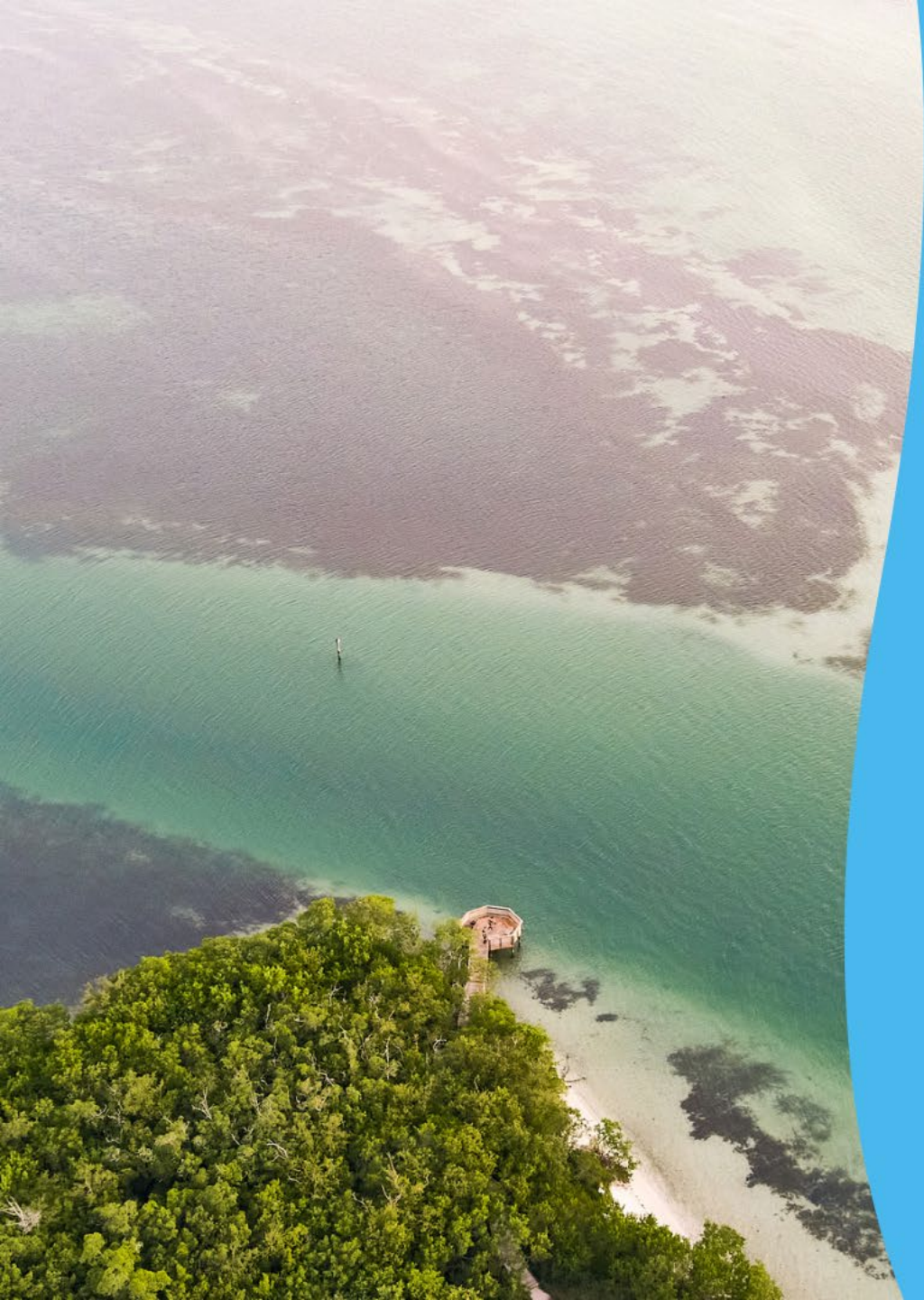




Managing the Bay's Health in a Changed and Changing World

Ryan Gandy Ph.D.



**SARASOTA BAY
ESTUARY PROGRAM**
RESTORING OUR BAYS

Where we work

“Where creeks meet the sea”

35-mile-long coastal lagoon

150 square mile watershed

5 embayment's

~~4~~ 5 inlets and passes

Spans two counties

Sarasota Bay Estuary Program Segments and Their Watersheds



Figure 1.

Source: SBEP

Our watersheds...

TABLE 1.
WATERSHED AND OPEN WATER ACREAGE OF THE SBEP BAYS

Watershed	Watershed (acres)	Open Water (acres)	Watershed-to-Open-Water Ratio (approx.)
Palma Sola Bay	6,587	3,215	2:1
Sarasota Bay	39,872	10,489	4:1
Roberts Bay	40,942	1,224	33:1
Little Sarasota Bay	8,580	1,948	4:1
Blackburn Bay	14,572	725	20:1

NOTE: SBEP = Sarasota Bay Estuary Program.

Sarasota Bay Estuary Program Segments and Their Watersheds



Figure 1.

Source: SBEP



Current Urbanization of our watersheds...

- Over 85% urbanized
- Remaining natural lands are in parks, preserves, and agriculture.
- Open land is needed to absorb and filter water running off the watershed.
- Loss of these lands causes water to rush toward the coast and can have adverse impacts on water quality, habitat, and animal populations.

Florida Waters Stewardship program

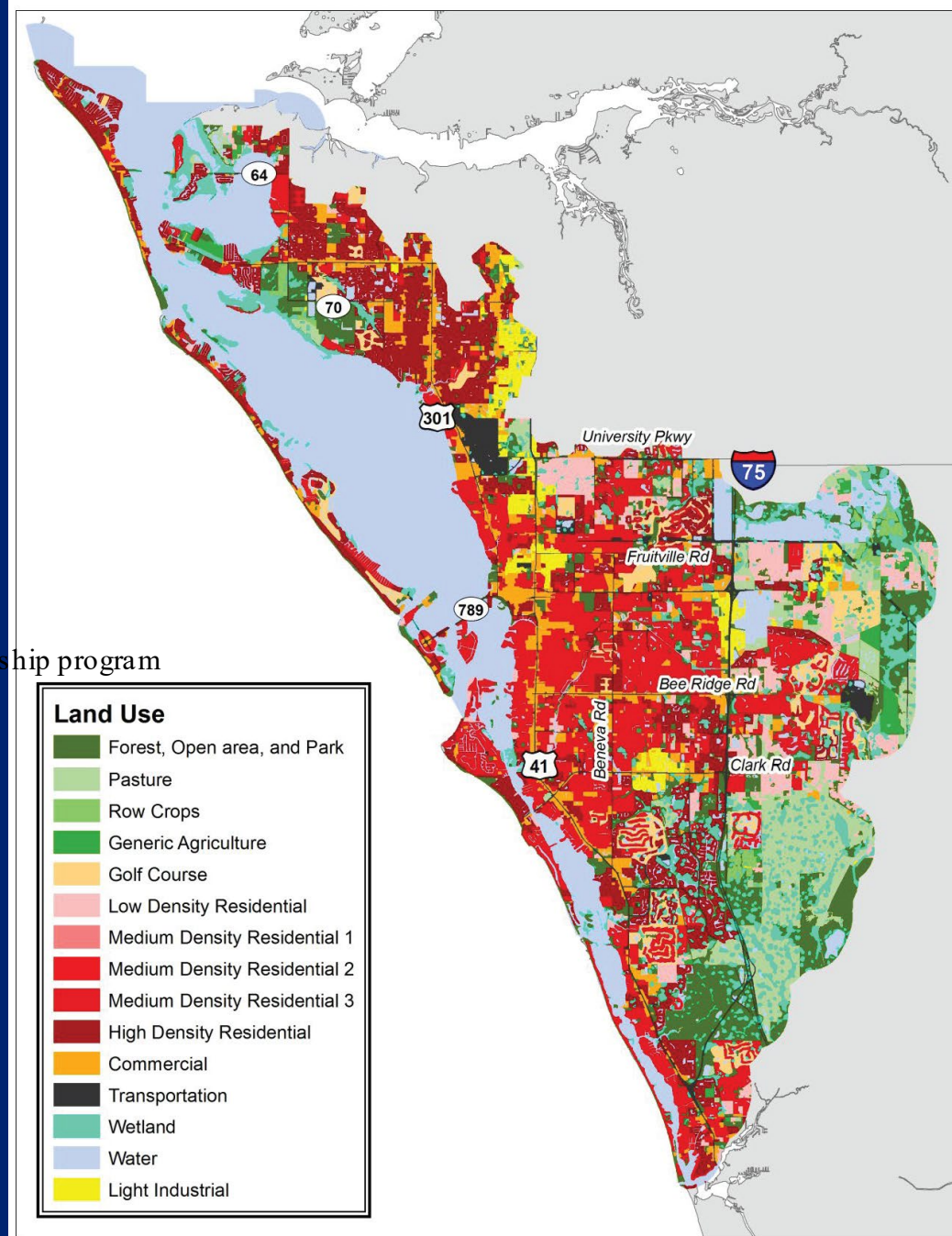


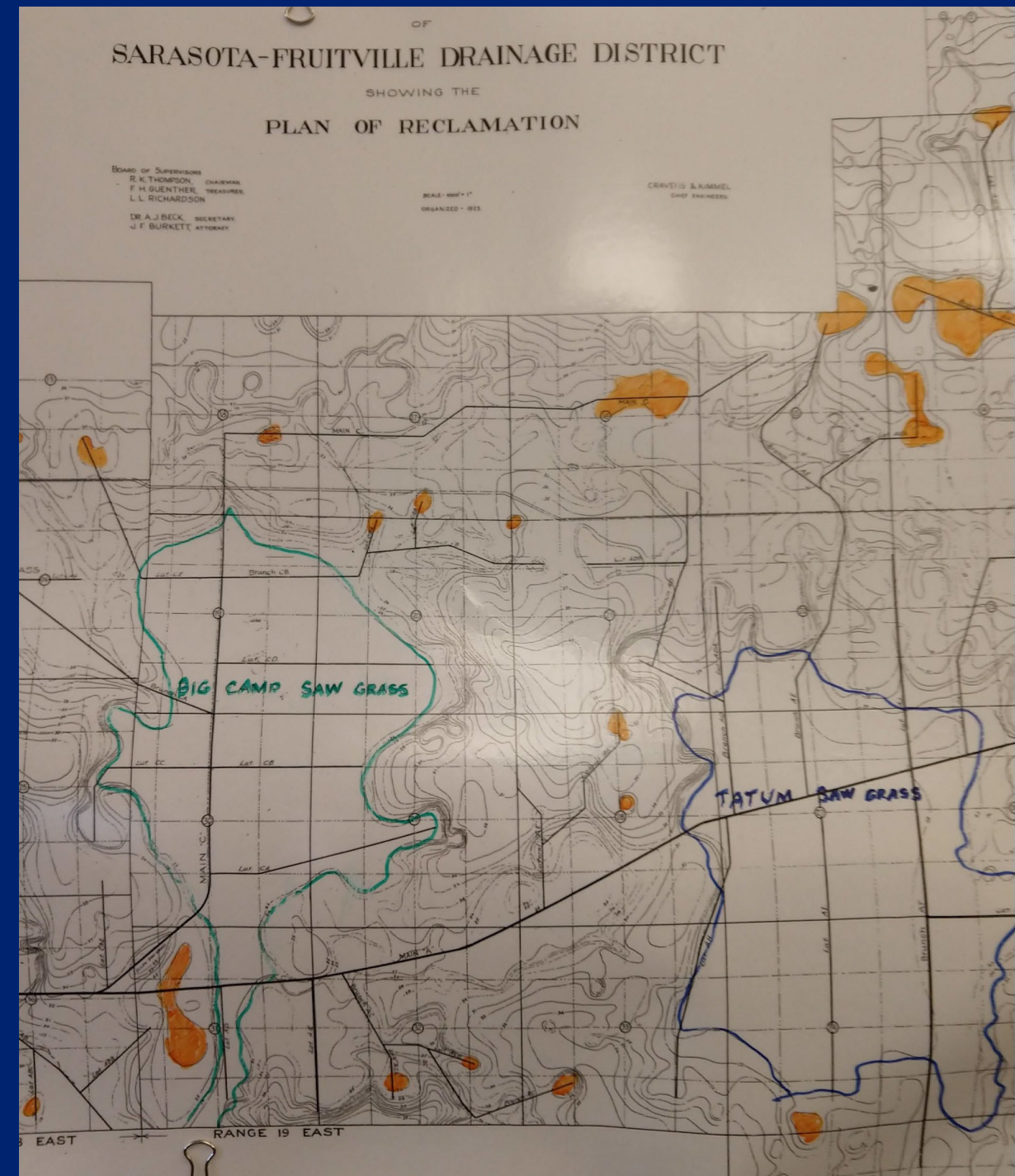
Figure 4. Map of the 16 Major Land Use Categories Used in the SIMPLE Model for 2021

Change in our region is not a recent trend.
Change is ever present and constant.
It all started with control of the water...

