Save Our Lagoon Project Plan

August 9, 2016

Presentation Outline

- Introduction
- Economic Importance
- Science-Based Targets
  - Impacts of Muck
- Data-Driven Project Selection
  - Transparency/Accountability/Adaptability
- Funding Options
- Acknowledgements

Presenters

- Virginia Barker, Director, Natural Resources Management Department
- Al Vazquez, Managing Partner, Closewaters LLC
- Dr. John Windsor, Professor Emeritus, Florida Institute of Technology Oceanography and Environmental Science
- Marcy Frick, REM, Senior Water Resources Engineer, Tetra Tech Inc.

Why Are We Here?

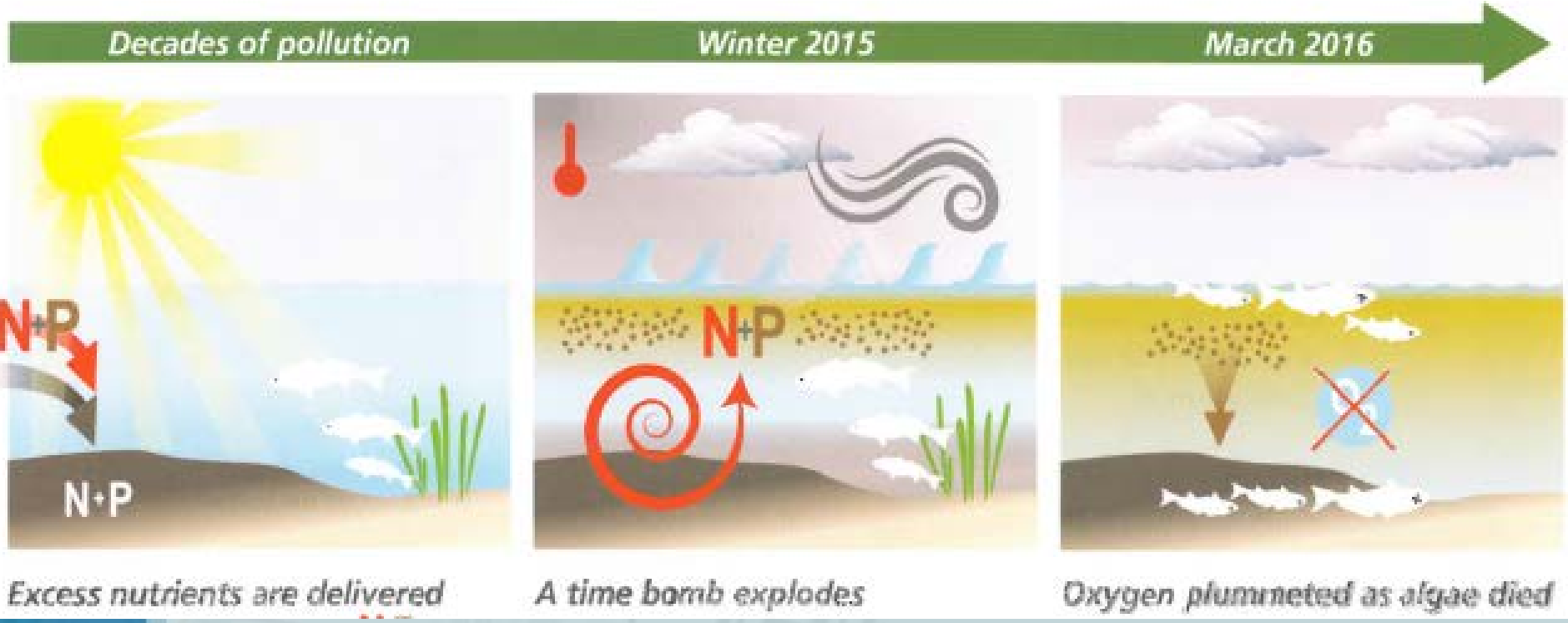
- 2011 algal superbloom
- 2011 secondary bloom
- 2012 brown tide
- 2013 brown tide
- 2013 unusual mortalities
- 2015-2016 brown tide
- 2016 extensive fish kill
- 60% loss of seagrass beds

2016 Events

- March fish kill
- April
  - Letter to the Governor
  - State agency response
  - Legislative delegation
  - Faster federal permits
- May
  - Board direction to develop referendum options
  - Board direction to draft a project plan

Indian River Lagoon

A deadly sequence of events



www.mrcirl.org

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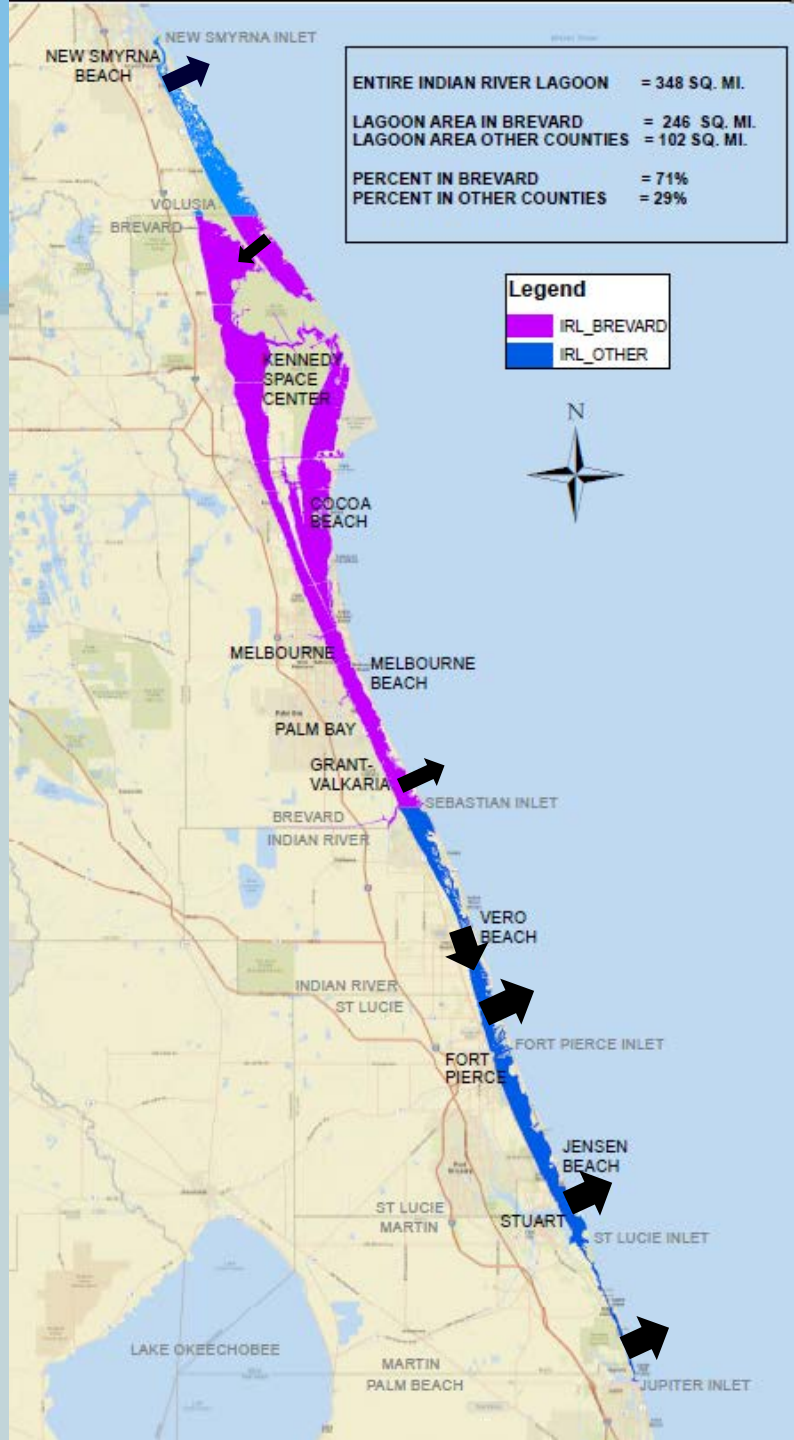
ian.umces.edu

Indian River Lagoon

- 71% of the IRL is in Brevard County
- 157,000 acres
- Local pollution
- Local responsibility
- Local opportunity



Delicate Balance

- IRL is an Estuary of National Significance
- One of the greatest diversity of plants and animals in the nation
- Balance has been disturbed:
  - Excessive pollutant inputs to the lagoon
  - Accumulation of harmful muck deposits
  - Loss of natural filtration systems

Plan Development

- Address remaining major sources of pollution
- Minimal cost to achieve regulatory compliance and healthy conditions;
  - Maximize benefits
  - Science and data-driven to minimize risk
  - Optimize Return on Investment
  - Allow for innovation and adaptation

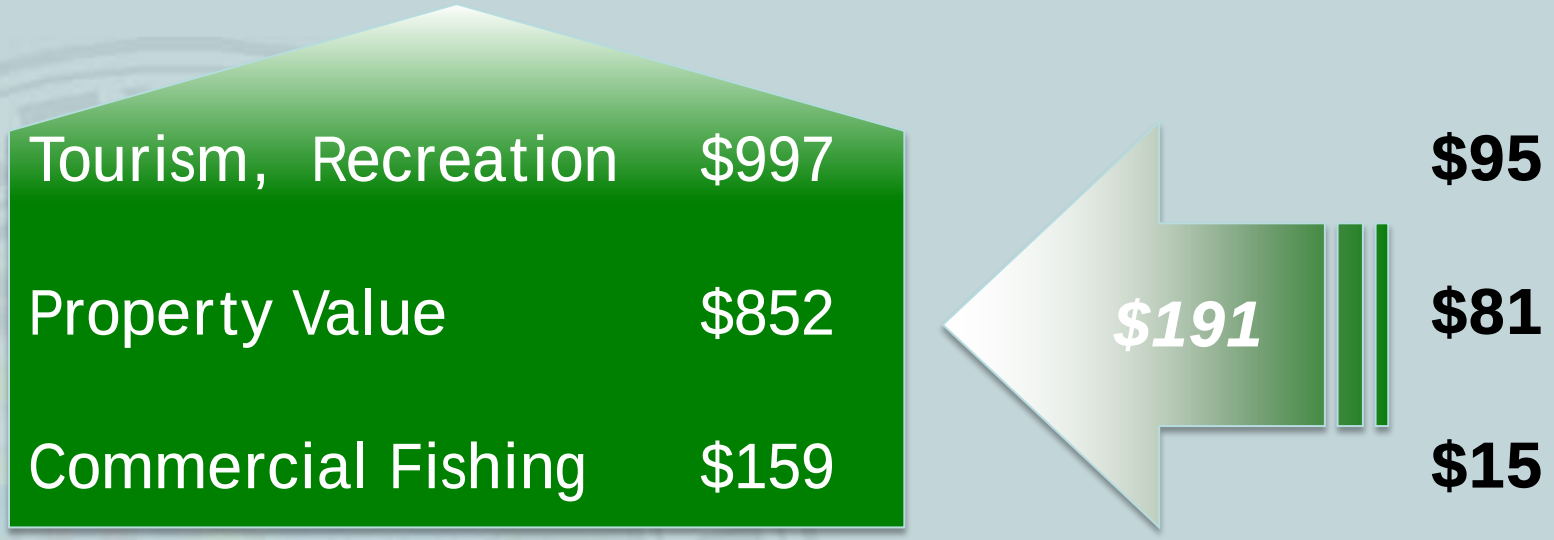
Save Our Lagoon Project Plan

Economic Importance of the Indian River Lagoon

Al Vazquez, Managing Partner
Closewaters LLC

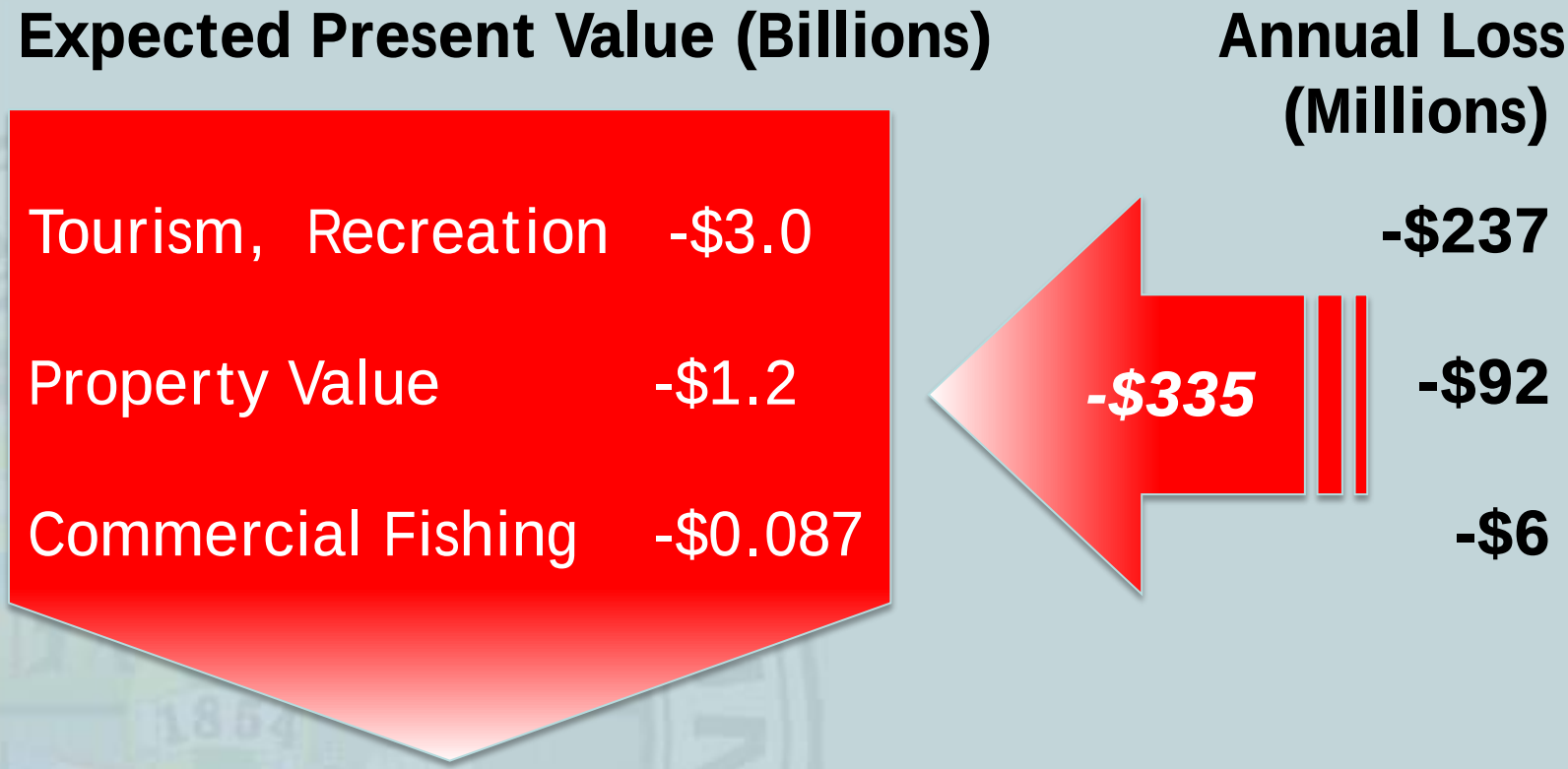
$2 Billion Potential Economic Gain with Restoration

