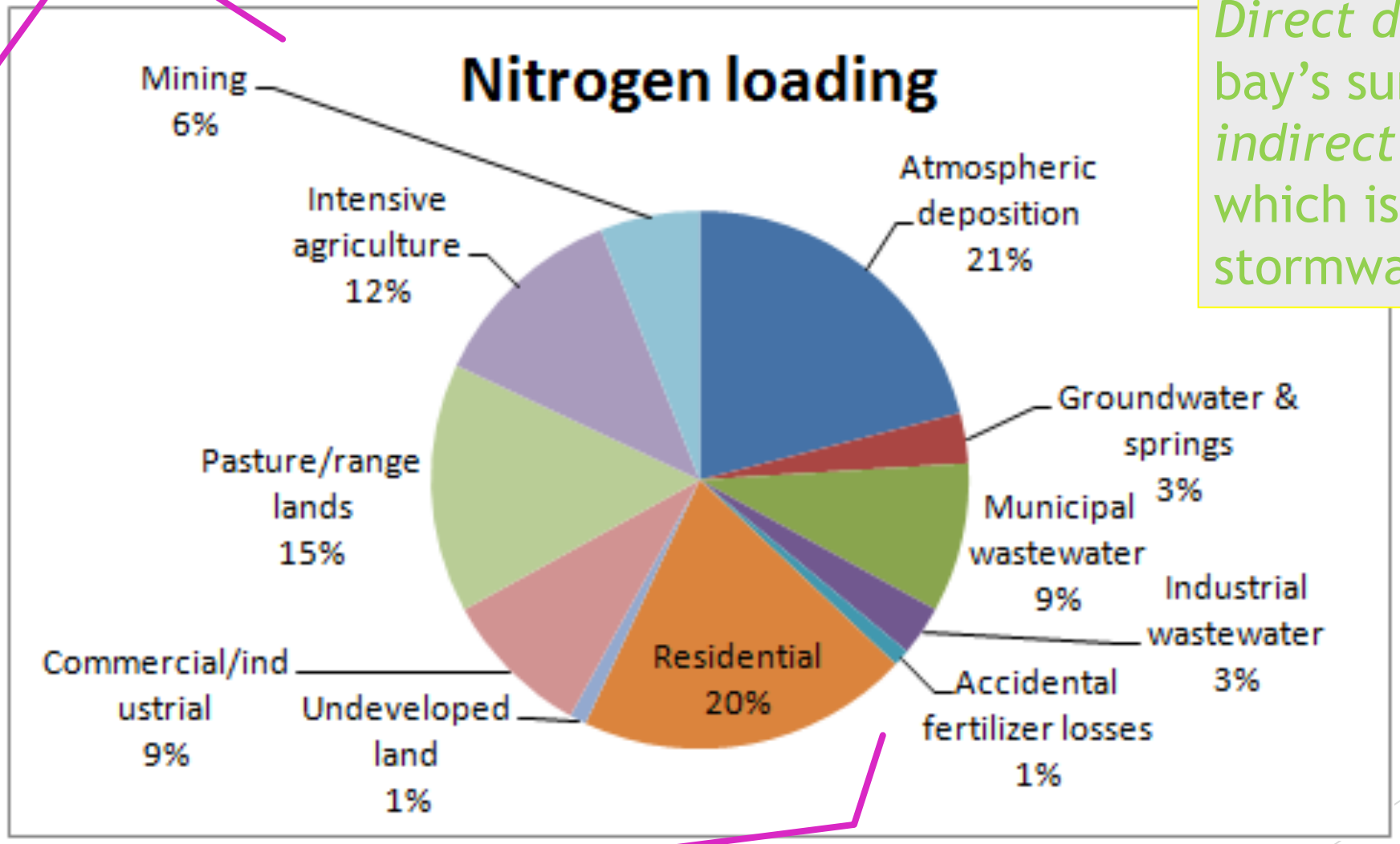


Sarasota Bay
(www.sarasotabay.org)

Sustaining Success

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





Atmospheric Deposition - *Direct deposition* to the bay's surface, and *indirect deposition*, which is an element of stormwater runoff