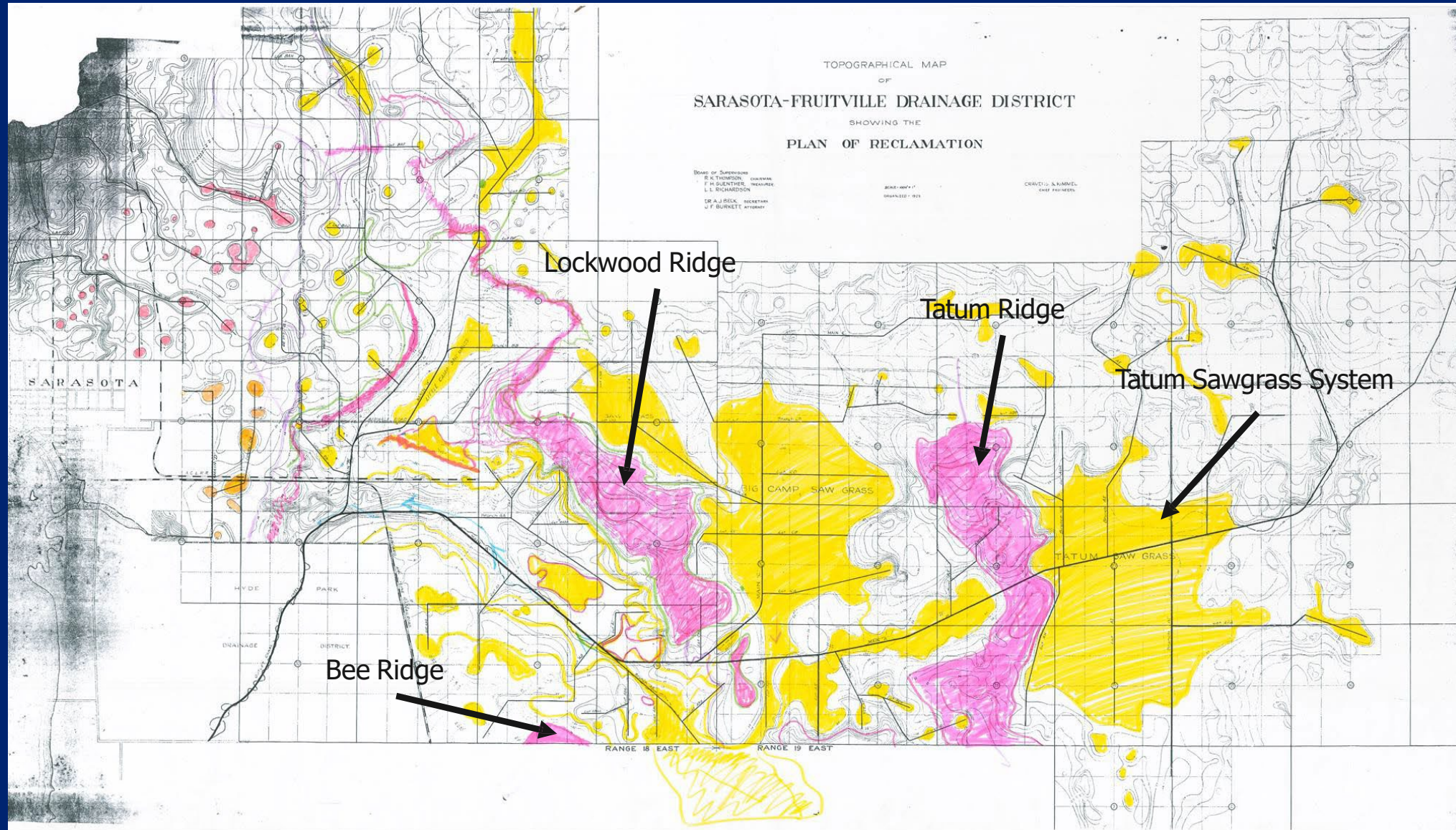


The Sarasota Bay Watershed was once very wet...

“I have bought land by the acre, and I have bought land by the foot; but, by God, I have never before bought land by the gallon.” – early Sarasota landowner 1920’s



1923 Drainage Design Map



The **impacts...**

Creeks altered to become “drainage outlets”.

Lowered water tables.

Drained the ponds and marshes for agricultural and later residential development; reducing storage capacity in the wetlands.

Maximized flow creating “flashiness” as development occurred.

Original systems was expanded in 1960-70’s to remediate flooding to maximize flow.

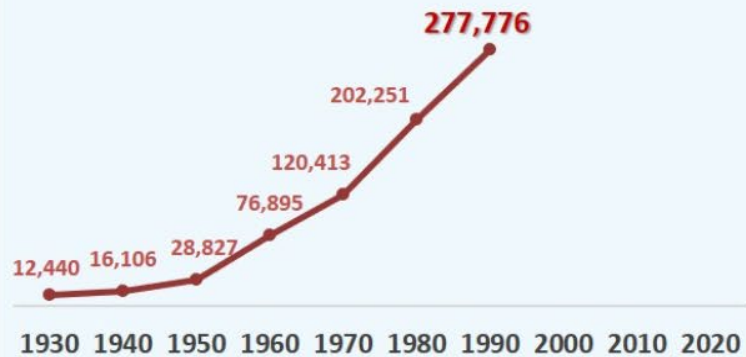


1990

Existing Residential Units

- Built 1981 to 1990
- Built 1980 or earlier

Resident Population Sarasota County



<https://storymaps.arcgis.com/stories/a60c1e328a1e4e74aaf9467f355e1a80>



Between 1950 – 1990:

80% of Sarasota County's mangrove shorelines were altered or lost.

39% of intertidal wetlands in the Sarasota Bay watershed were converted to development or agriculture.

30% decline in seagrass meadows.

Sarasota Bay in 1989

Poor water quality

Disappearing habitats and
wildlife

Lack of management
structure & rapid
population growth



Community response

Formation of Sarasota Bay National Estuary Program

- Framework for Action (1992)
- Comprehensive Conservation and Management Plan (1995)
- Updated regularly

1989

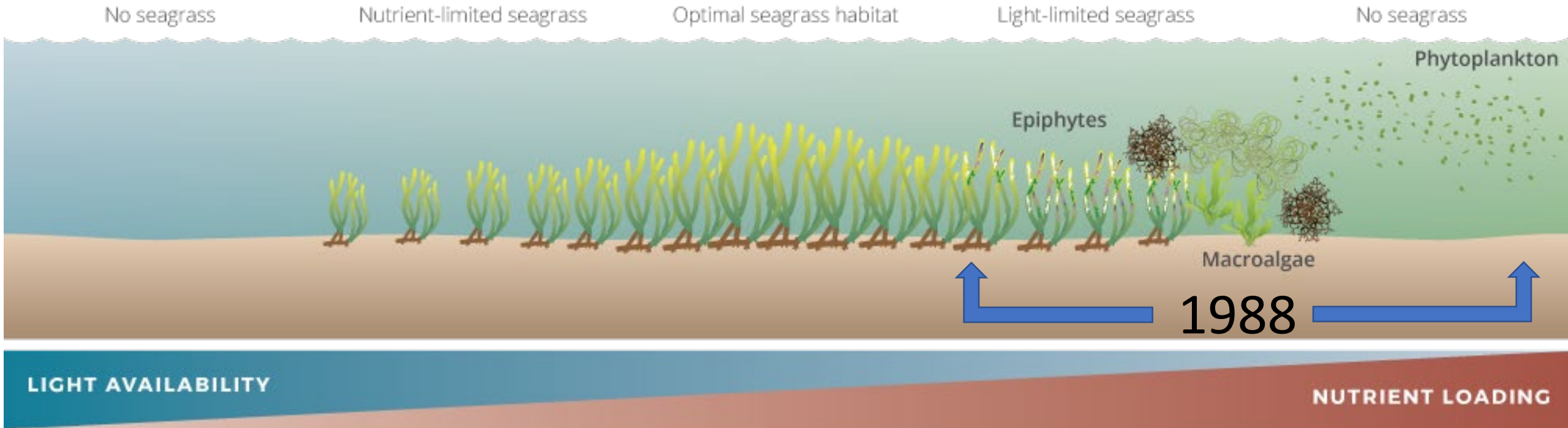
1995

Designation of Sarasota Bay as
Priority Water Body in Surface
Water Improvement and
Management Program

- Updated regularly

1989 Issue #1: Poor water quality – Nutrient Impairments (N and Chl-a)

EFFECT OF INCREASING NUTRIENTS ON SEAGRASSES AND OTHER PLANTS

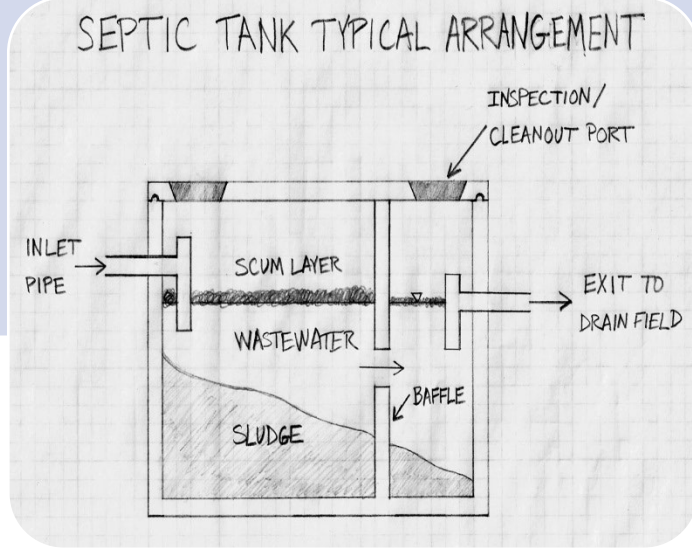


Conceptual diagram illustrating the effect of nutrients of aquatic primary producers

Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source:

ian.umces.edu

Sources of anthropogenic nitrogen in Sarasota Bay



Wastewater

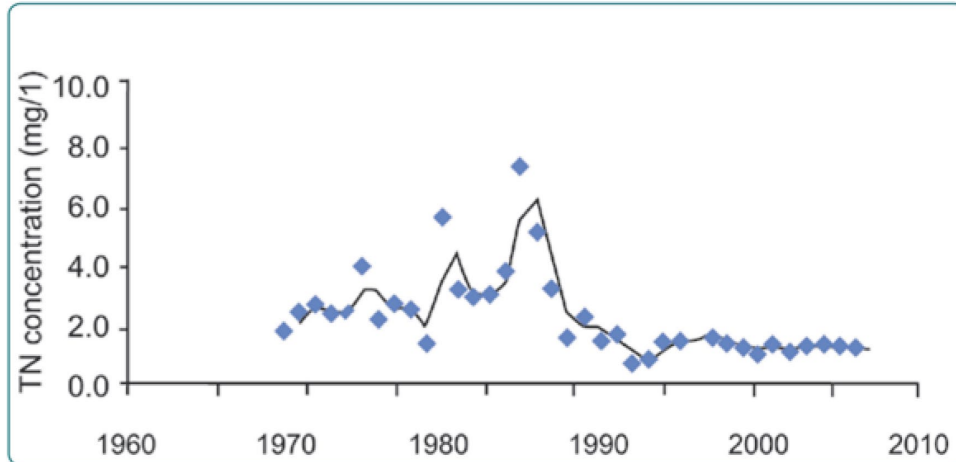


Stormwater



Atmosphere

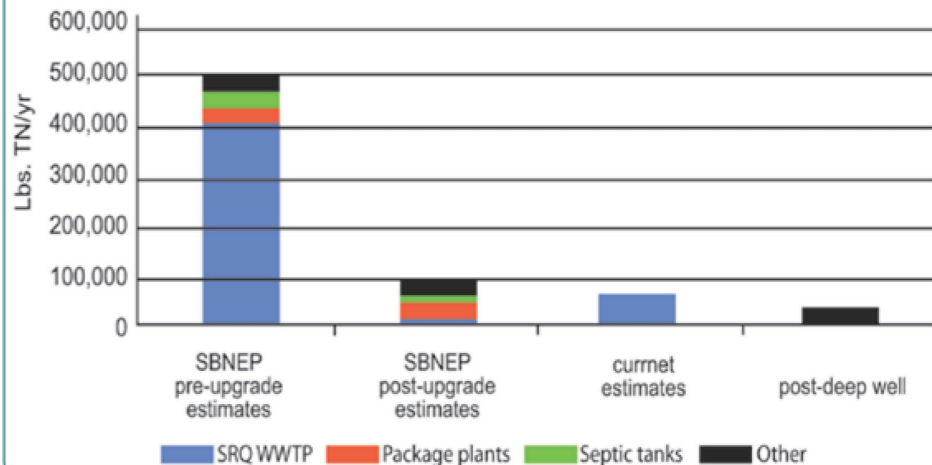
Phillippi Creek Nitrogen Concentrations (annual average)



Nitrogen concentrations in Phillippi Creek.