Expected Present Value (Millions) Annual Benefits



Not Included: Health and Collateral Brand Benefits e.g. Beach Tourism

$4.3 Billion Potential Economic Loss without Restoration



Not Included: Regulatory Fines, Pathogen Outbreak, Collateral Brand Impacts

Return on Investment and the Value of Timeliness

- **$6.3 billion benefit:**
  - **$2 billion gain**
  - **$4.3 billion loss avoidance**
- **$302 million plan**
- **20:1 Benefit to Cost Ratio**
- **$526 million/year at risk with delay**
  - **26% ROI for completion in 5 years**
  - **10% ROI for completion in 10 years**

FY 2016-2017 Proposed County General Fund Budget

GF Revenue Sources:		GF Uses:	
Current Ad Valorem	$132,922,029	Charter Officers	$105,248,379
Prior Year Ad Valorem	$380,000	Court Operations	$2,805,831
Communication Svc Tax	$6,398,374	Outside Agencies	$510,200
FPL Franchise Fees	$10,133,158	Mandates	$25,953,827
State Shared Revenue	$11,456,316	Reserves	$15,808,953
Local Half Cent Sales Tax	$25,038,719	Total GF Uses	$150,327,190
All Other Operating Revenue	$8,759,462	BOCC GF Supported Departments	
Balance Forward	$18,457,810	Total Comp and Benefits	$30,942,164
Non-Operating Revenue	$6,863,981	Operating and Capital Expenses	$33,946,465
Total General Fund Sources:	**$220,409,848**	Debt Service	$5,194,029
		Total General Fund Uses:	**$220,409,848**

3 Key Funding Points

1. General Fund of $220 million cannot fund a $302 million plan
2. County funding of $302 million would enable leverage of matching funds to improve on bare-bones plan
3. Acceleration to 5 years increases ROI from 10% to 26% so it makes sense to finance at 4% to speed implementation

Decision Science

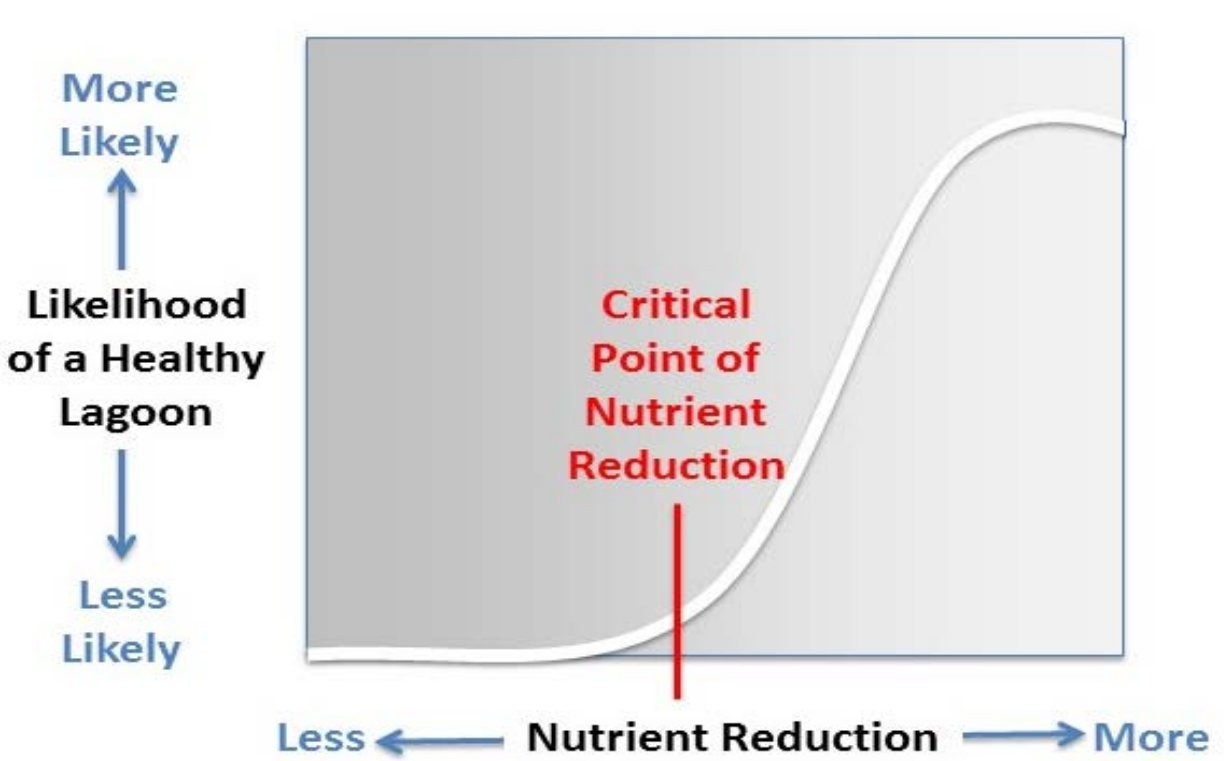
- Select most cost-effective projects and sequence into a multi-year plan
- Maximize the benefits for every dollar spent and minimize the unavoidable risks
- Involve local experts in plan development

Input from Subject Matter Experts

- Achieve nutrient abatement through a blend of options
- No one type of project alone can achieve adequate nutrient abatement
- Must stop excessive nutrient loading to minimize recurring muck accumulation

IRL Response Curve

- **“Critical mass" of nutrient reductions needed to achieve significant and sustainable benefits**



Save Our Lagoon Project Plan

Science – Based Targets for Indian River Lagoon Health

Virginia Barker, Director

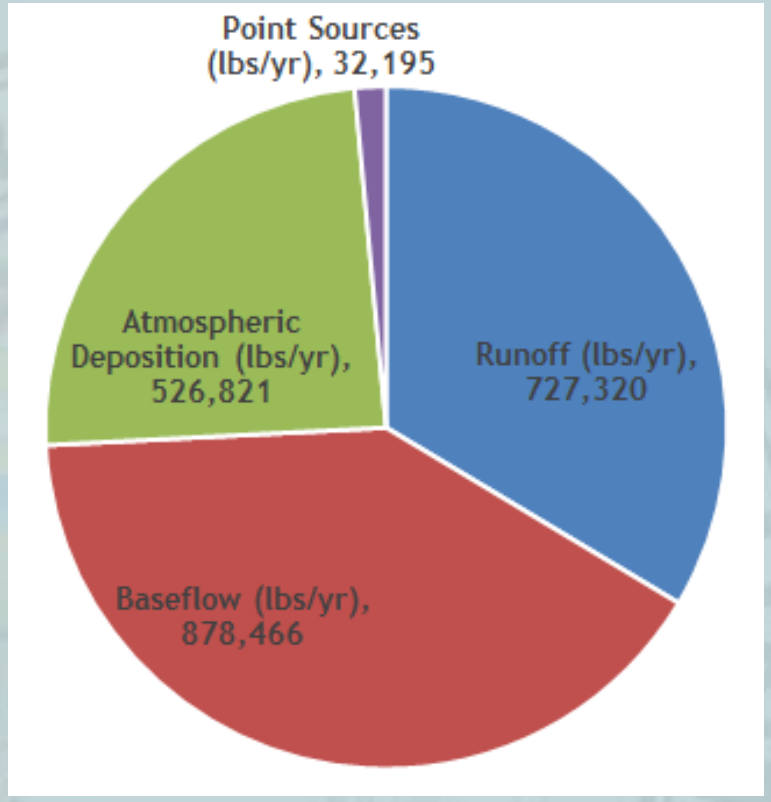
Natural Resources Management Department

Healthy Lagoon Targets

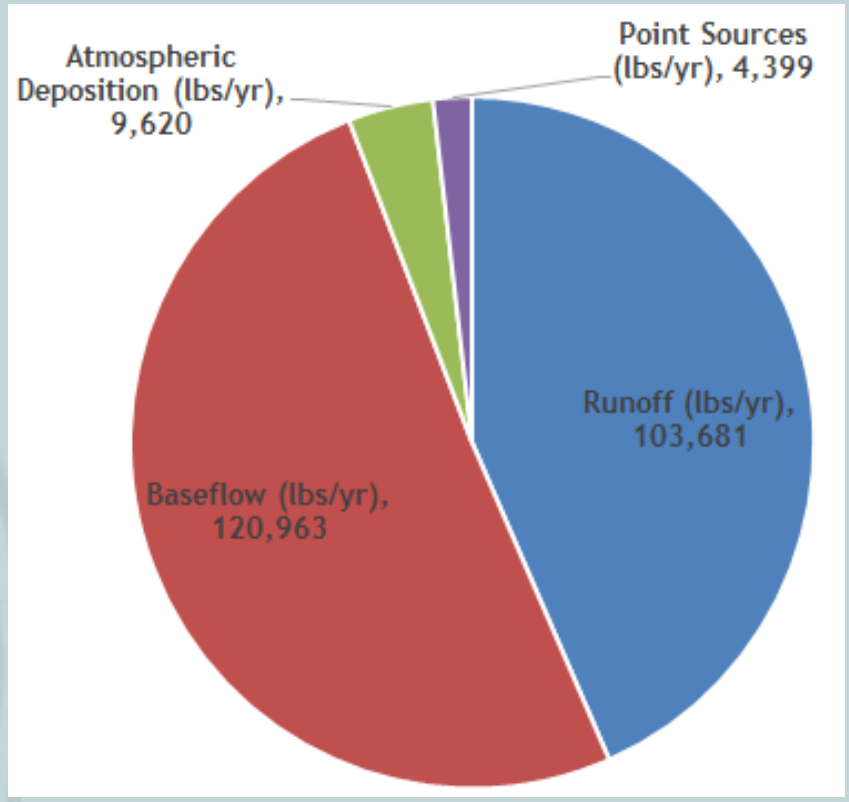
- **Seagrass**
  - Area to exceed 1943 mapped area
- **Water Clarity**
  - Algal blooms rare, bottom visible
- **Dissolved Oxygen**
  - Fish kills uncommon
- **Clean, White, Sandy Sediment**
  - Muck limited to deep pits and channels
- **Filtration**
  - Entire lagoon volume filtered annually

External Sources of Nutrient Pollutant into the IRL

Nitrogen Sources



Phosphorus Sources



Source: IRL TMDL Refinement Studies, 2011-2016
Dr. Harvey Harper, Dr. Antony Janicki, Dr. Claudia Listopad, Dr. Steven Peene

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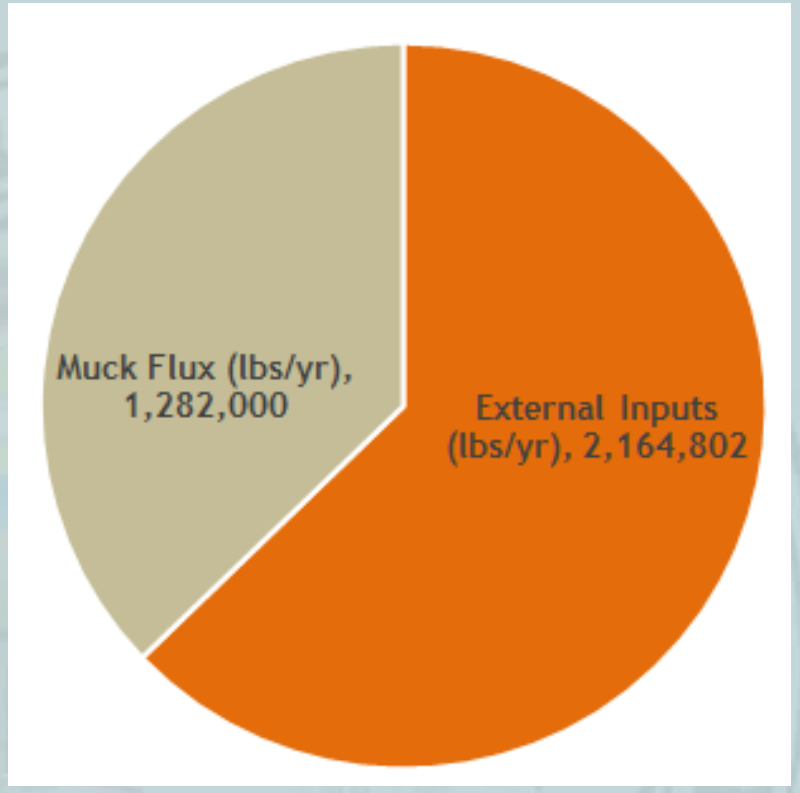
External Pollution Sources Versus Muck Flux in the IRL