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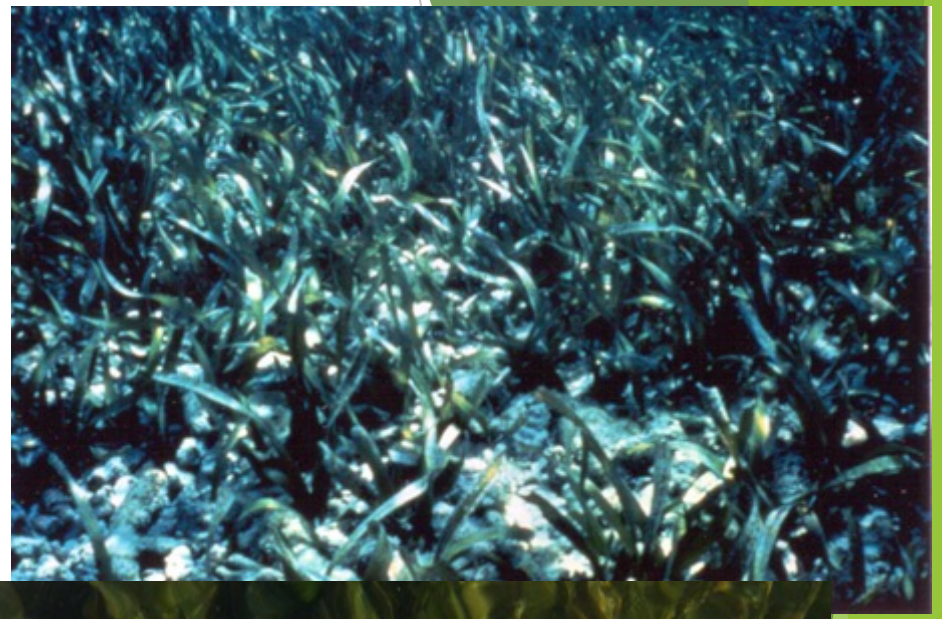
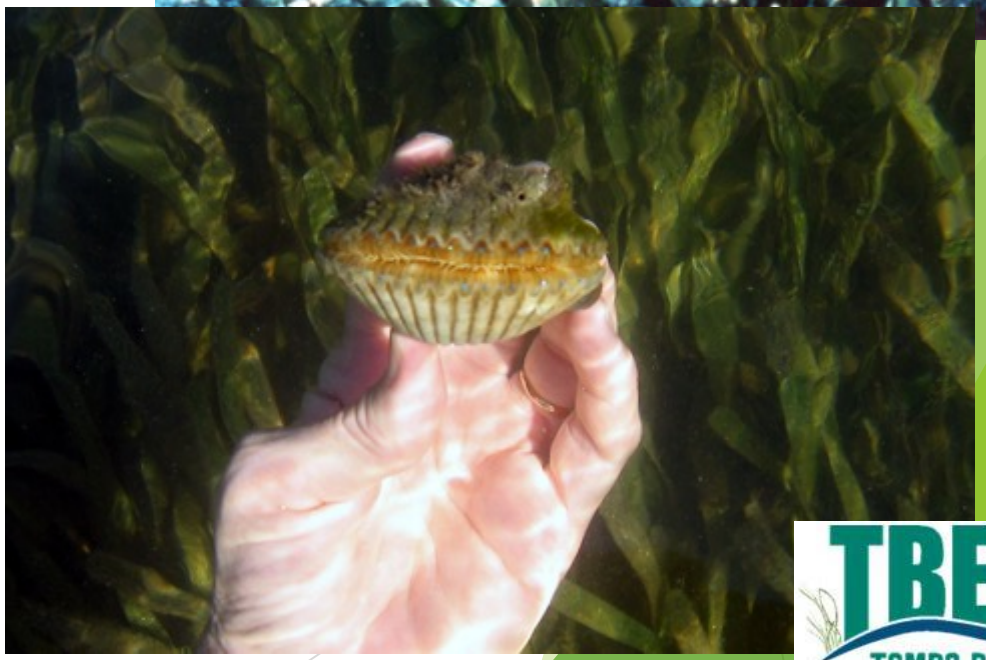
2017 TBEP Management Plan Update
New Water Quality Management Actions

- Reduce Residential Fertilizer Contributions to Stormwater Runoff
- Continue to Reduce Wastewater & Stormwater Inputs Through Expansion of Reuse / Recharge Projects
- Develop & Fund Localized Research & Management Actions for Problematic Areas (e.g. Old Tampa Bay)

Recap

- Nitrogen/Seagrass Paradigm
- Data as the backbone
- Research advising management & policy
- New actions to continue restoration





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www.tbeptech.org

Thanks, any questions?

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