Source: Kurz, 2005

Nitrogen Loads to Whitaker Bayou

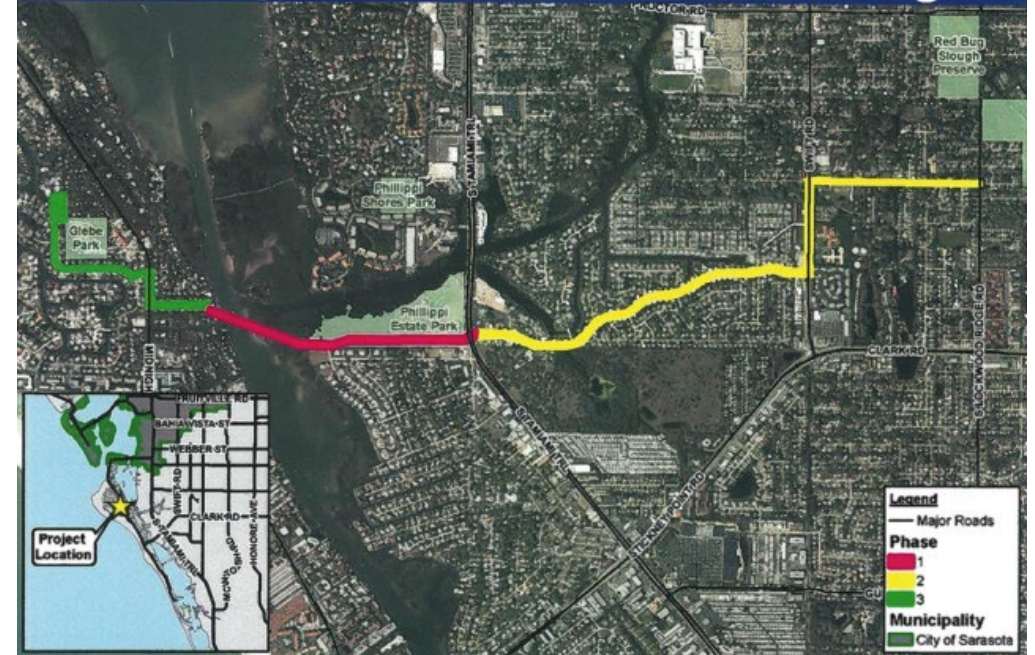


Nitrogen loads to Whitaker Bayou.

Source: Tomasko et al., 2005

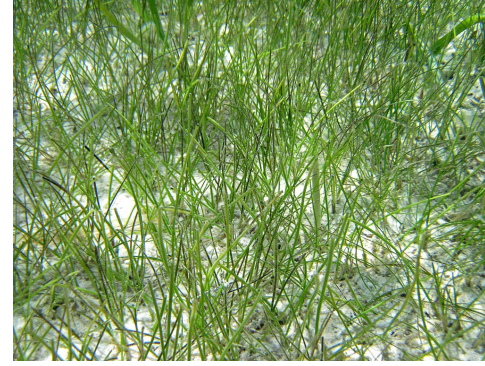
By 1999 the removal of septic systems and outdated Non-AWT wastewater treatment plants reduced nitrogen loads to Sarasota Bay by 67%.

Siesta Key AWWTP Decommissioning

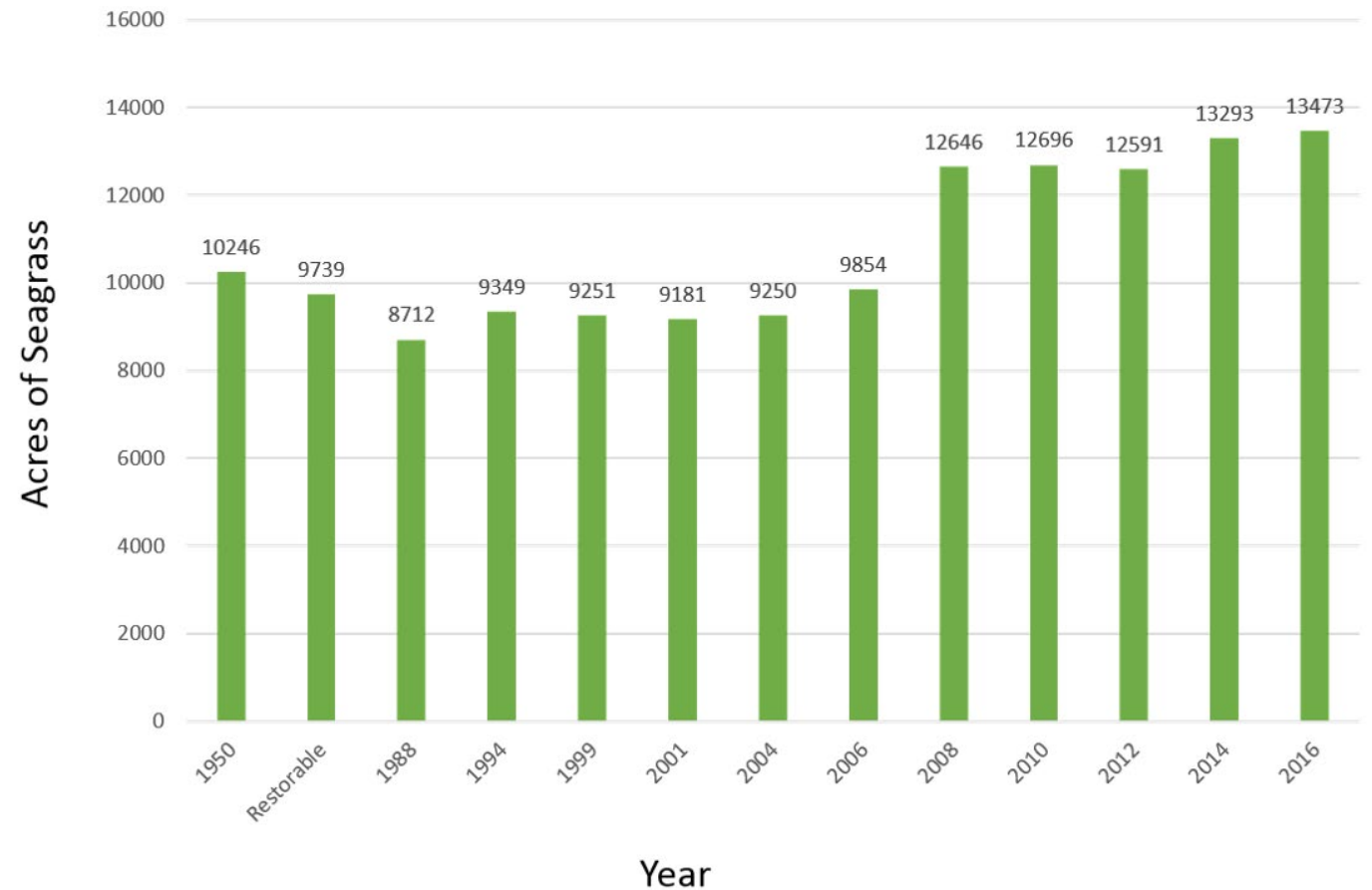


2016 Conclusion:
Reducing pollution
has direct benefits

Seagrass meadows
in Sarasota Bay
have increased by
54% since the late
1980s.



SBEP Seagrass Coverage (Acres)



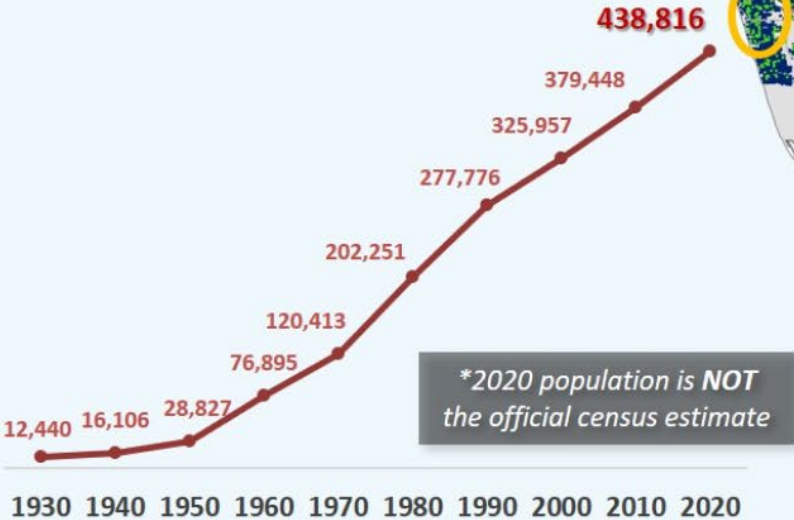
Urbanization
and growth
continued and
stretched
wastewater
capacity and
infrastructure

2020

Existing Residential Units

- Built 2011 to 2020
- Built 2010 or earlier
- New Large Developments (sample)
- Infill and Redevelopment (sample)