Nitrogen Sources



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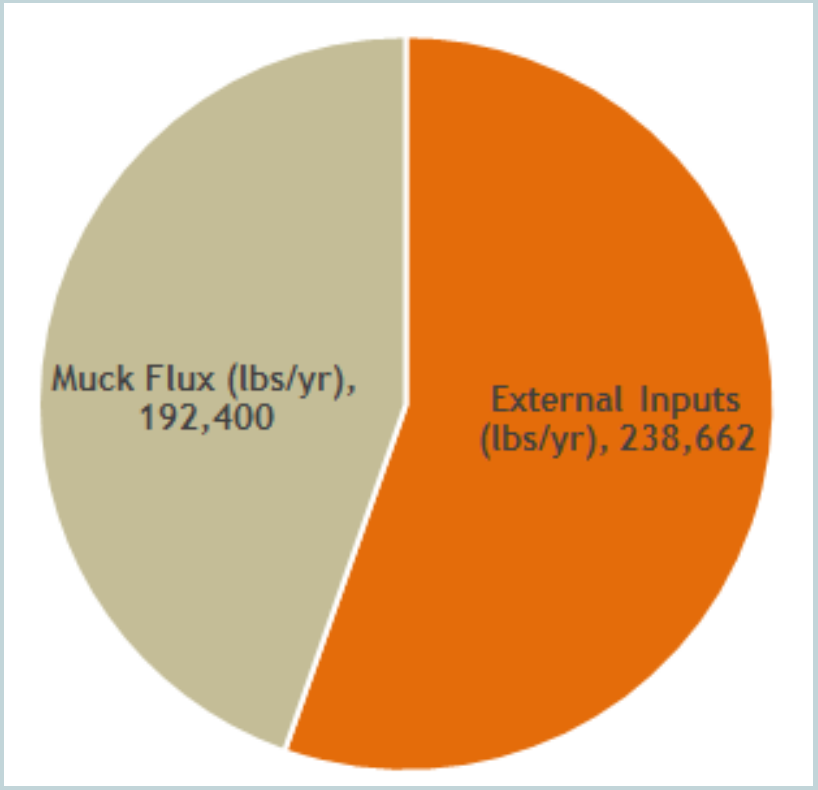

Source: Personal Communication with Dr. John Trefry, 2016

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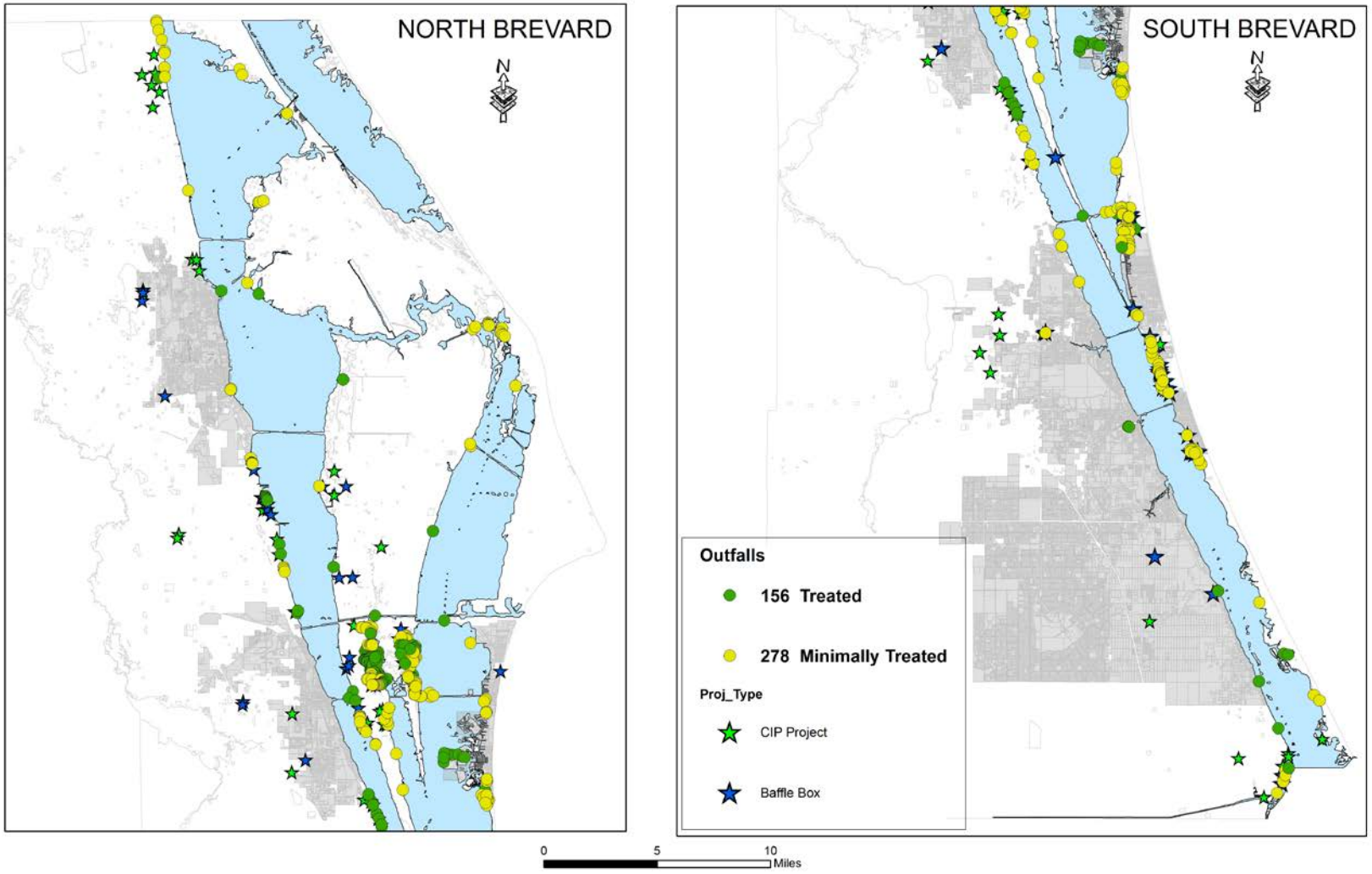
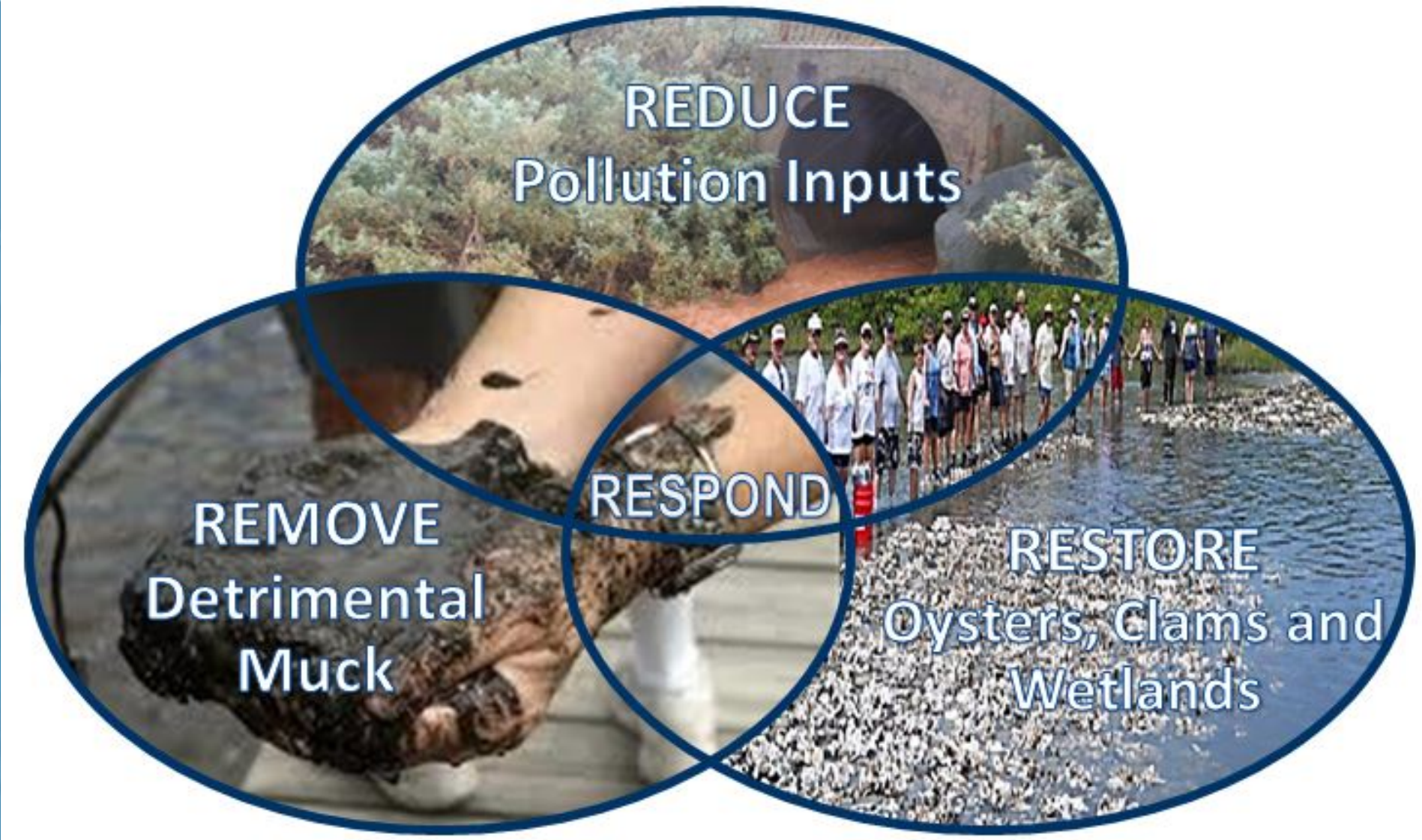
Pollutant Sources Addressed in the Save Our Lagoon Project Plan

- ✓ Fertilizer
- ✓ Point sources – reclaimed water
- ✓ Septic systems
- ✓ Stormwater
- ✓ Muck flux
- • Atmospheric

Existing Treatment



Save Our Lagoon Project Plan



Impacts of Environmental Muck Dredging

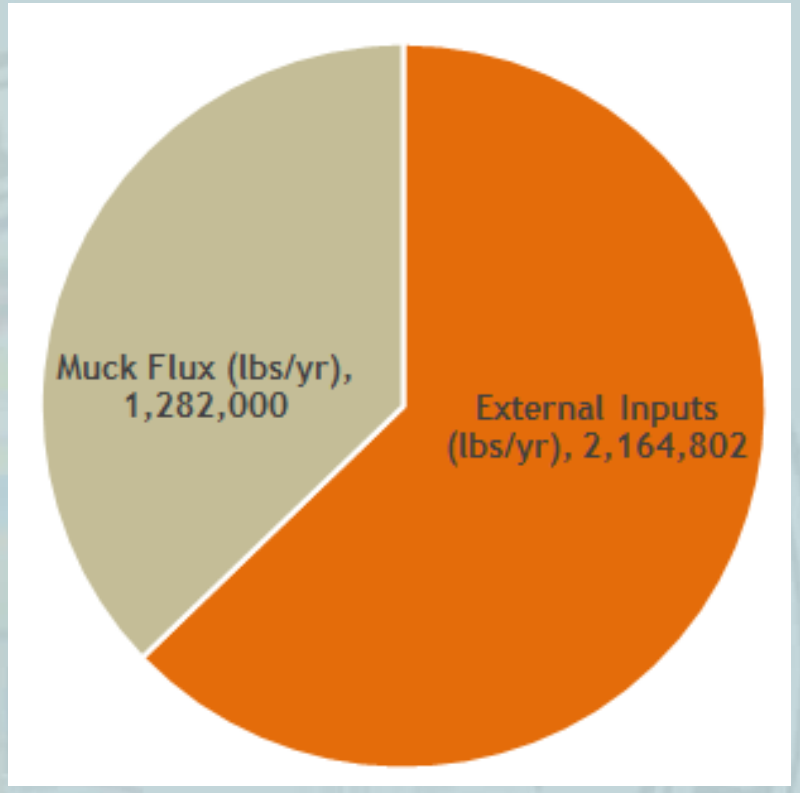
Dr. John Windsor
Professor Emeritus
Oceanography and Environmental Science
Florida Institute of Technology

What is the most important threat to Lagoon health?

- Fertilizer
- Point sources – reclaimed water
- Septic systems
- Stormwater
- Muck flux
- Atmospheric

External Pollution Sources Versus Muck Flux in the IRL

Nitrogen Sources



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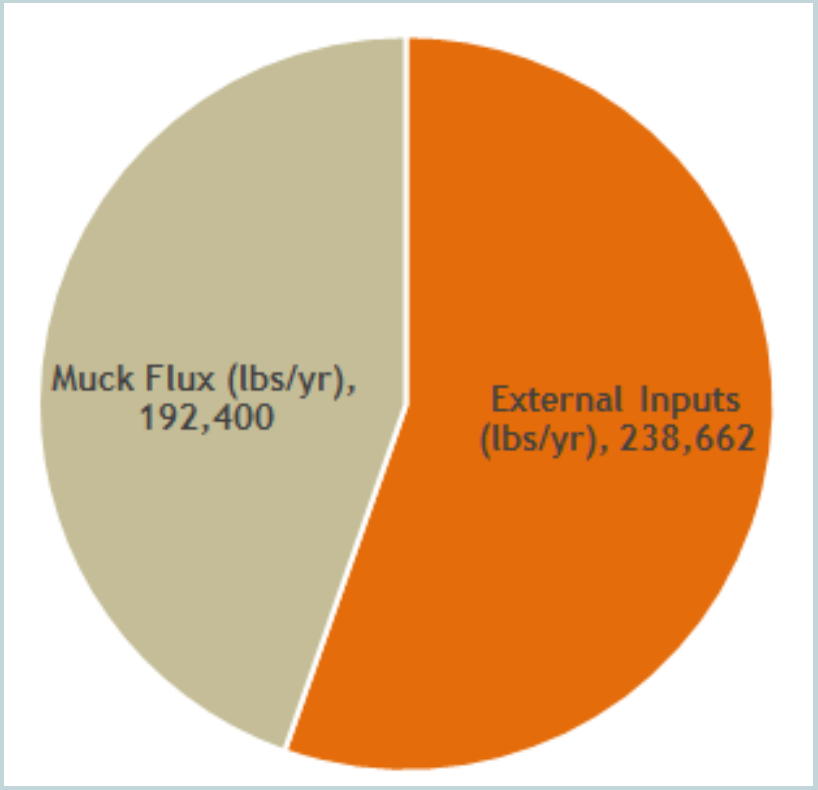

Source: Personal Communication with Dr. John Trefry, 2016

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What is Indian River Lagoon muck?