Resident Population
Sarasota County

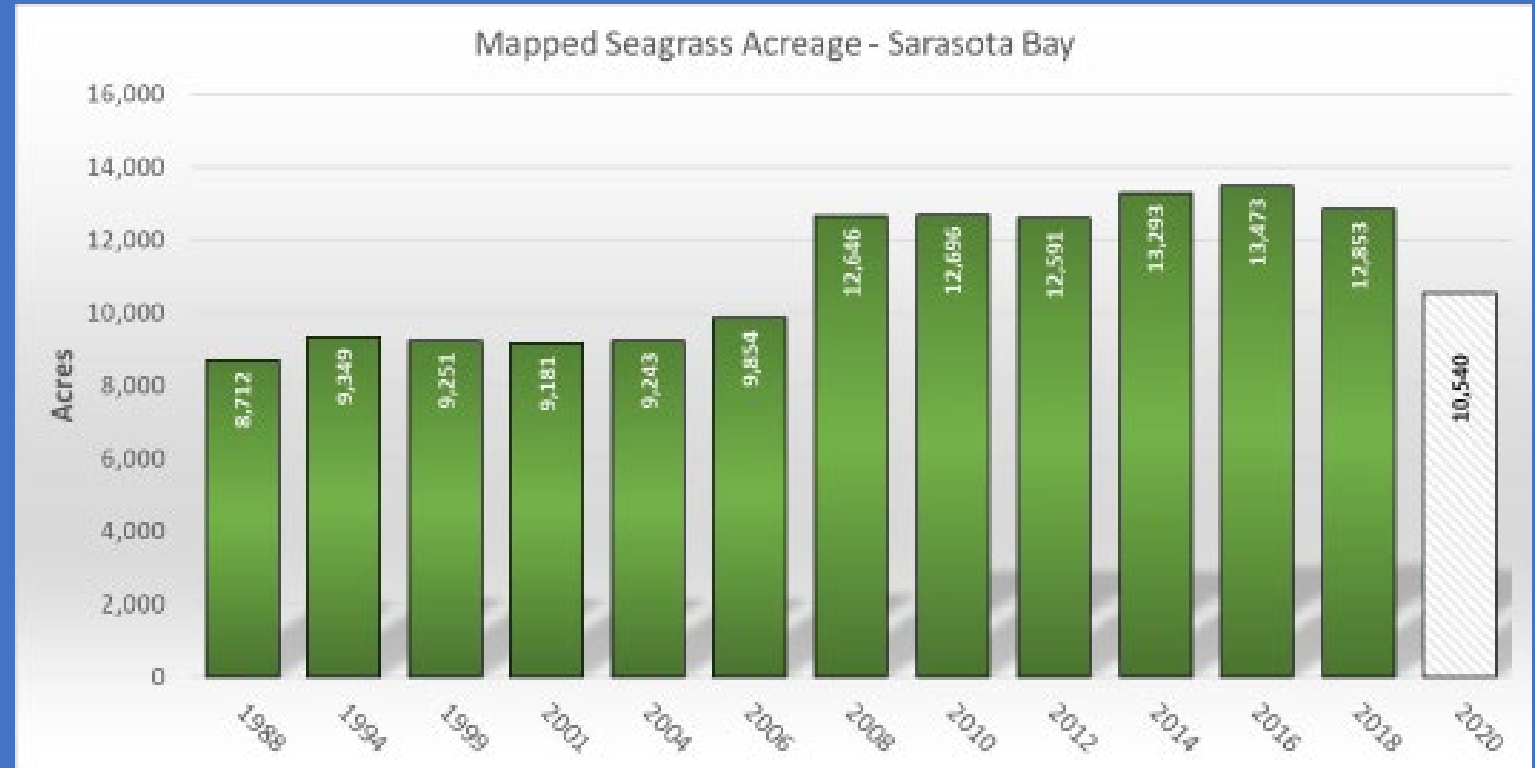


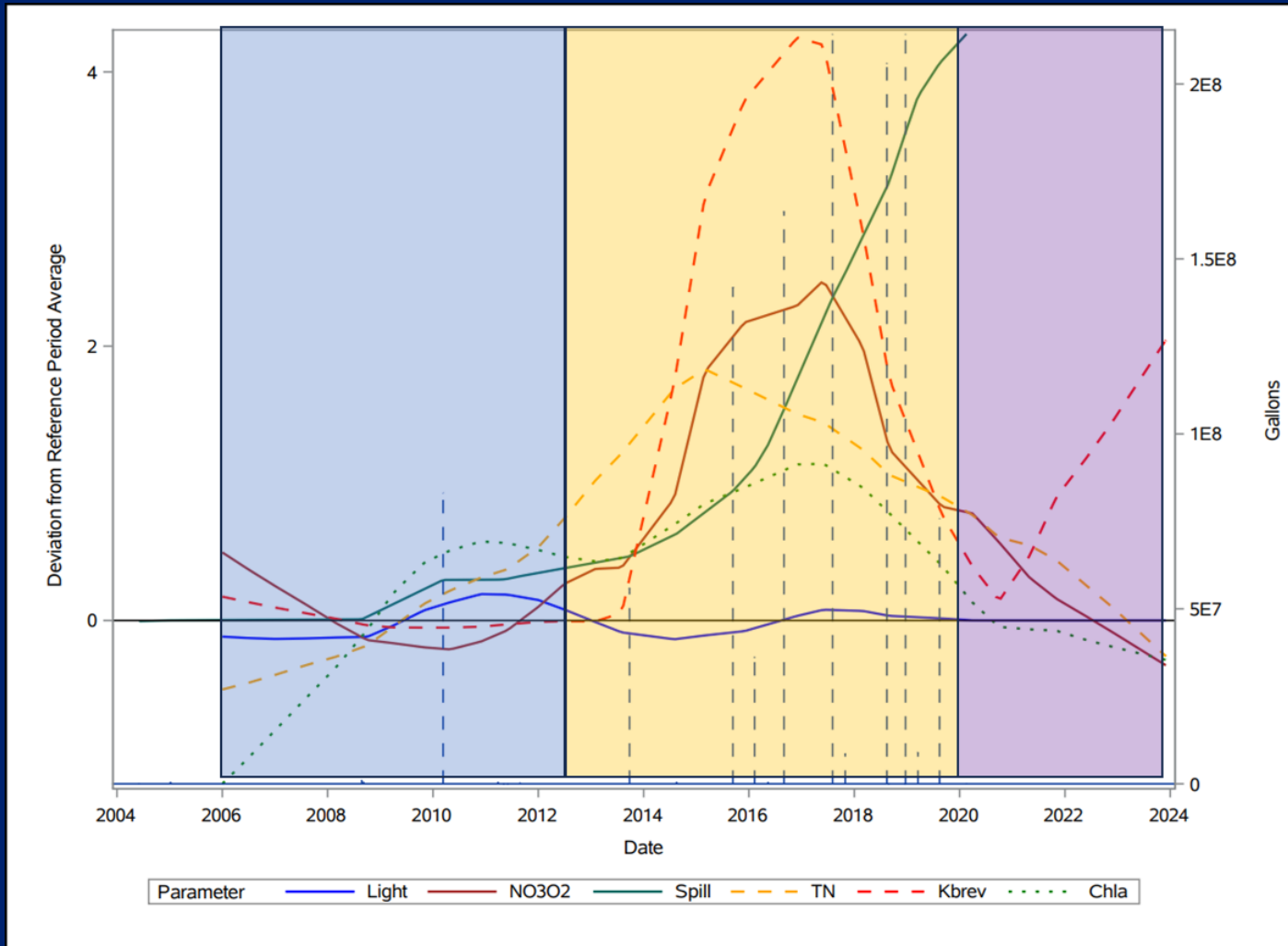
Villages of
LWR South

Grand Palm

West Villages
(North Port)

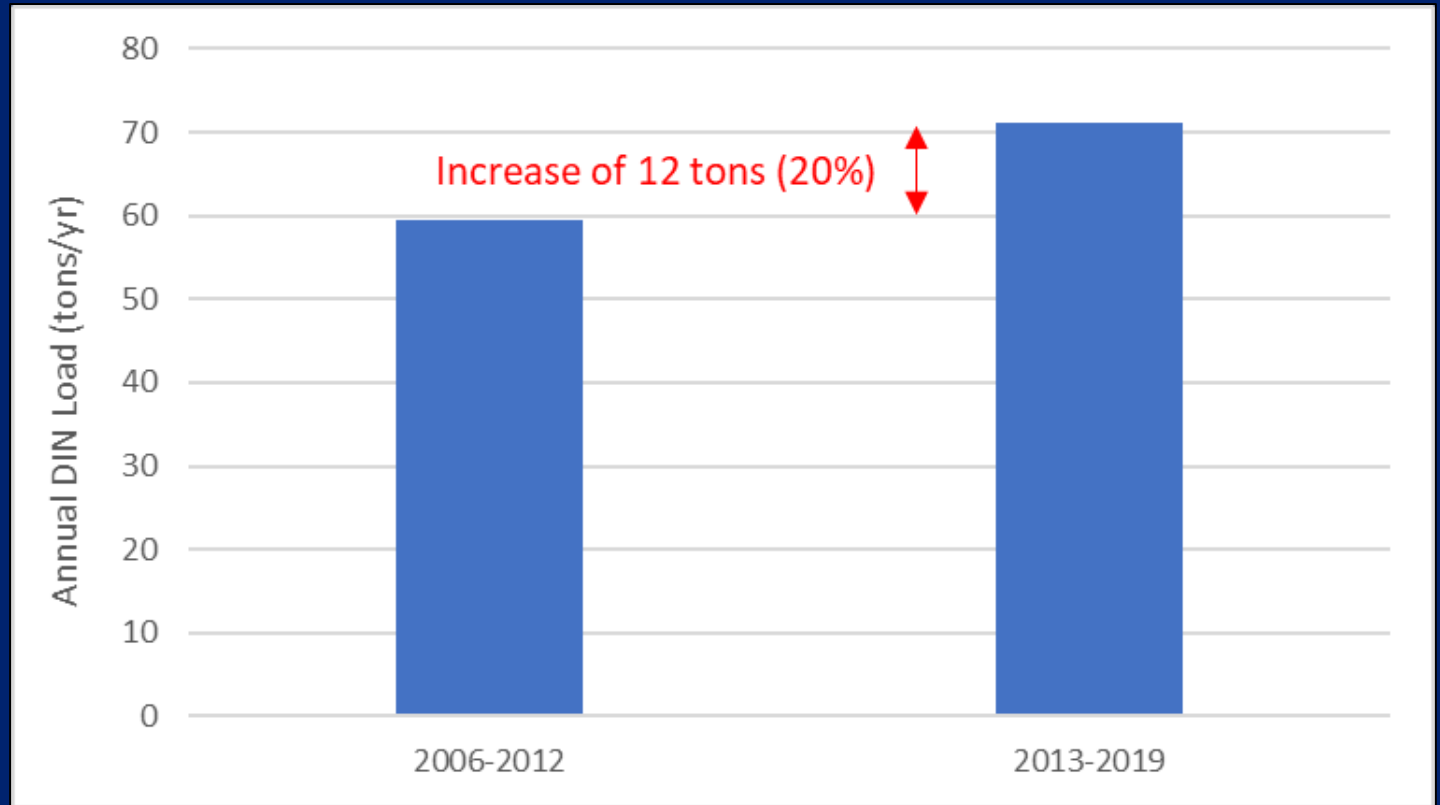
2020 down –
22% - from peak
coverage in 2016





- The bay entered a **Degraded Period (2013-2019)** clearly worse for multiple indicators of trophic status
 - DIN, TN, Chl-a, *K. brevis*
- Causes were multiple **wastewater spills (green line) over 1 BILLION gallons in total**
 - Ageing infrastructure operating above capacity
 - Infiltration
 - Mostly restricted to “degraded period”
- Are spills the only issue?
 - Likely that over-application of high nutrient reclaimed water preceded discharges

The most relevant nutrient load to the bay is Nitrogen that increased by 20%



Stormwater runoff – Lower Nitrogen concentrations (30% DIN)

Wastewater – Higher concentrations (80 to 90% DIN)



Yes, there is more than 12 tons that we could act on!

Could we reduce
inorganic nitrogen
loads by 12 tons?

- Reclaimed water - 20 tons/yr.
- **Spills and overflows - 6 tons/yr.**
- Septic tanks ca. 20 tons/yr.
- Eliminating these sources is more than enough to get what we need

How to get there:

- Lining wastewater pipes
- Conversion of treatment plants to AWT
- Stormwater retrofits of older neighborhoods to reduce the “non-zero” impacts of new development

Early Investments in Load Reduction



\$25 million spent by Manatee County to upgrade SWRWRF



\$1 million spent by SWFWMD and Sarasota County on stormwater retrofit at Hudson Bayou (800 acres)



\$250 million by Sarasota County to expand and upgrade Bee Ridge WWTP



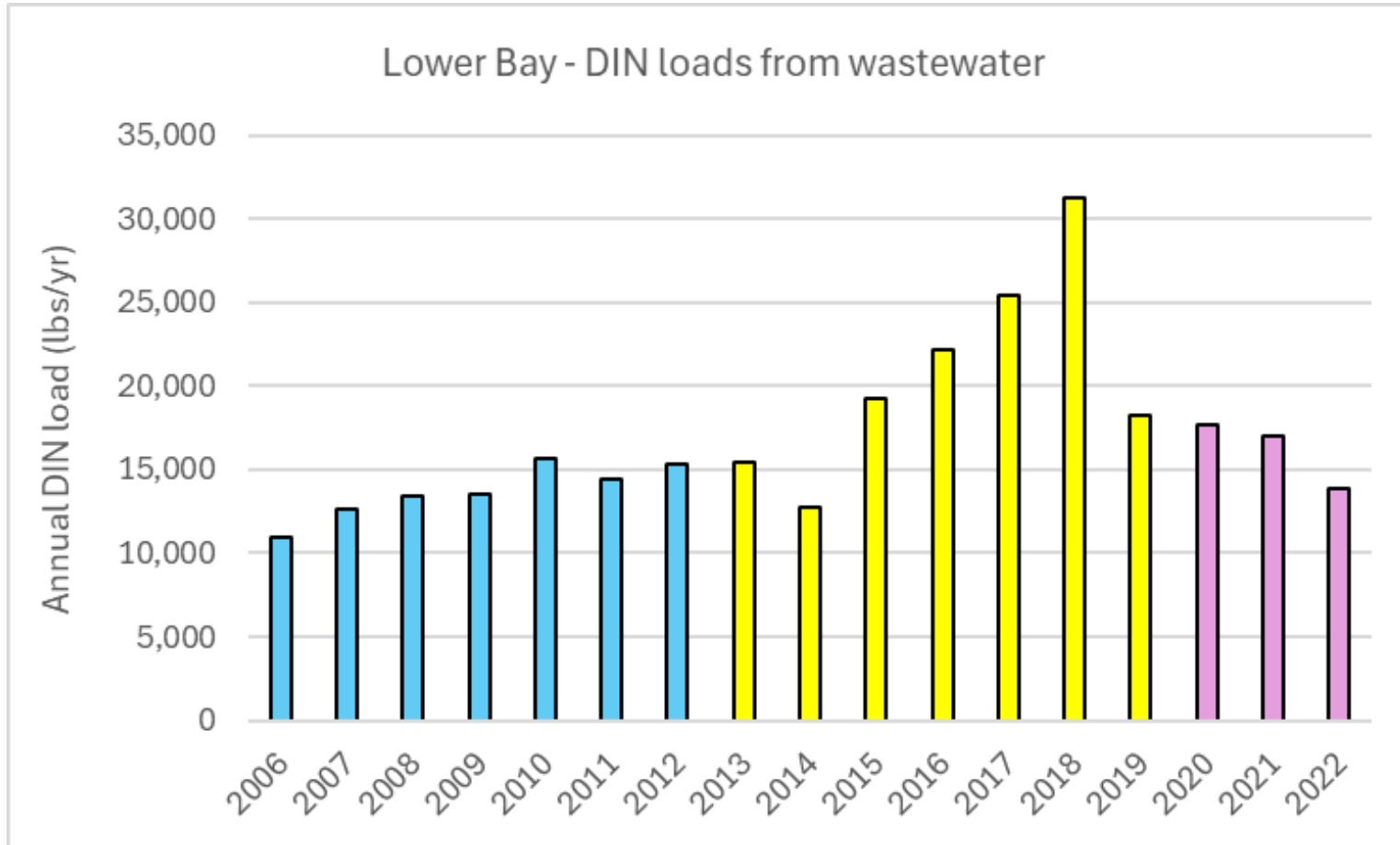
\$3 million by SWFWMD and City of Sarasota on Bobby Jones stormwater retrofit (5,700 acres)



\$1.8 million from EPA for FISH Preserve Phase IV, GT Bray, and restarting artificial reef program



Changes in DIN loads to lower bay



Wastewater DIN loads:

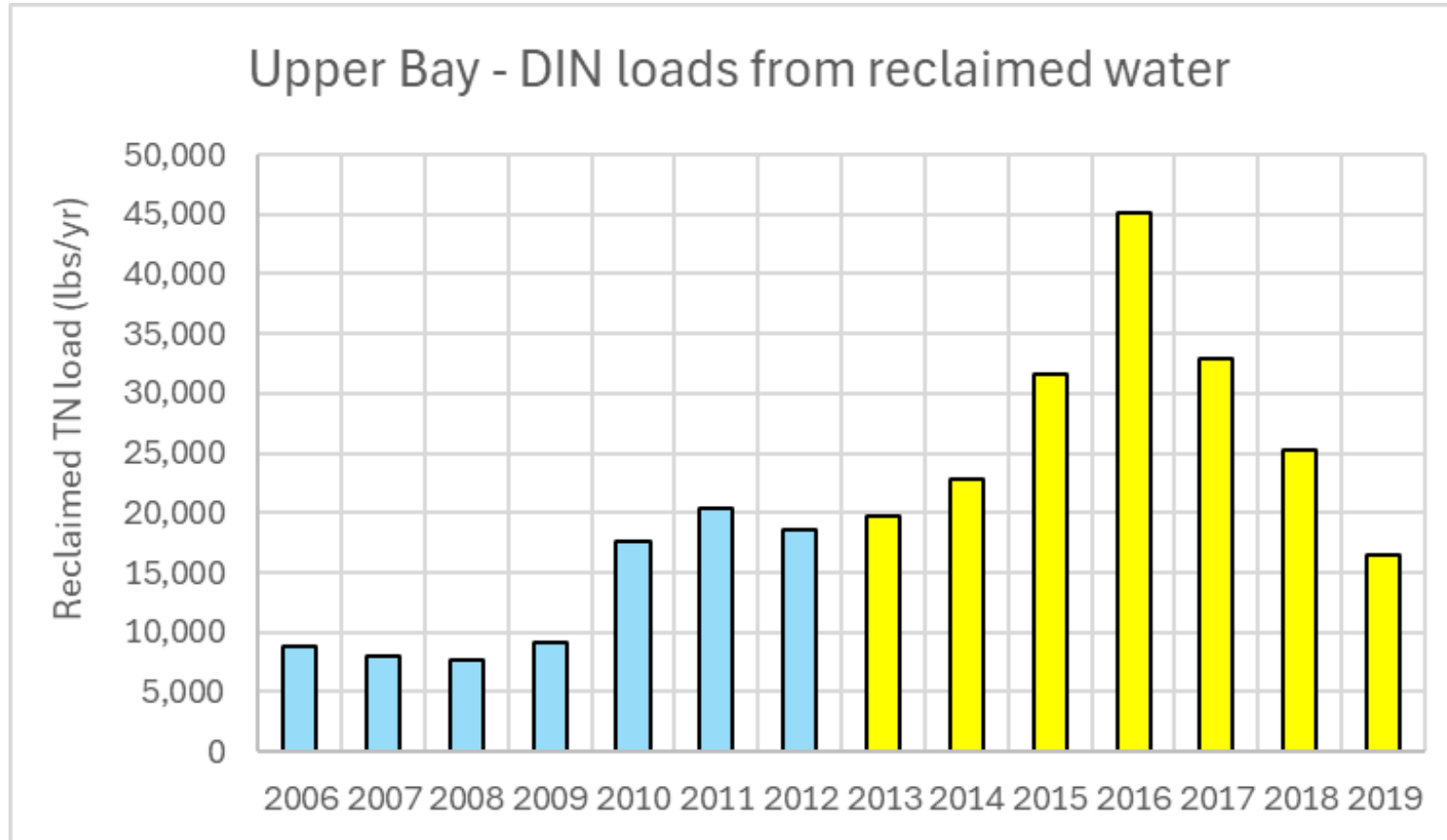
50% increase (on average) from reference to degraded periods

22% decrease (on average; so far) from degraded to recovering periods

Over 8 tons/ yr decline from 2018 to 2022



Changes in DIN loads to upper bay



Reclaimed water DIN loads:

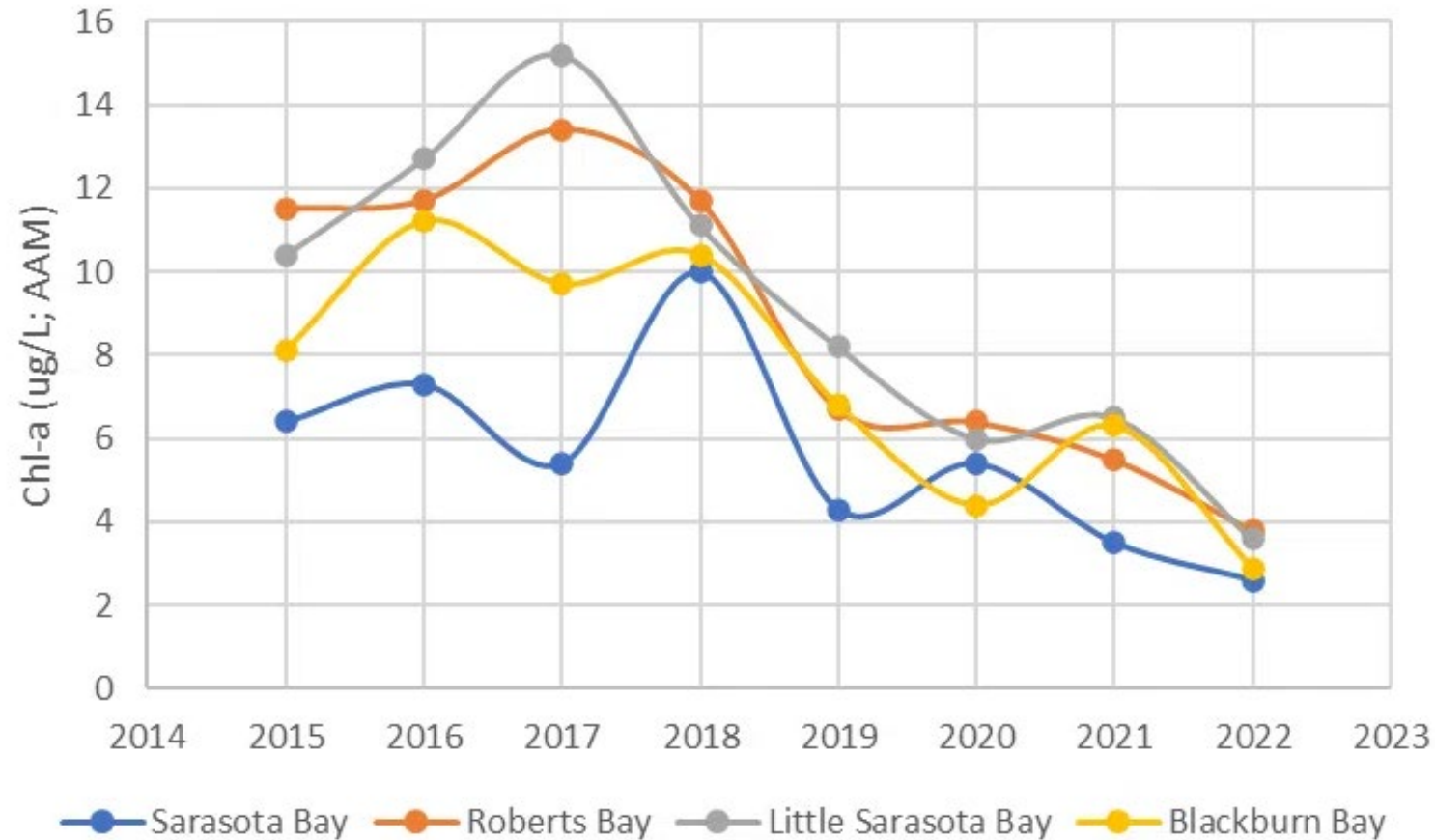
115% increase (on average) from reference to degraded periods

Upgrade to Manatee County SW Treatment Plant around 2017 (from ca. 13 to ca. 7 mg TN/L)

Approximate 15 tons/ yr decline from 2016 to 2019



Widespread improvements in water quality



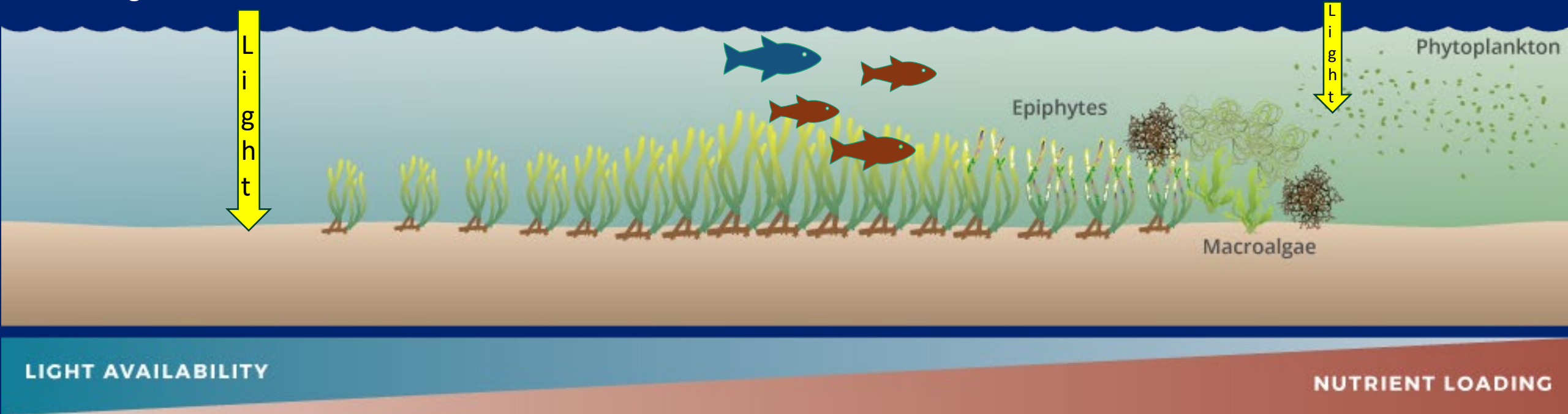
>50% decline in
Chl-a between
2015 and 2022



We are reminded that Managing Sarasota Bay Means Managing Nitrogen

Low Nitrogen

High Nitrogen



Conceptual diagram illustrating the effect of nutrients on aquatic primary producers

Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source:

ian.umces.edu

Ecosystem Health Report Card

WHAT IS THE BAY REPORT CARD?

Every year, we create an **Ecosystem Health Report Card** to track conditions in each of our five bay segments. The report card is intended to guide and prioritize monitoring and management actions. We use **four measurements** of ecosystem health to assess conditions in our bays.

Total Nitrogen

A common nutrient.
Too much can lead to
algae growth.



Chlorophyll-a

Floating microscopic algae.
Too much can impact water
clarity.



Seagrass

Vital to our bay.
A good indicator of
overall water quality.



Macroalgae

Known as seaweeds.
Can be harmful to bay
health when present in
high quantities.

HOW DO WE SCORE?

We assign each bay segment one of four scores for each year based on the status of that bay segment's ecosystem health indicators. We encourage continued monitoring in bay segments with good scores while bays with poorer scores require more attention.

One poor score may not indicate an ongoing problem, but a bay with several years of yellow or red scores almost certainly needs scrutiny and management action.

- A** All signs indicate healthy water quality;
continue to monitor as usual
- B** Most signs indicate healthy water quality;
monitor carefully
- C** One or more signs indicate concern;
investigate stressors, check for compliance
with wastewater and stormwater permits,
and plan for management actions
- D** All signs indicate water quality degradation;
take management actions





SARASOTA BAY ECOSYSTEM HEALTH REPORT CARD

2024

	YEAR	PALMA SOLA	UPPER	ROBERTS	LITTLE	BLACKBURN
Reference Period	2006	3.67	3.50	3.50	3.75	3.75
	2007	3.00	3.25	4.00	3.75	3.75
	2008	3.67	3.00	3.00	3.25	3.25
	2009	3.67	3.25	3.25	3.50	3.00
	2010	3.67	3.50	3.00	2.75	2.75
	2011	4.00	3.50	3.00	2.75	2.50
	2012	3.00	3.25	3.25	3.00	3.00
Degraded Period	2013	3.67	3.00	2.50	2.00	2.00
	2014	4.00	3.50	2.50	2.25	2.25
	2015	3.67	2.75	2.00	2.00	2.00
	2016	3.67	2.75	1.75	1.75	2.25
	2017	3.67	2.75	2.00	2.00	2.00
	2018	4.00	2.25	2.00	1.25	1.75
	2019	4.00	2.75	3.25	1.50	1.50
Recovering	2020	4.00	3.00	3.00	2.25	2.00
	2021	3.75	3.75	3.75	2.75	3.00
	2022	4.00	3.25	2.75	2.25	2.75
	2023	3.75	3.50	3.50	3.00	3.25
	2024	3.75	3.75	3.25	2.75	2.75

Excellent Conditions	Concerning Conditions
Good Conditions	Poor Conditions

Ecosystem Health Indicators

Total Nitrogen
A common nutrient.
Too much can lead to algae growth.

Chlorophyll-a
Floating microscopic algae. Too much can impact water clarity.

Seagrass
Vital to our bay. A good indicator of overall water quality.

Macroalgae
Known as seaweeds. Can be harmful to bay health when present in high quantities.

Reference period

Degraded period

Improving trends

Ecosystem Health Report Card

Across the bay, healthier conditions during the **reference period**.

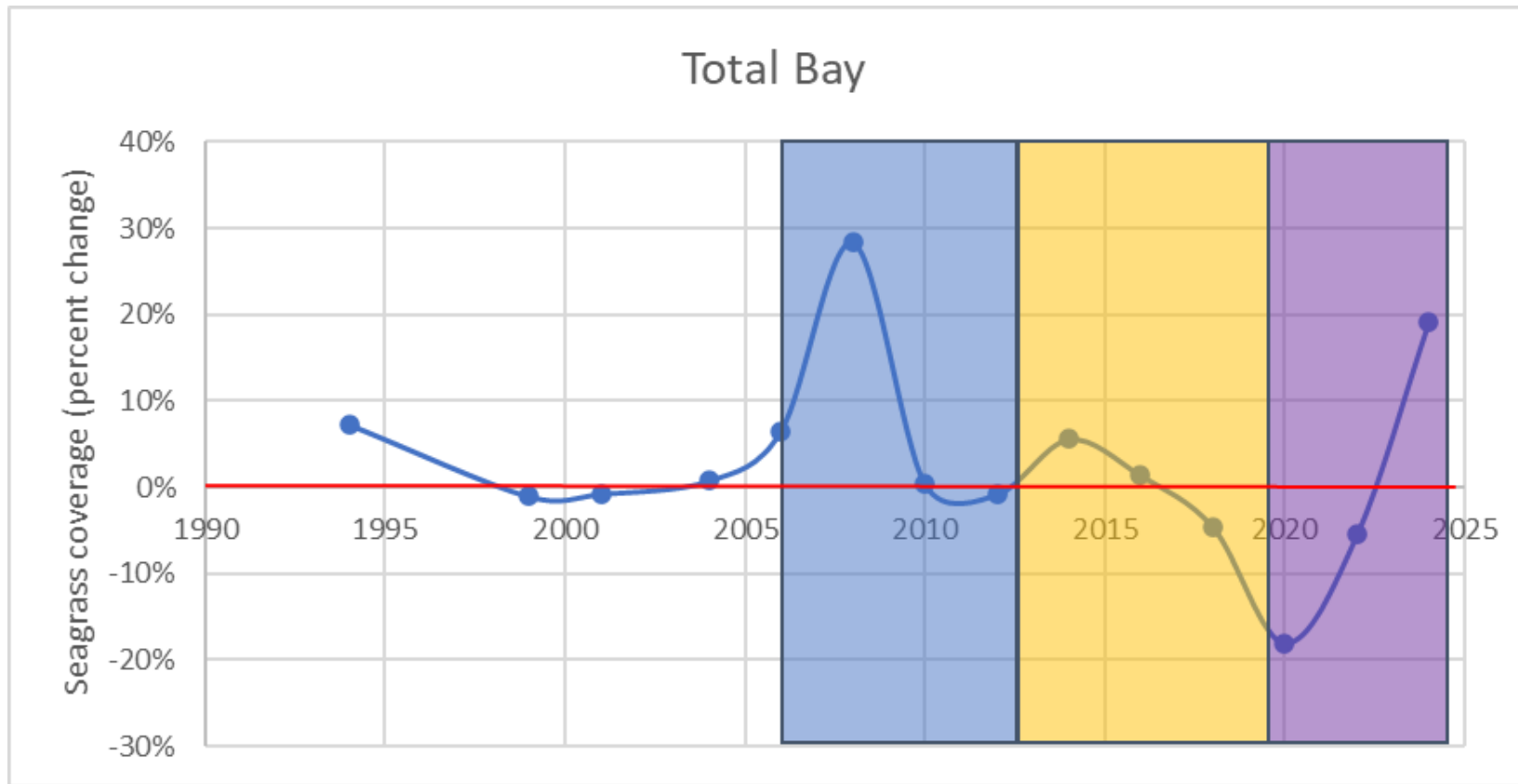
Better water quality, less macroalgae, ca. 30% increase in seagrass

During the **degraded period**, worse water quality *dissolved inorganic nitrogen (DIN) loads were 20% higher*, more macroalgae, and ca. 30% seagrass loss

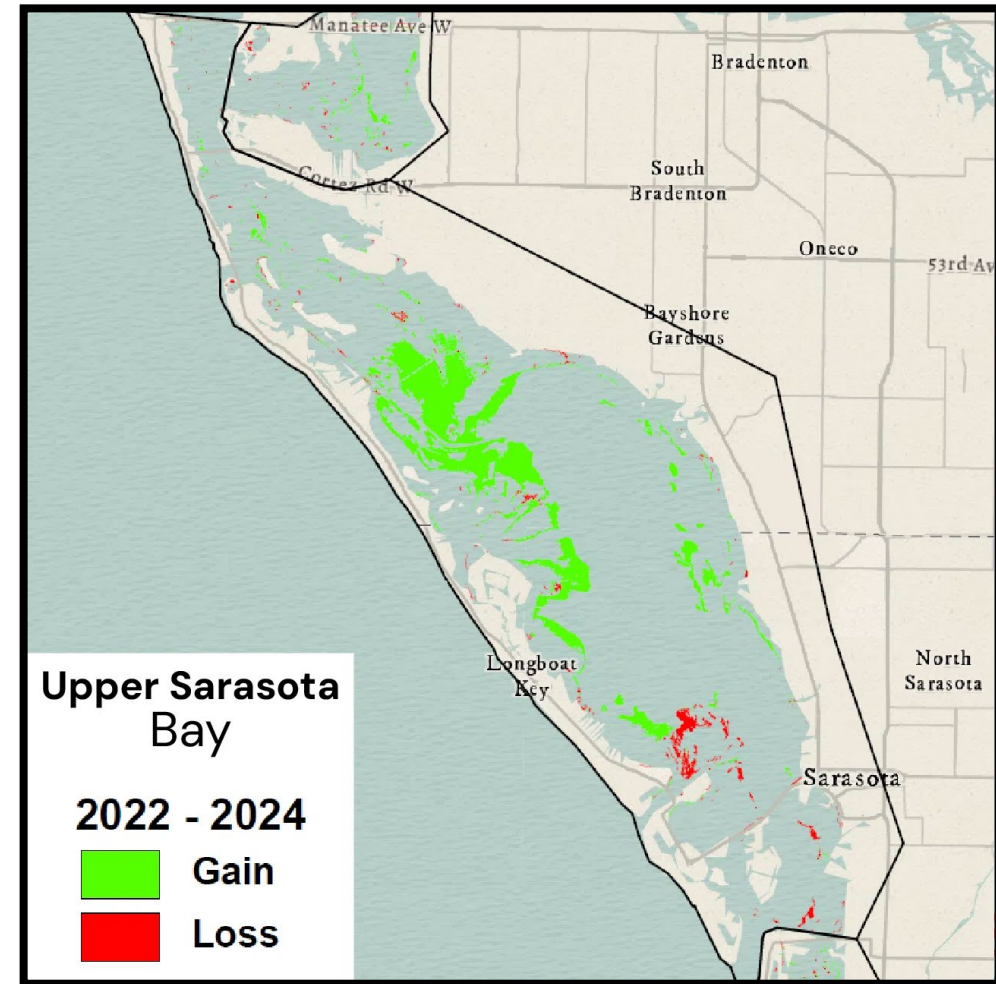
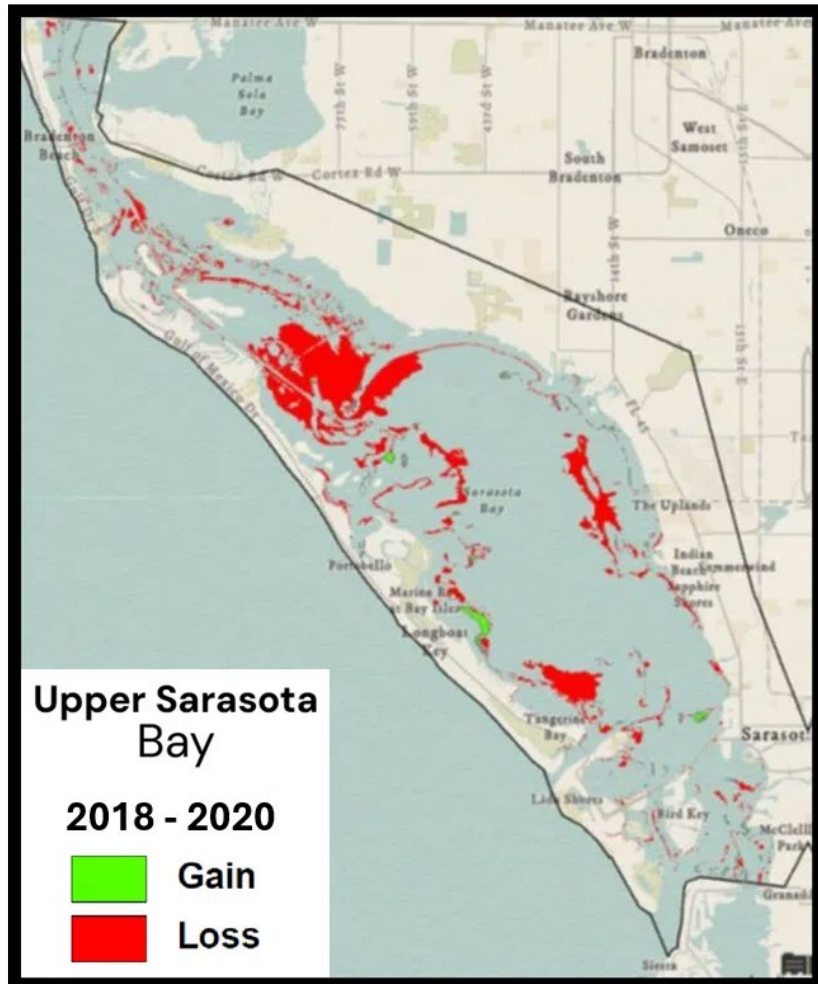
DIN loads reduced by 20% (12 tons) evidence of **improving conditions** despite Piney Point in 2021, Hurricane Ian and Tropical Storm Nicole in 2022, and the storms of 2024.

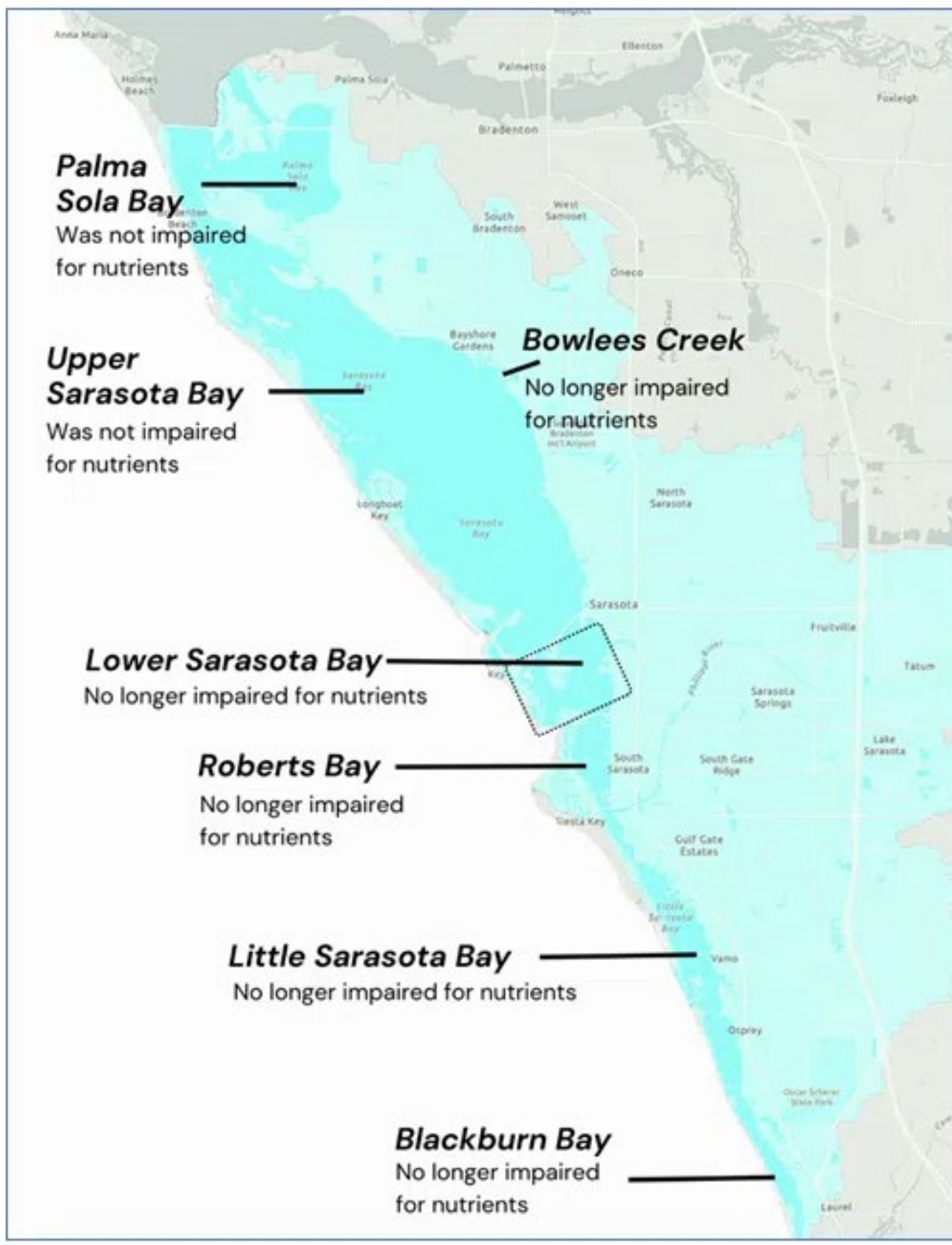


2024 - second biggest increase (19%) in seagrass coverage (1,900 acres)
over the past 30 years



However, much of the increase is recovery from prior decreases





Sarasota Bay is no longer
“impaired” for nutrients
(FDEP, 2023)



Wildlife benefits of expected substantial increase in seagrass acreage



Great news, but we must still be vigilant...