- More than 75% water by weight
- More than 90% water by volume
- 76-99% silt and clay
- 11-22% organic matter
  - 4-7% organic carbon
  - 0.4-0.8% organic nitrogen

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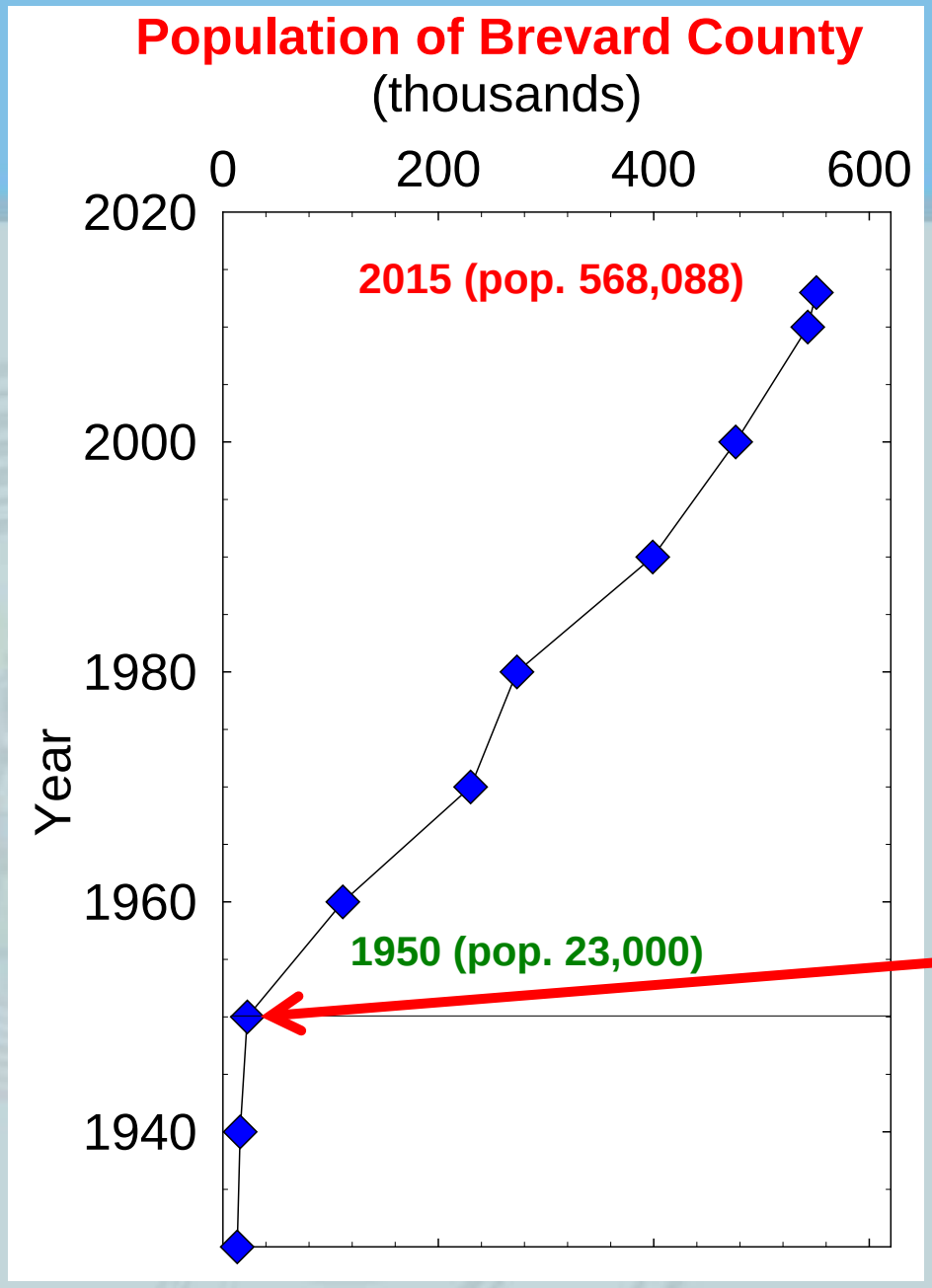


Courtesy Dr. John Trefry

Why is IRL muck important?

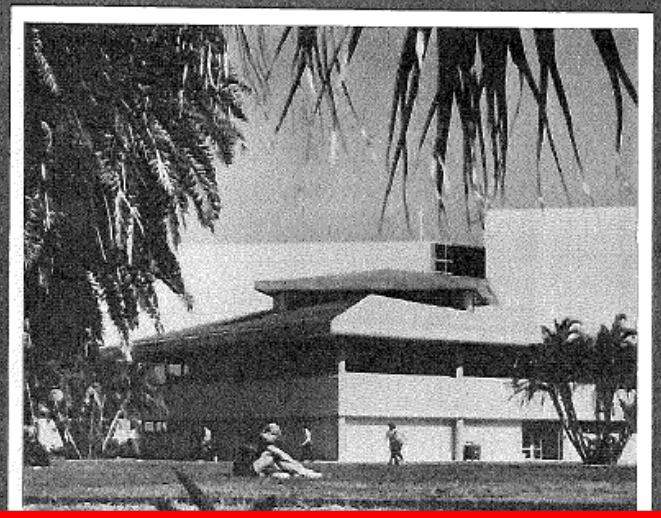
1. Increases turbidity and inhibits seagrass growth.
2. Depletes oxygen in sediment and water.
3. Covers the natural bottom and destroys natural biological habitats.
4. Stores and releases nutrients

Should muck be removed?

1. Decrease turbidity and enhance seagrass growth.
2. Increases oxygen in water.
3. Restores natural bottom.
4. No longer a source for nutrients!
5. IRL Muck can be moved by storms

1980s

F. I. T. SPEAKERS



Let's Get the Muck Off the Bottom of the Indian River Lagoon
John H. Trefry

F.I.T. Florida Institute of Technology

Should muck be removed?

Muck is targeted in management plans:

IRLNEP Comprehensive Conservation and Management Plan (CCMP)

FSD-6 Reduce impacts of muck on Indian River Lagoon

IRL Surface Water Improvement and Management (SWIM)

***IR-1-105D* Muck Identification and Control**

Brevard Comprehensive Maritime Management Master Plan (CM3P)

***1B1-b* Remove Muck from Interior Waterways**

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What is muck dredging?

Courtesy Dr. John Trefry

Is muck dredging perfect?

1. Current hydraulic dredging and dewatering practices are not perfect, although they are the best option available now – and good enough to get us started.
2. A dedicated funding source should drive innovation and production of better tools and techniques.
3. FIT is already testing potential draghead and dewatering improvements on a small scale in a canal.

What is the FIT Environmental Muck Dredging Research Project?

Research Goal:

To determine impacts of environmental muck dredging in Indian River Lagoon.

The Multidisciplinary Team:

- **10 Faculty**
- **6 Research Staff**
- **Dozens of graduate/undergraduate students**
- **Collaboration with County staff, SJRWMD, FDEP, and external reviewers**

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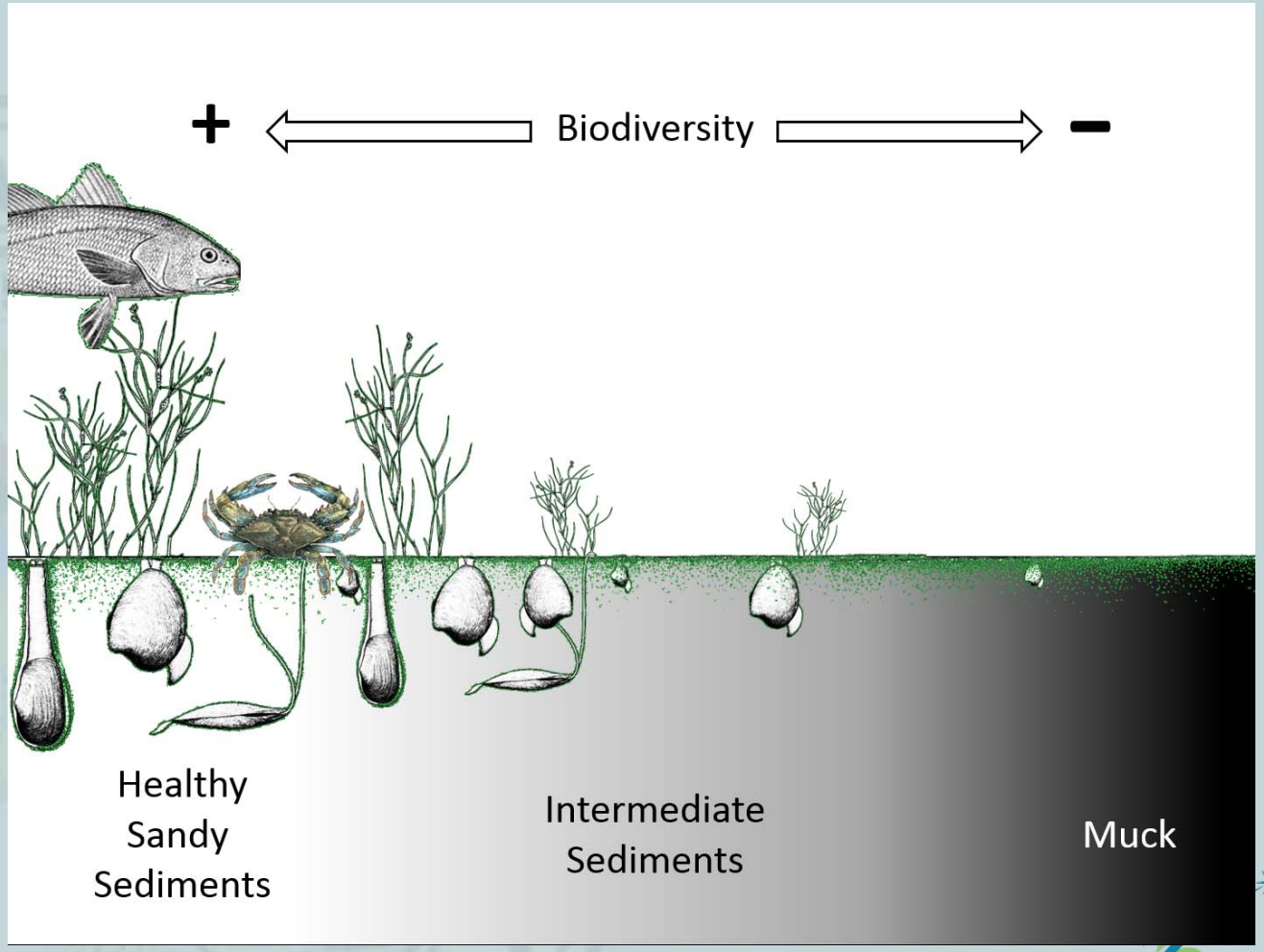
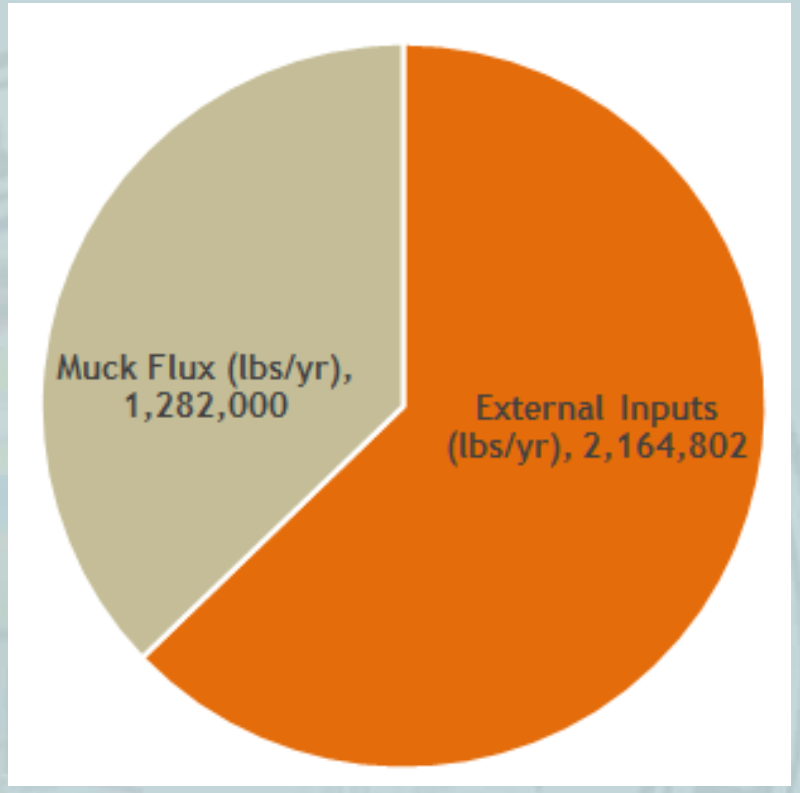
What has FIT-EMD learned?