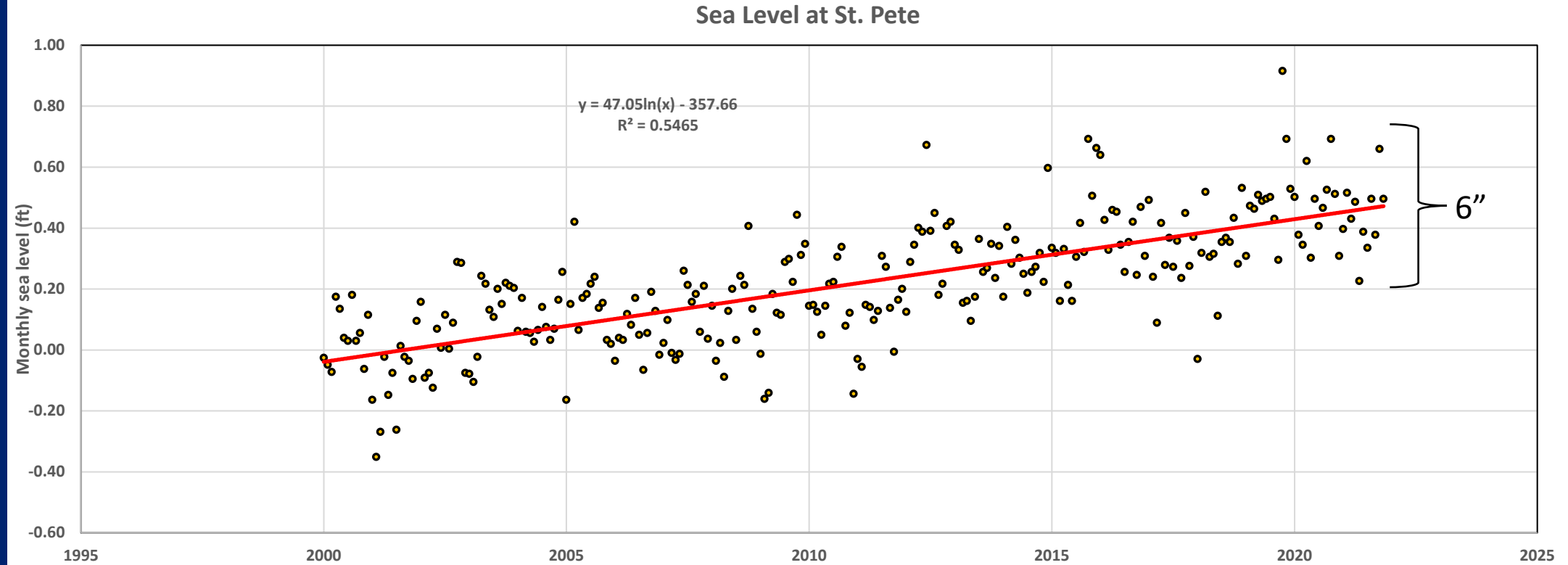
Our population will
continue to grow
across the watershed

- We have a “hold the line” strategy
- Focus on the next 30 years

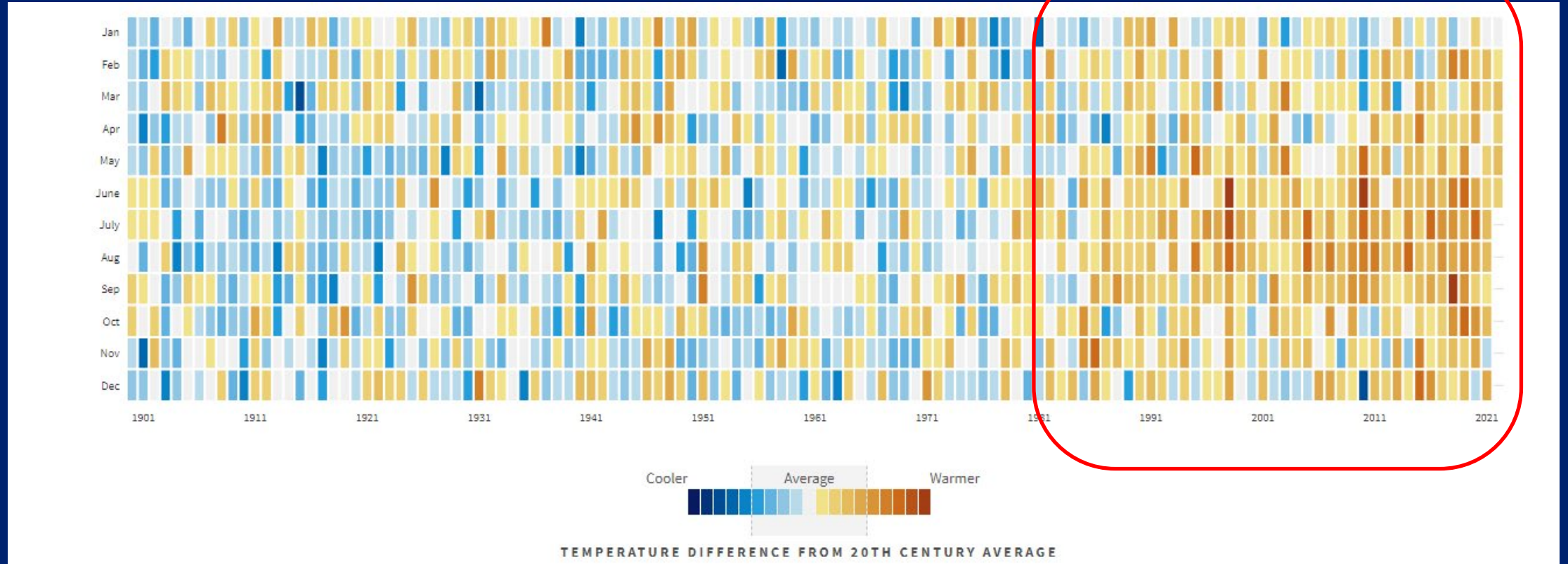
Our climate is changing
in ways that will
complicate our efforts

- Sea level
- Temperatures
- Tropical events

Sea Level Data Since 2000

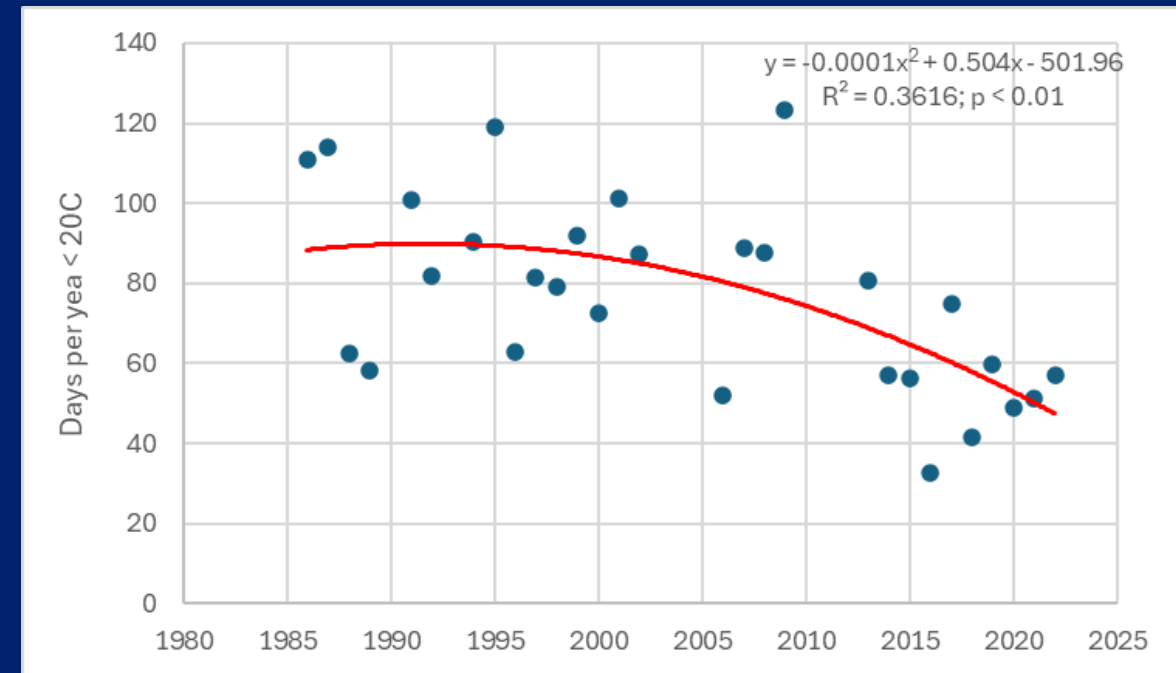


Overall trend of increased air temperatures across most of the year

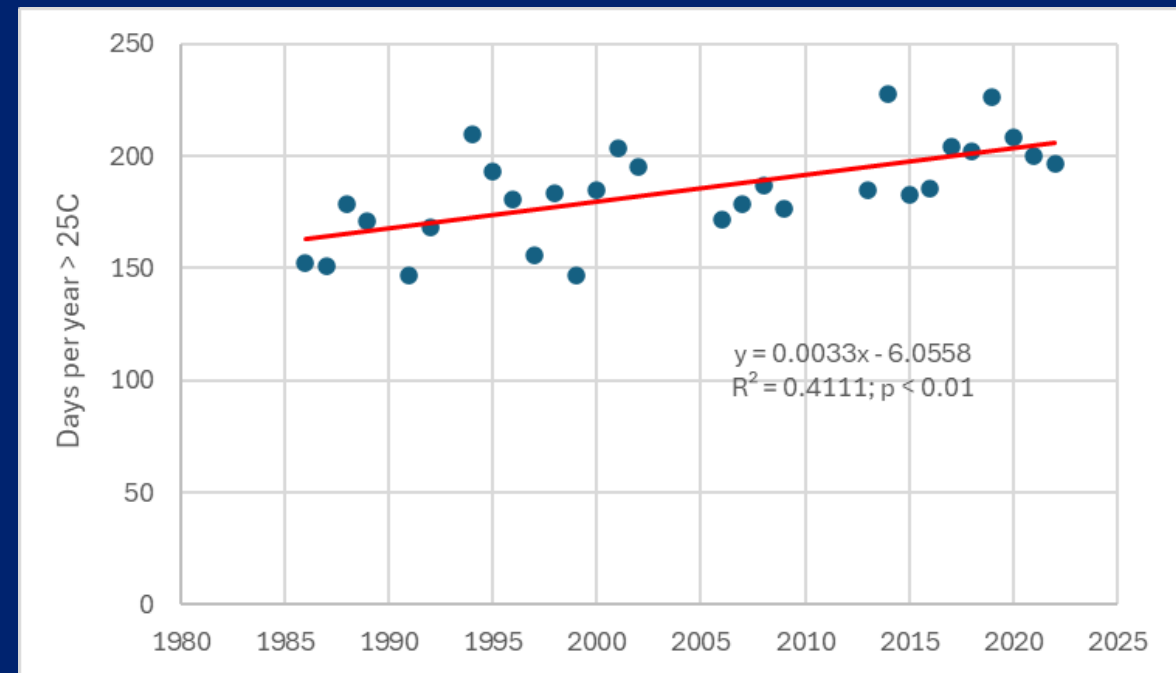


[Climate in Sarasota County, Florida](#) | [USAFacts](#)

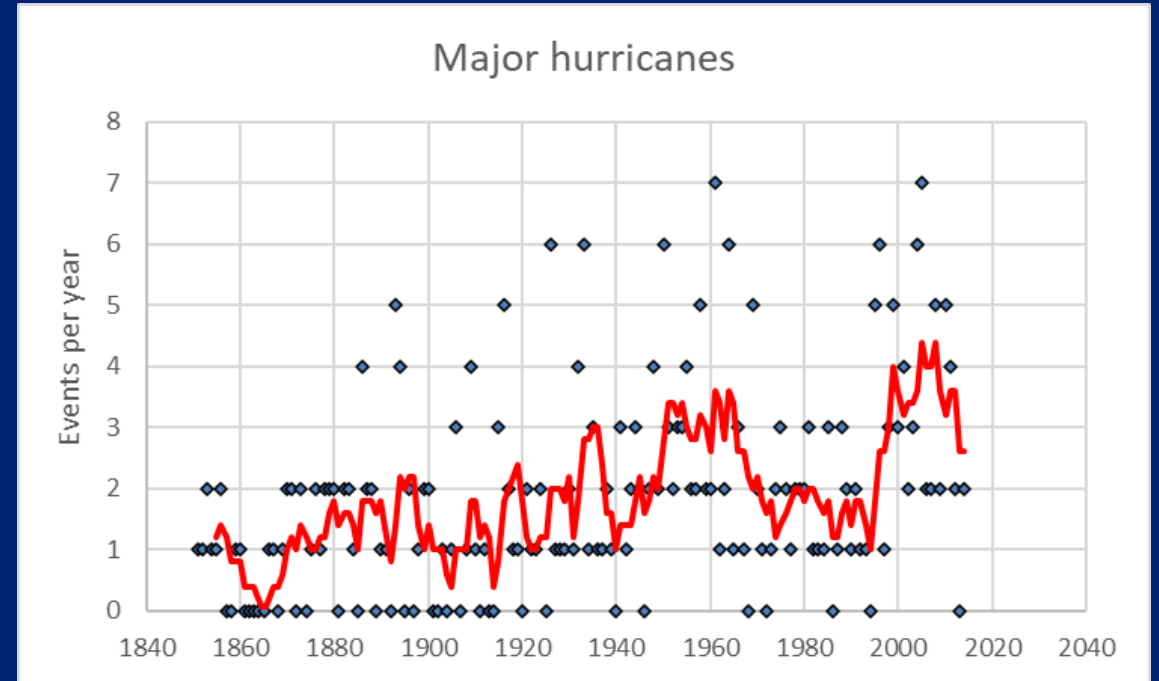
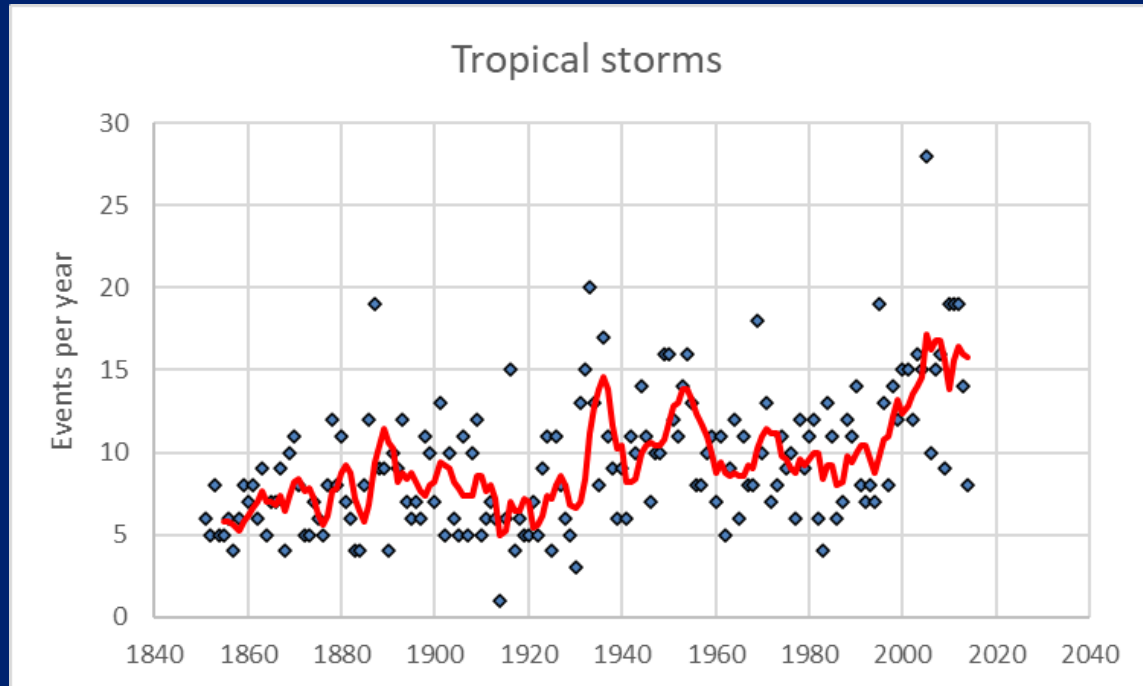
- Water temperatures below 20⁰ C (68⁰ F)
 - Reduced growth rate for *Karenia brevis*
 - Mid to late 1980s – 3 months/yr “too cold”
 - Last 10 years - 1 1/2 months/yr “too cold”



- Water temperatures above 25⁰ C (77⁰ F)
 - Higher growth rate for *Dapis pleousa*
 - Mid to late 1980s – 5-month growing season
 - Last 10 years – 6 1/2 month growing season



Tropical storms and hurricanes are “heat engines”

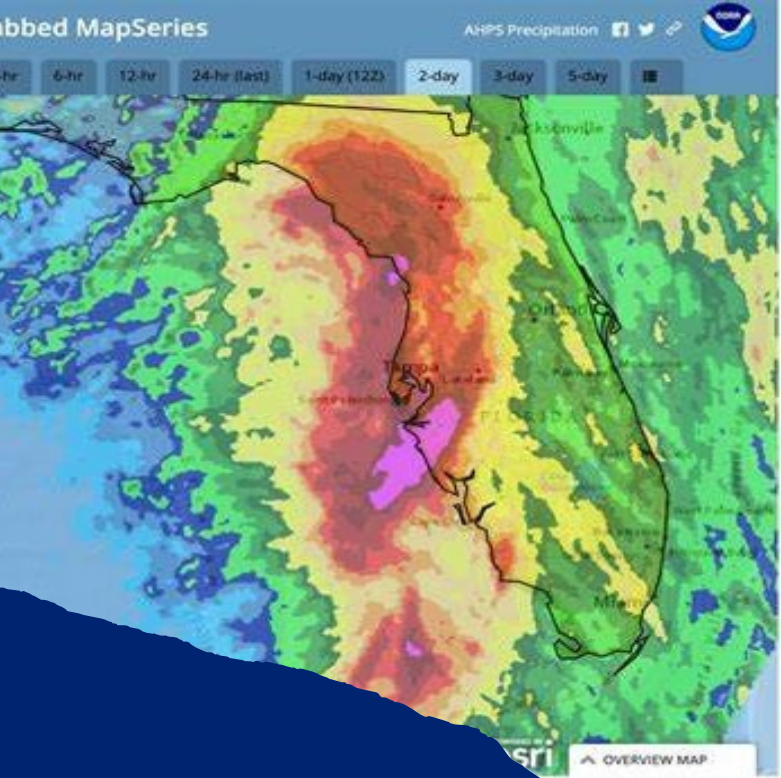


National Hurricane Center - Atlantic Basin Count - <https://www.nhc.noaa.gov/climo/>

A lot of “once in a century” events lately...



- Ian (2022)
- Nicole (2022)
- Idalia (2023)
- Invest 90L (June 2024)
- Debby (August 2024)
- Helene (September 2024)
- Milton (October 2024)



Increasing rainfall and larger more frequent hurricanes are stressing the older coastal stormwater systems.

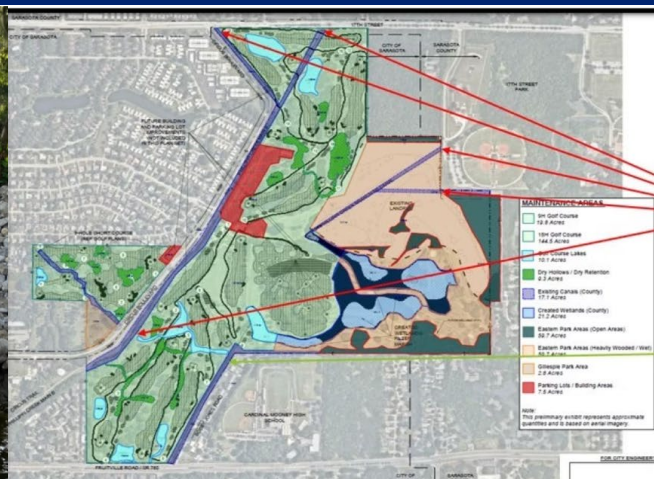
Pre 2000 stormwater conveyances were designed to drain the land by rapidly move water to the bay leaving little time for the watershed to do it's job.

Our bays and estuaries receive a large pulse of polluted freshwater from their watersheds that can result in fishkills and increased chances of red tide events.



Regional Stormwater Retrofit Project Bobby Jones Golf Course

Treats 5,800-acre watershed resulting in an estimated removal >900 lbs TN/yr



Inflow comes from Phillippi Creek Main B and Phillippi Creek Branch BB Canal. Water is directed through the wetland system at the Nature Park at Bobby Jones

Outflow continues downstream of Phillippi Creek Branch BB Canal.



Coastal Change is Constant

Helene's storm surge created a pass – which lasted just a few days

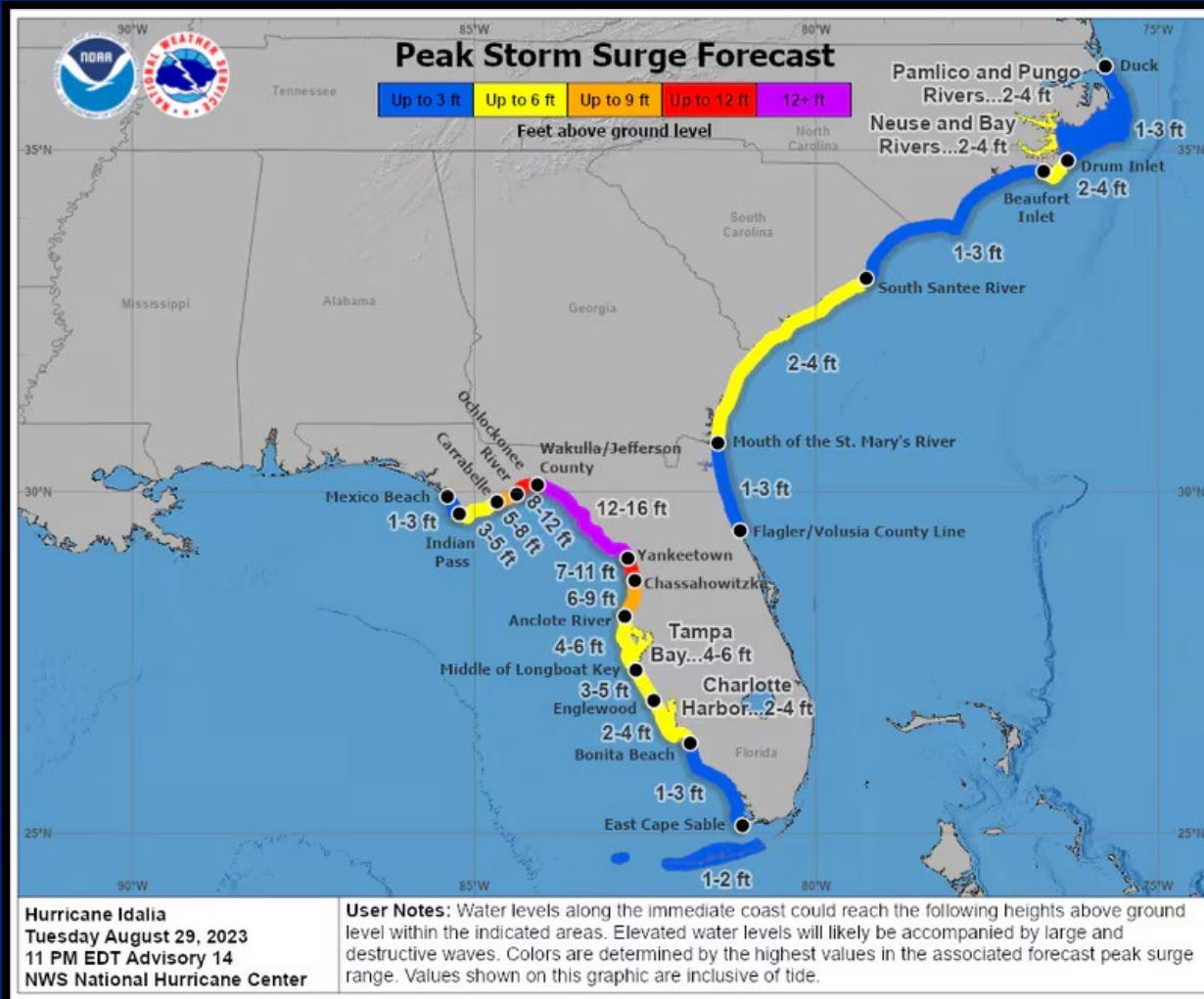


Photo via Oyster Boys posting on Facebook

Surge *and wave action* from Milton finished the job



Closed Pass 10-day water exchange 27%
Open Pass 10-day water exchange 74%



Courtesy of Kerri Scolardi @ Mote



A healthy bay is important to our **economy**





A healthy bay is important to our **quality of life**





Many **habitats** depend on good water quality





A cleaner bay is a more **resilient** bay.





OUR PLAN

for a thriving estuary

111 S. Orange Avenue, Suite
200W Sarasota, FL 34236
(941) 955-8085 | sarasotabay.org