Courtesy Dr. Kevin Johnson

External Pollution Sources Versus Muck Flux in the IRL

Nitrogen Sources



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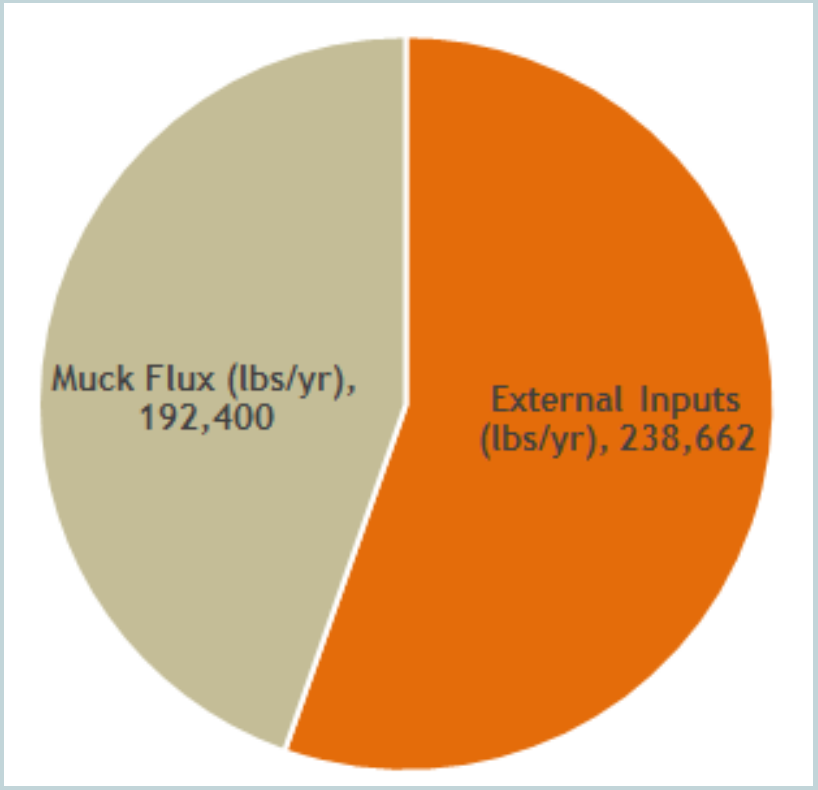

Source: Personal Communication with Dr. John Trefry, 2016

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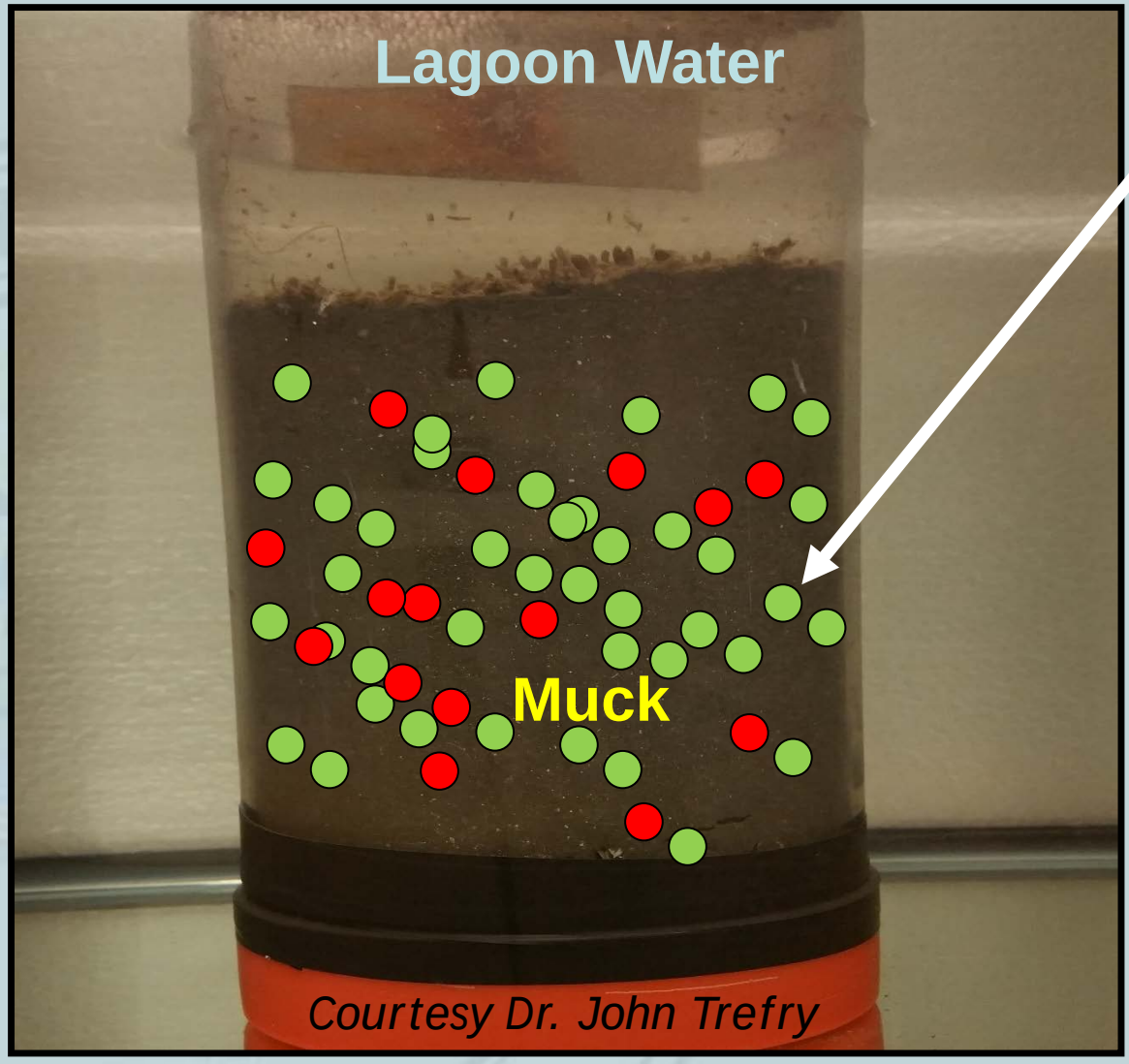
What is muck flux?



Billions of molecules of dissolved N and P are diffusing from the muck into the lagoon water.

FIT Muck Research Team

the inputs that form muck.

Courtesy Dr. John Trefry

Data Driven Project Selection for the Indian River Lagoon

Marcy Frick, Senior Water Resources Engineer
Tetra Tech Inc.

Project Selection

Projects were selected to:

- Maximize nutrient reductions
- Minimize cost
- Shorten lag time
- Reduce risk
- Optimize return on investment

Florida-Friendly Landscaping

THE SMART WAY TO GROW

MY BREVARD YARD

Be Floridian Now

SAVING OUR LAKES, RIVERS, & ESTUARIES ONE YARD AT A TIME

BLUE LIFE FLORIDA

Reduce - Fertilizer

- **Fertilizer ordinance compliance**

- **Reductions have occurred to date**

Parameter	FY2013-14 lbs after Attenuation: Pre-Ordinance	FY2014-15 lbs after Attenuation: Post-Ordinance	Reductions from Ordinance to Date (lbs/yr)
TN	127,540	81,644	45,896
TP	12,640	3,252	9,388
	BEFORE	AFTER	REDUCTION

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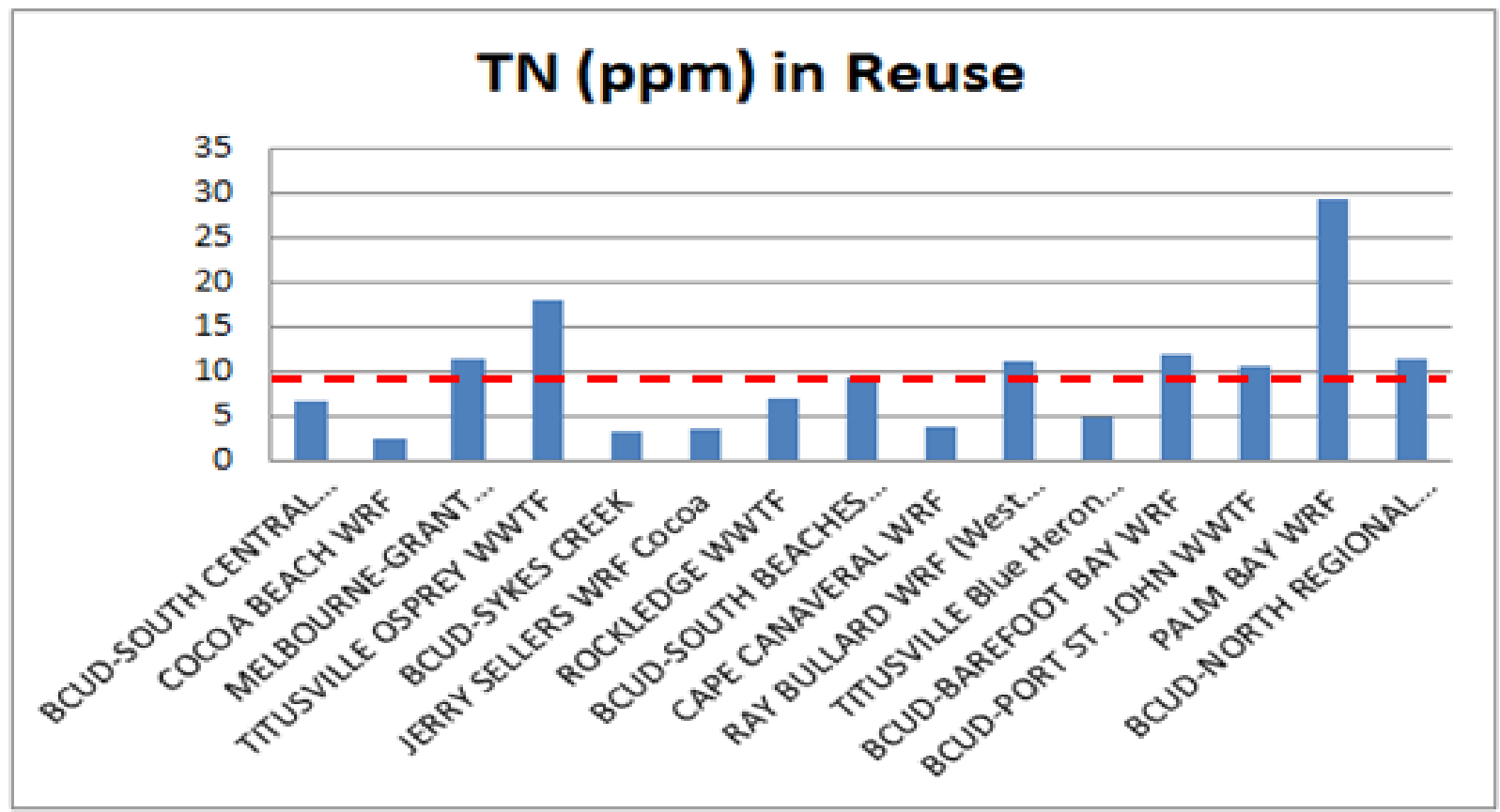
Reduce - Fertilizer

- Expand public education and outreach
- Increase ordinance compliance 25%
- Cost: $625,000 (over 5 years)
- Benefit: 6,123 lbs/yr of TN and 813 lbs/yr of TP reduction
- Efficiency: $102/lb of TN/yr

Reduce – Reclaimed Water Nutrients



9 ppm (mg/L): Nitrogen concentration that supports maximum turfgrass growth. Don't excessively irrigate. (2014 IFAS study: AE479)

Reduce – Nutrients in Reclaimed Water

- Higher concentrations leach more nutrients into the groundwater
- Upgrade treatment at WWTFs to reduce nutrients in reclaimed water

Facility	Cost to Upgrade	TN Removed after Attenuation (lbs/yr)	Cost/lb/yr of TN Removed
City of Palm Bay WRF	$1,400,000	17,790	$79
City of Titusville Osprey WWTF	$8,000,000	22,988	$348
City of West Melbourne Ray Bullard WRF	$6,000,000	5,368	$1,118
Barefoot Bay WRF	$6,000,000	3,507	$1,711
North Regional WWTF	$6,000,000	1,739	$3,451
Port St. John WWTF	$6,000,000	2,037	$2,946
City of Melbourne Grant Street WWTF	$6,000,000	1,498	$4,004

Reduce – Nutrients Leaching from Septic Systems

- The Florida Department of Health has permitted over 90,000 septic systems in Brevard County
- About 10% have been removed
- Almost 60,000 are in the IRL Basin
- Connecting or upgrading all 60,000 is not cost-effective
- Focus on highest risk situations

Cost for Septic System Removal

Septic System Distance from Surface Water	Number of Septic Systems	TN (lbs/yr/system)	TN (lbs/yr)	Total Cost	Cost/lb/yr of TN
Less than 55 yards	15,090	27.095	408,863	$301,800,000	$738
Between 55 and 219 yards	25,987	6.865	178,395	$519,740,000	$2,913
Greater than 219 yards	18,361	0.0005	10	$367,220,000	$37,624,010
Total in IRL Basin	***59,438***	***N/A***	***587,268***	***$1,188,760,000***	***$2,024 (average)***

Estimated TN load per year per system based on data from a St. Lucie study

Estimated cost of $20,000 each per County's Utility Services Department

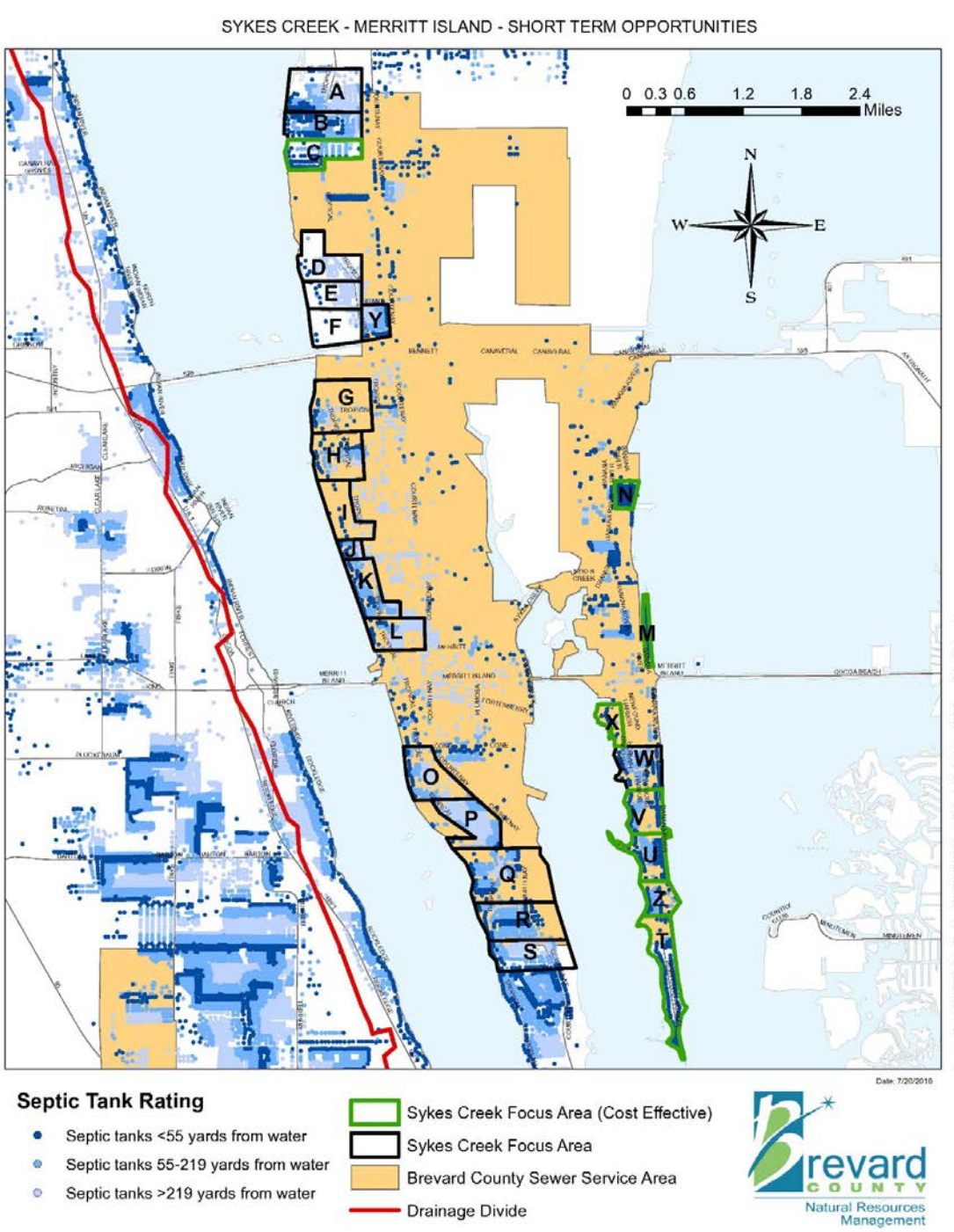
Example Prioritization

- **Focus on neighborhoods that could be connected to sewer for less than $1,200/lb TN**

Service Area	Number of Lots	Cost	TN Reduction (lbs/yr)	TN Cost/lb/yr
Sykes Creek - Zone N	86	$1,720,000	2,330	$738
Sykes Creek - Zone M	58	$1,160,000	1,572	$738
Sykes Creek - Zone T	139	$2,780,000	3,685	$754
Sykes Creek - Zone X	14	$280,000	359	$780
Sykes Creek - Zone V	98	$1,960,000	1,927	$1,017
Sykes Creek - Zone U	145	$2,900,000	2,573	$1,127
Sykes Creek - Zone Z	73	$1,460,000	1,290	$1,132
Sykes Creek - Zone W	142	$2,840,000	1,923	$1,477
Sykes Creek - Zone R	206	$4,120,000	2,686	$1,534
Sykes Creek - Zone Q	186	$3,720,000	2,319	$1,604
Sykes Creek - Zone S	163	$3,260,000	1,407	$2,317

Septic Removal

Merritt Island Example Area



Reduce – Use of Septic Systems

- **Remove 3.9% of septic systems within the IRL Basin by connecting to central sewer**

Sub-lagoon	Number of Lots	Cost	TN Reductions (lbs/yr)	Average Cost/lb/yr of TN
Banana River Lagoon	613	$12,260,000	13,736	$898
North IRL	641	$12,820,000	14,029	$875
Central IRL	1,093	$16,684,000	28,744	$746
Total	***2,347***	***$41,764,000***	***56,509***	***$840***

Septic System Prioritization

- **Criteria:**
  - Age of System
  - Soil Type
  - Depth to Groundwater
  - Septic System Density
  - Proximity to Surface Waters

- **Prioritize worst conditions that pose highest risk to Lagoon water quality**

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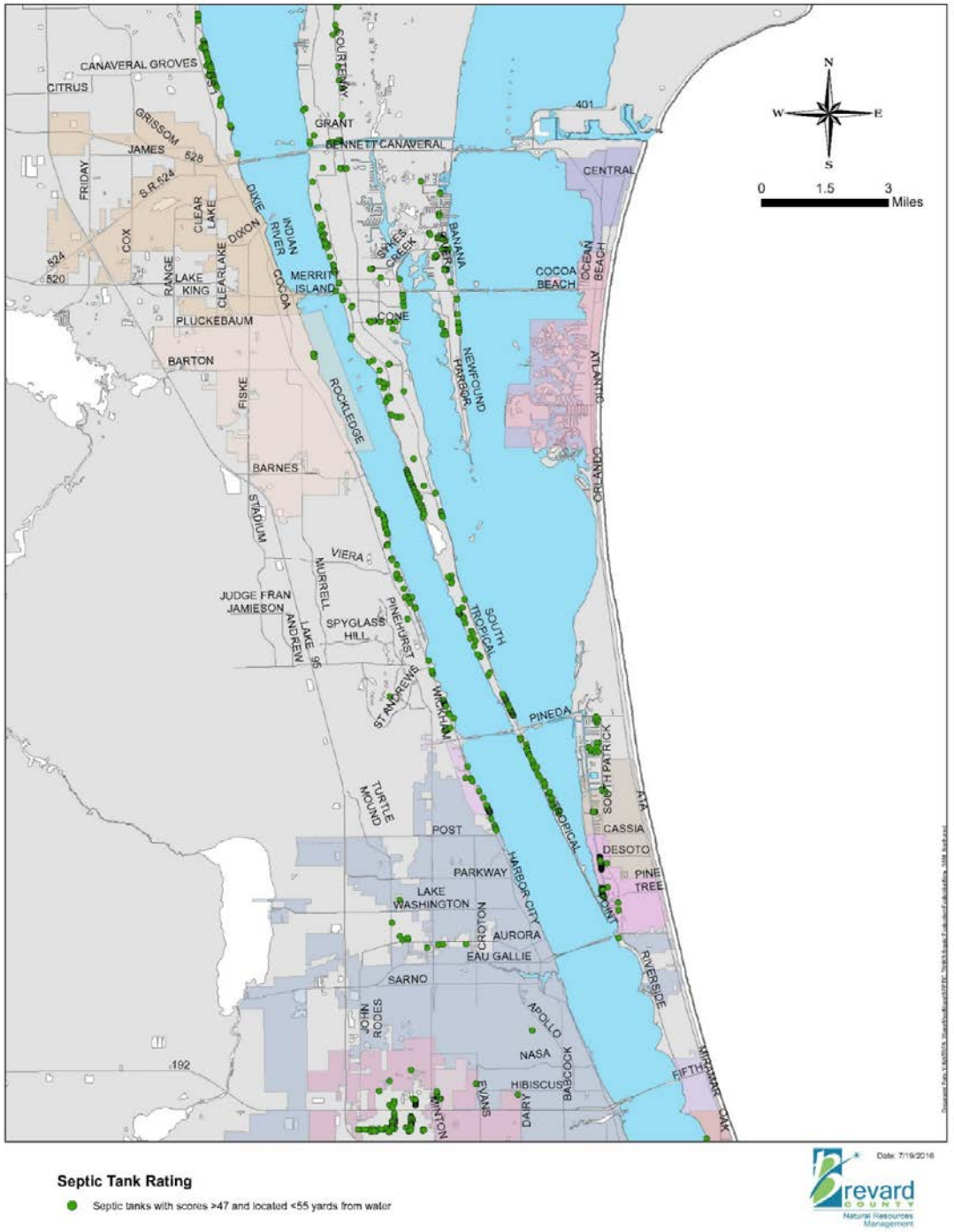
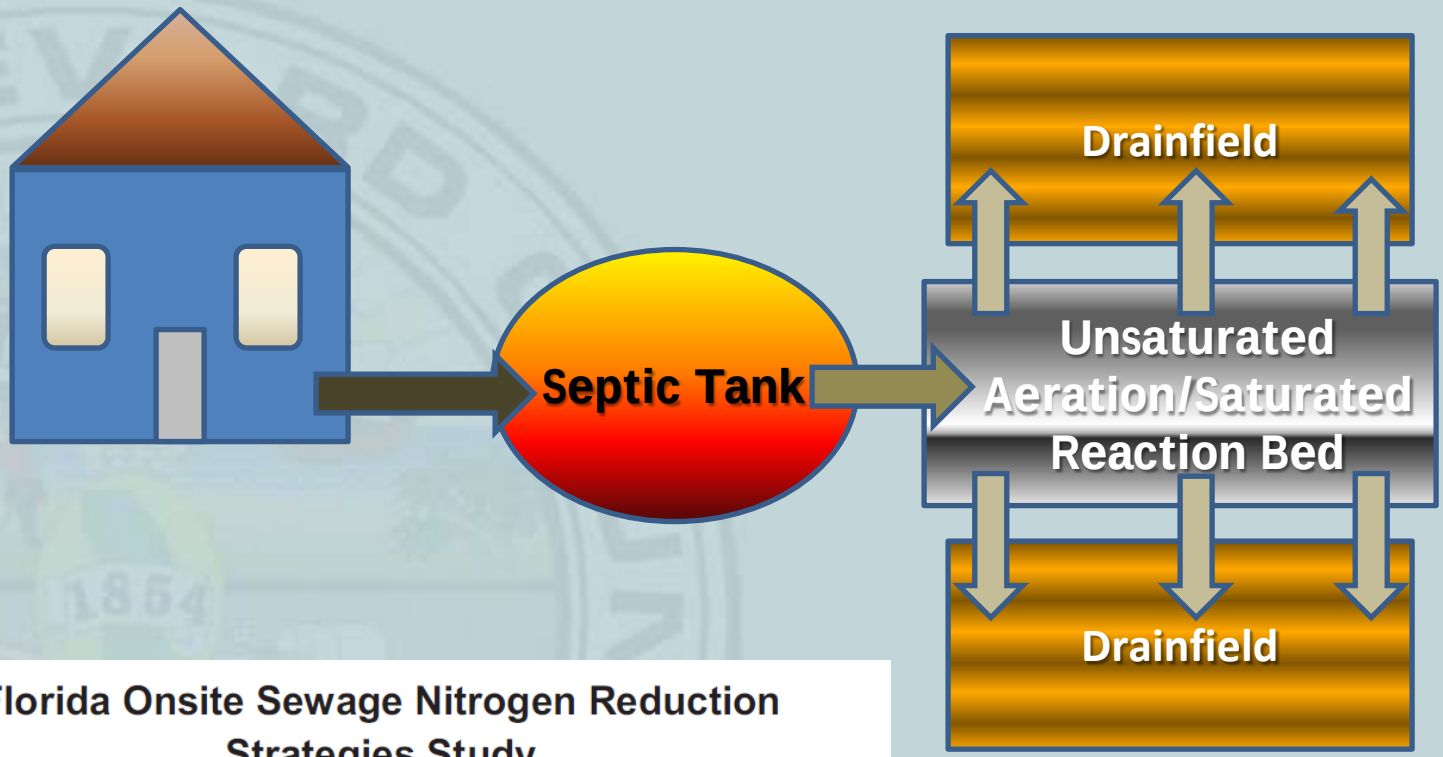
Septic Upgrade

Central Brevard Example Area



Reduce – Septic Drainfield Leaching



Florida Onsite Sewage Nitrogen Reduction Strategies Study

Final Report

December 31, 2015

Reduce – Septic Drainfield Leaching

- **Plan includes upgrade of the worst 2.3% of remaining systems within the IRL Basin**

Sub-lagoon	Number of Lots	Cost	TN Reductions (lbs/yr)
Banana River Lagoon	258	$4,128,000	5,145
North IRL	515	$8,240,000	10,270
Central IRL	614	$9,824,000	12,244
Total	***1,387***	***$22,192,000***	***27,659***

Reduce – Stormwater Loading

- **Ditch denitrification is the most cost-effective treatment for dry season flow**
- **Add biosorption activated media (BAM) to improve nutrient removal efficiency**

Sub-lagoon	Number of Basins	Estimated Total Project Cost	TN Reductions (lbs/yr)	Cost/lb/yr of TN	TP Reductions (lbs/yr)	Cost/lb/yr of TP
Banana River Lagoon	41	$4,625,000	48,391	$96	6,896	$671
North IRL	37	$4,850,000	52,936	$92	7,632	$635
Central IRL	6	$1,325,000	17,113	$77	2,497	$531
Total	*84*	*$10,800,000*	*118,440*	*$88 (avg)*	*17,025*	*$612 (avg)*

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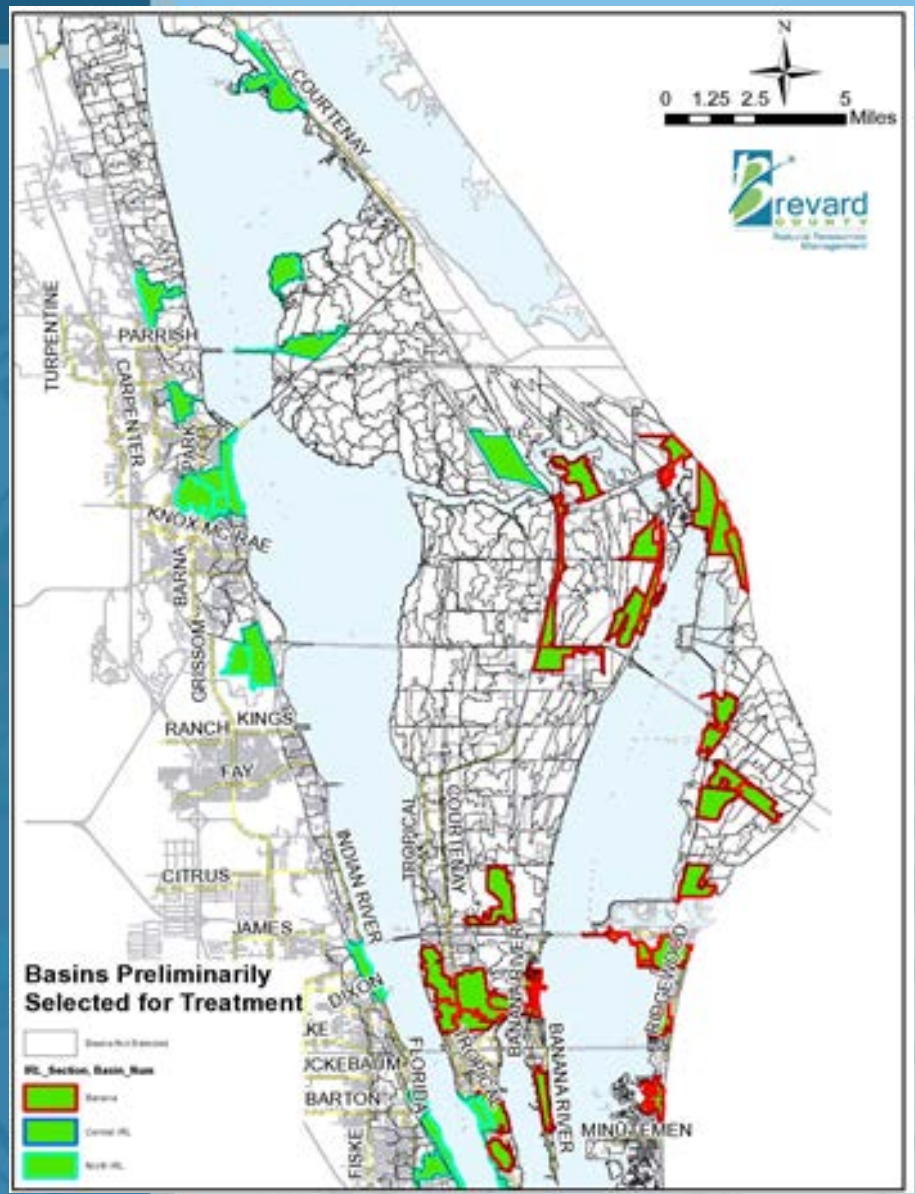
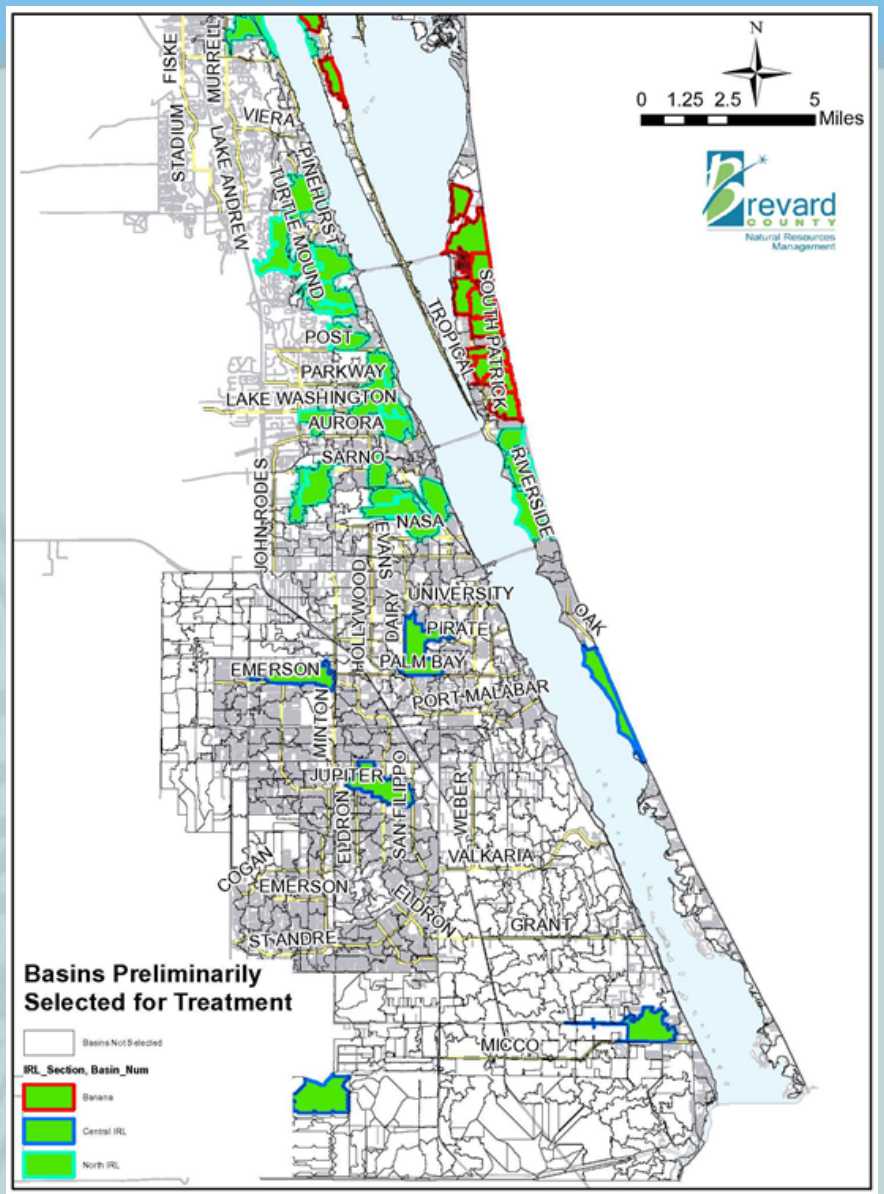
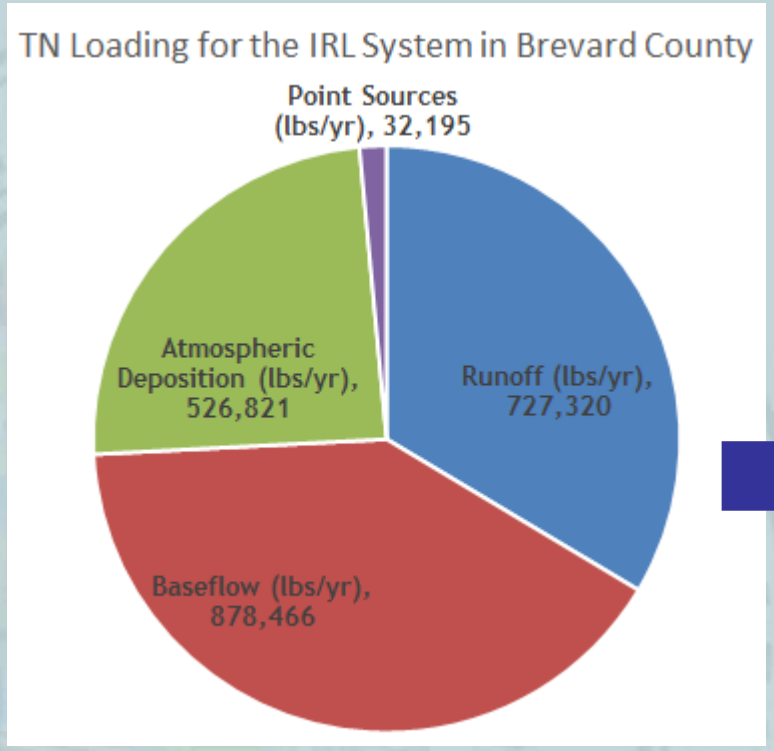
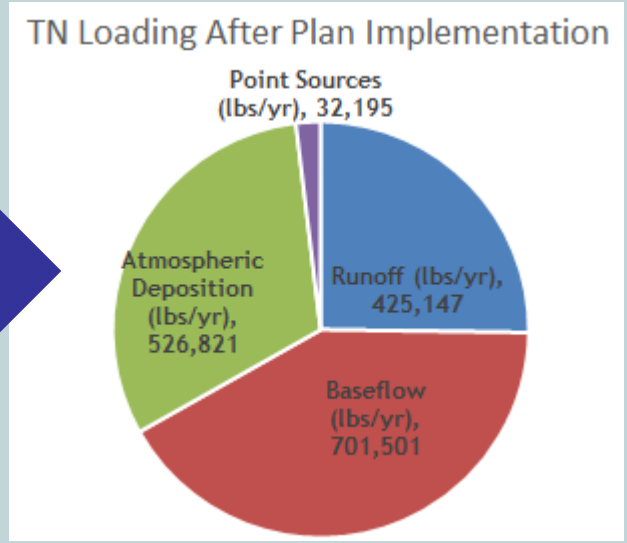
Reduce – Stormwater Loading



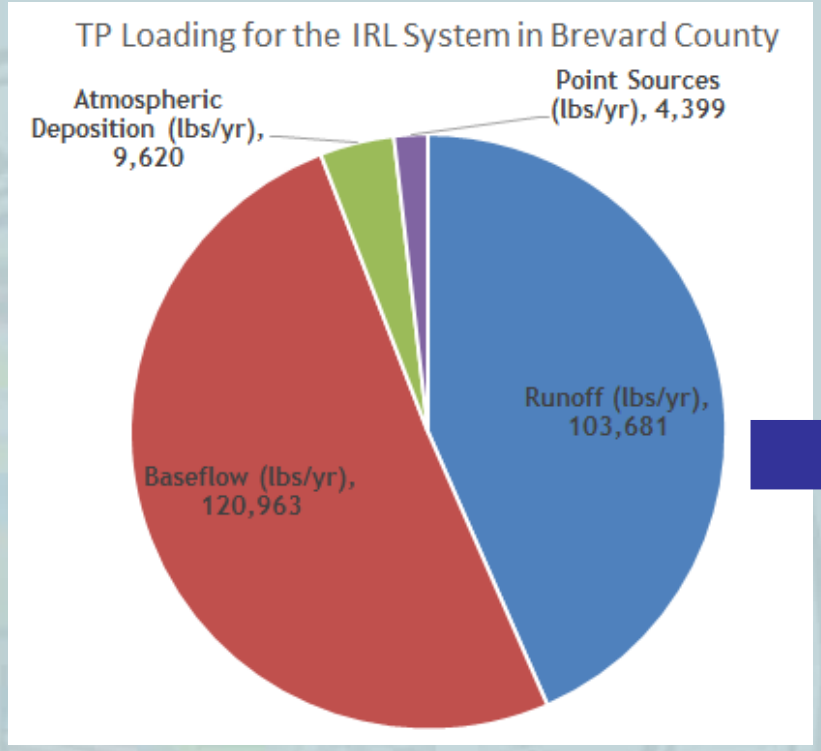


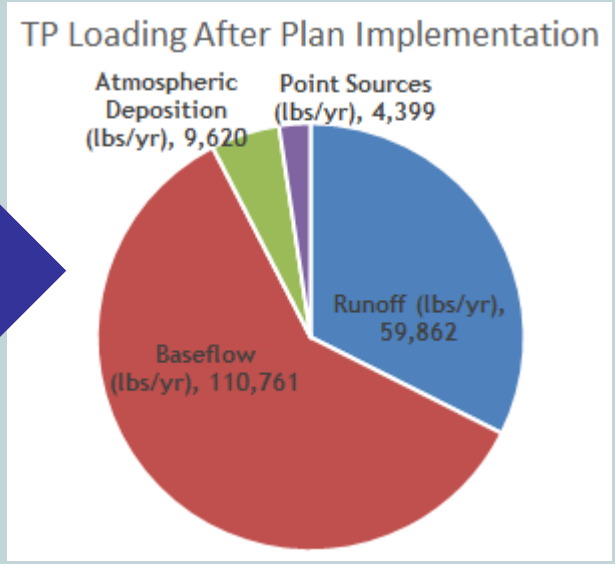
Nitrogen Loading Before and After Plan Implementation



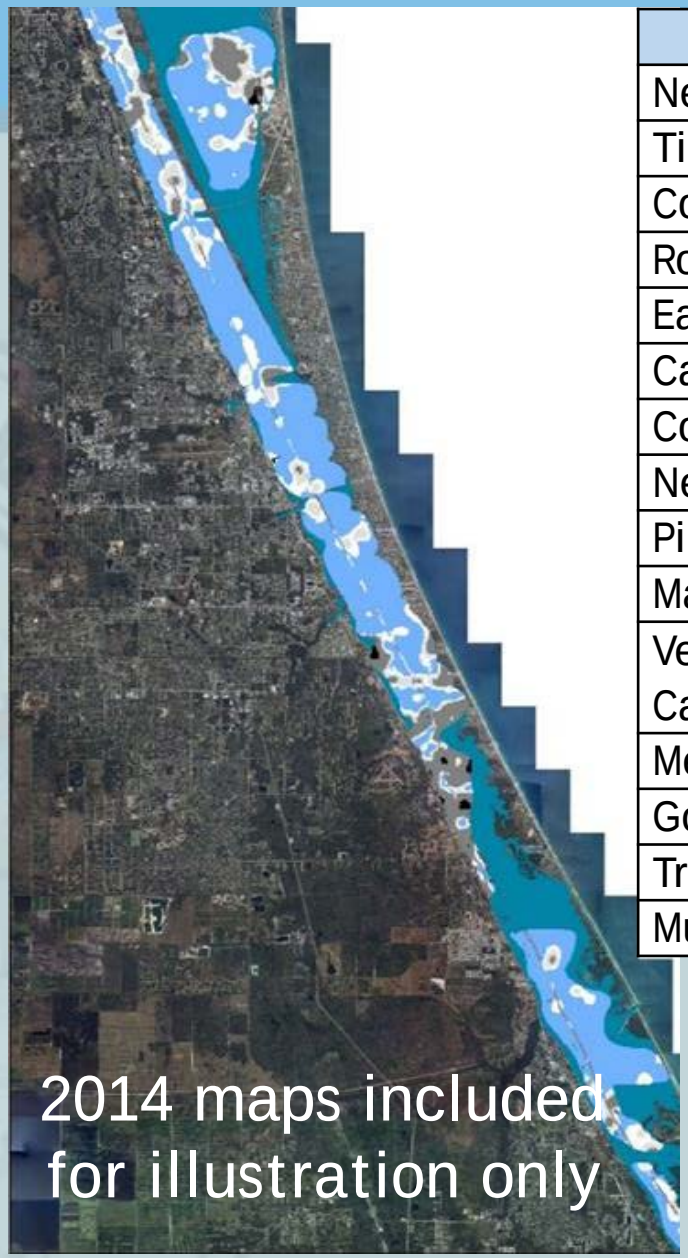


Phosphorus Loading Before and After Plan Implementation





Remove – Detrimental Muck



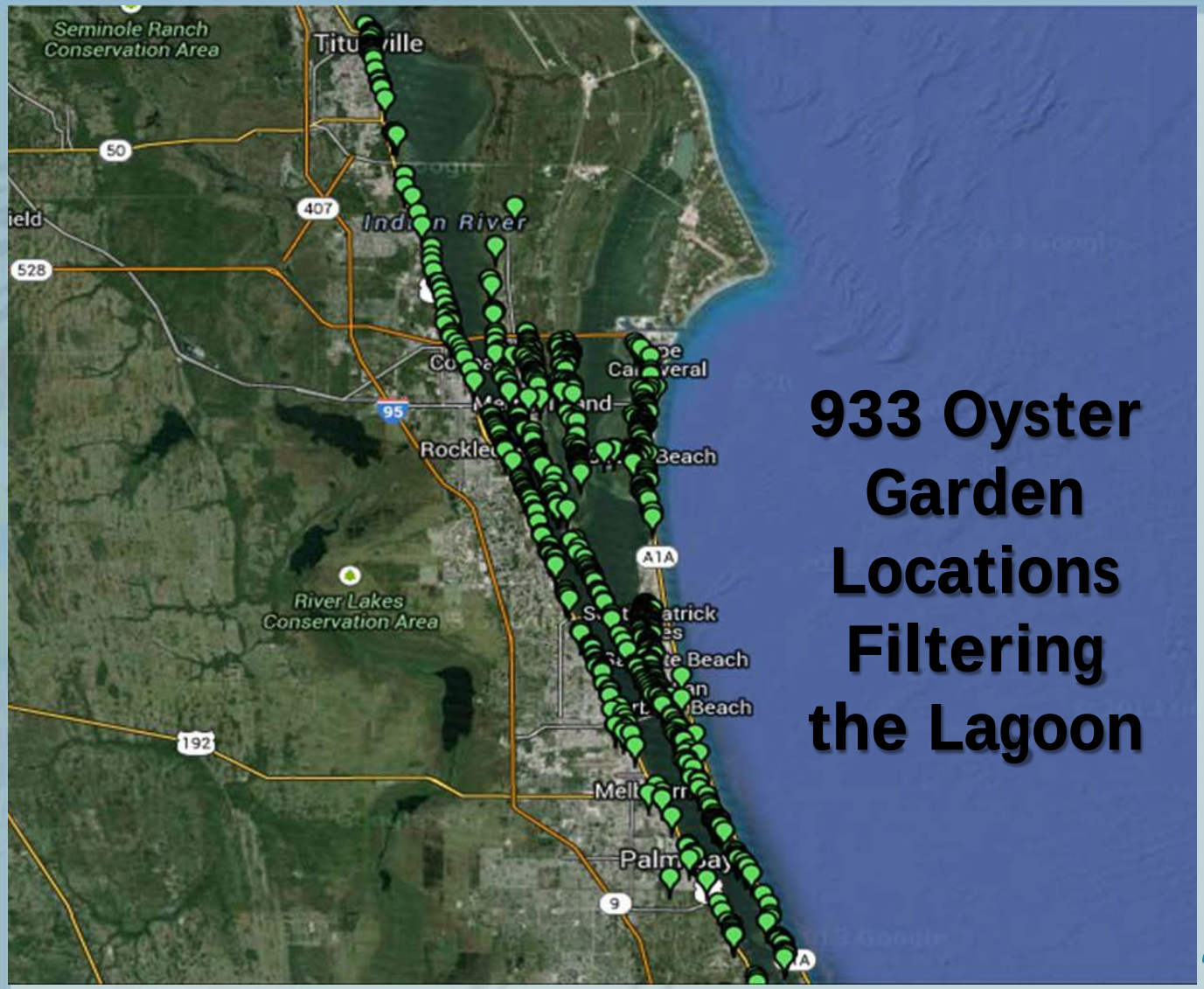
Locations
Near Haulover Canal
Titusville Area
Cocoa Area
Rockledge Area
Eau Gallie Area
Cape Canaveral Area
Cocoa Beach Area
Newfound Harbor Area
Pineda Causeway Area
Mathers Bridge Area
Venetian Collector Canals/Channels
Melbourne Causeway Area
Goat Creek Area
Trout Creek Area
Mullet Creek Islands Area

Remove – Detrimental Muck

- **Focus on largest muck deposits in the open waters of the lagoon**

Location	TN Flux Reduction (lbs/yr)	Project Cost	Cost/lb/yr of TN Removed	TP Flux Reduction (lbs/yr)	Cost/lb/yr of TP Removed
Mosquito Lagoon	35,000	$16,100,000	$460	5,250	$3,067
North IRL	231,500	$89,250,000	$386	34,700	$2,572
Banana River Lagoon	165,300	$71,750,000	$434	24,800	$2,893
Central IRL	59,500	$21,000,000	$353	8,900	$2,400

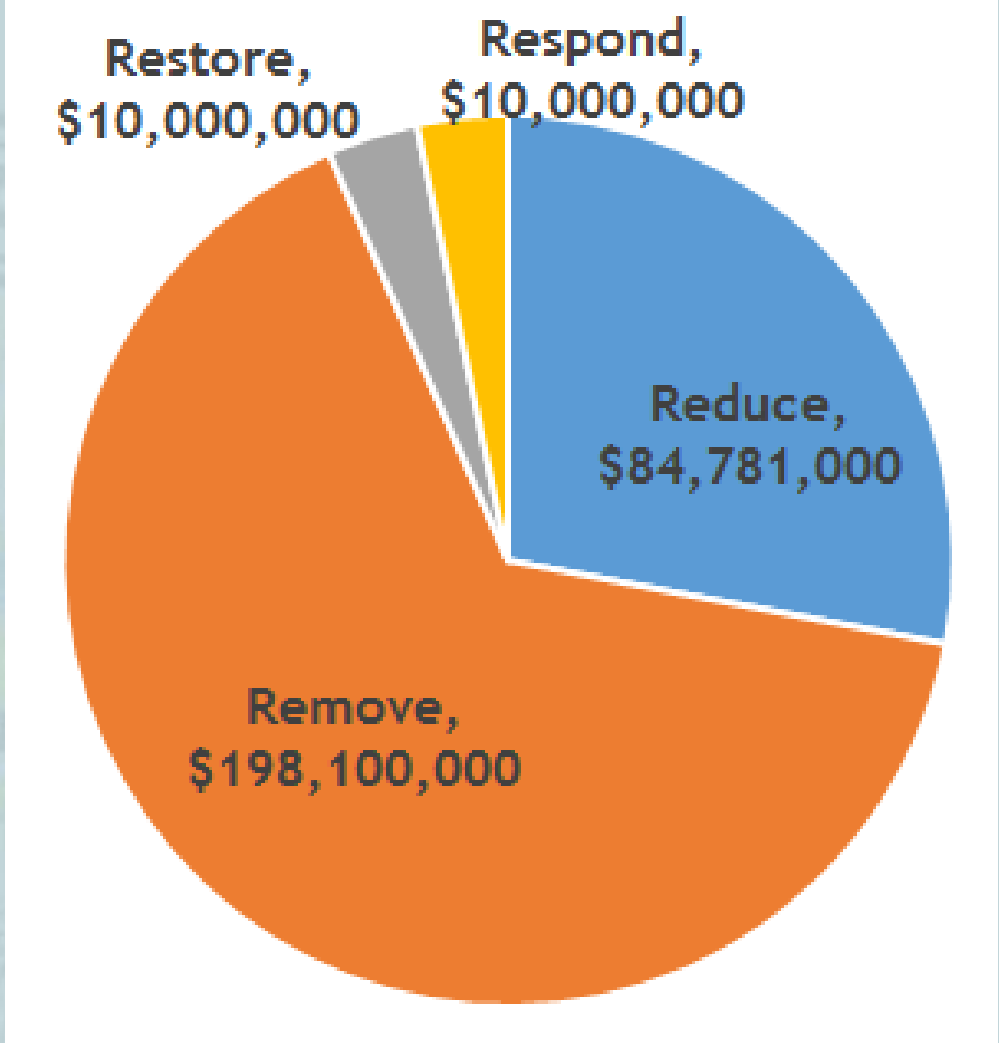
Restore – Oyster Bars/Living Shorelines



Restore – Oyster Bars/Living Shorelines

- 20 miles of shoreline oyster bars would filter the lagoon volume annually
- Cost: $10 million
- Benefit: 21,120 lbs/yr of TN and 7,181 lbs/yr of TP reductions
- Efficiency: $473/lb of TN/yr
- Estimated benefit based on information from Chesapeake Bay area
  - Benefits in IRL will likely be greater

Project Plan Expenditures



Respond – Citizen Oversight

- **Transparency –**
  - Were projects on schedule?
- **Accountability –**
  - Were project cost estimates correct?
- **Performance –**
  - Are the projects reducing pollution, as planned?
- **Responsive Management -**
  - Are there better projects to go in the plan?

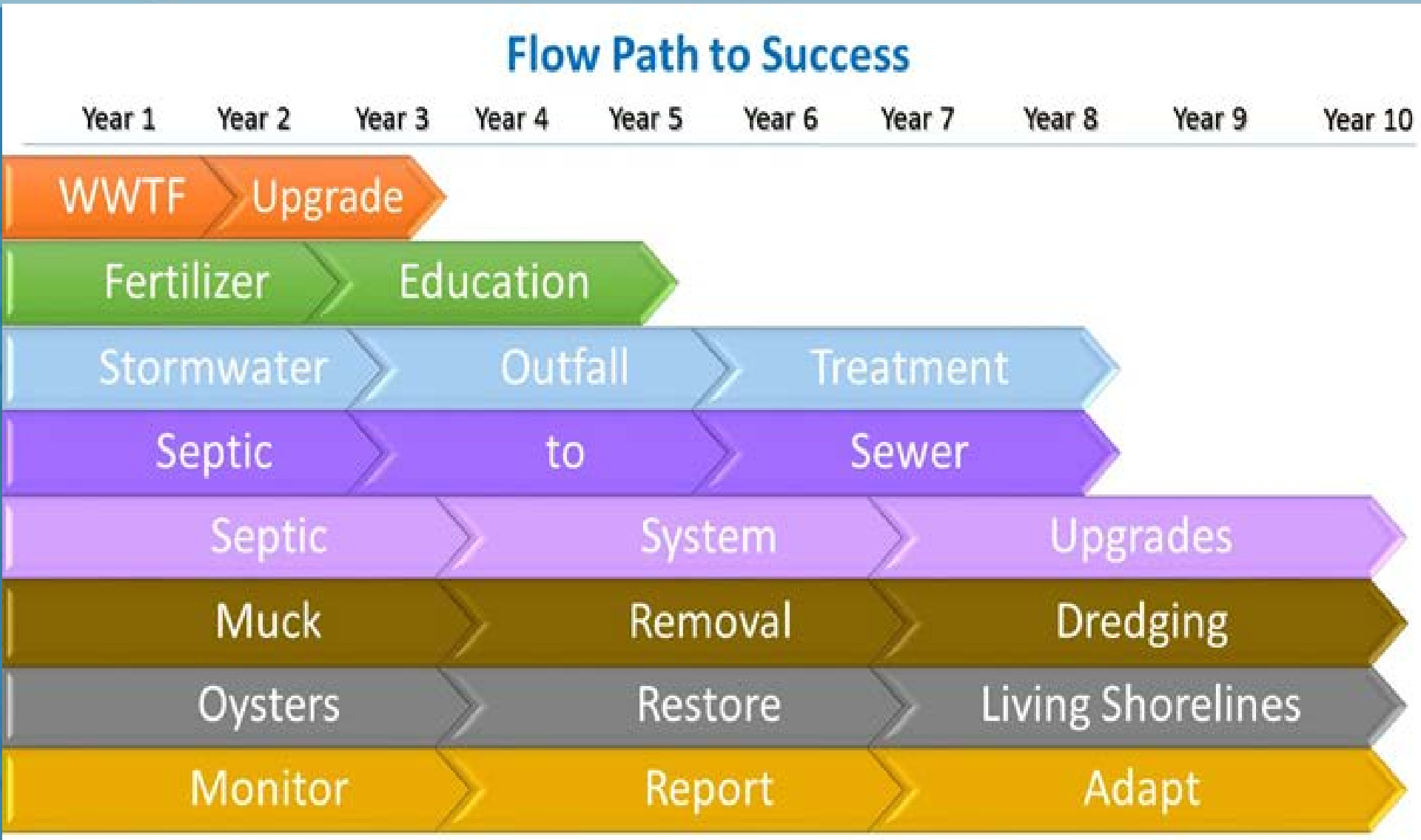
Respond – Adaptive Management of the Plan

- STEAM Team - Volunteer Citizen Oversight
  - Scientists
  - Technology entrepreneurs
  - Economists/Finance
  - Real estate interests
  - Education/outreach
  - Tourism/nature-based tourism
  - Lagoon advocacy
- League of Cities nominates ½ of Team
- Board of County Commissioners nominates ½

Summary of Plan Benefits

Project Category	Project Type	Estimated Total Project Cost	Nitrogen Reductions (lbs/yr)	Average Cost/lb/yr of TN	Phosphorus Reductions (lbs/yr)	Average Cost/lb/yr of TP
Reduce	Fertilizer Management/Public Education	$625,000	6,123	$102	813	$769
	WWTF Upgrades for Reclaimed Water	$9,400,000	40,778	$214	TBD	TBD
	Septic System Removal	$41,764,000	56,509	$852	N/A	N/A
	Septic System Upgrades	$22,192,000	27,659	$802	N/A	N/A
	Stormwater Projects	$10,800,000	118,440	$88	17,026	$612
Remove	Muck Removal	$198,100,000	491,300	$408	73,650	$2,733
Restore	Oyster Reef Living Shorelines	$10,000,000	21,120	$473	7,181	$1,393
Respond	Projects Monitoring	$10,000,000	N/A	N/A	N/A	N/A
Total	***Total***	***$302,881,000***	***761,929***	***$398***	***98,670***	***$1,377***

Summary of Plan Benefits



Save Our Lagoon Project Plan

Funding Options for Plan Implementation

Virginia Barker, Director

Natural Resources Management Department

How Can We Fund the Plan?

Option 1: Voter-approved County-wide Ad Valorem levy

- Save Our Lagoon Special Taxing District
- 1 mill ($1 per $1000 of taxable value)
- 10 year sunset
- $32 million per year
- 10-year total of $320 million

Grants could accelerate schedule and benefits

How Can We Fund the Plan?

Option 2: Voter-approved County-wide Ad Valorem levy

- Save Our Lagoon Special Taxing District
- 1/2 mill (50¢ per $1000 of taxable value)
- 20 year sunset
- $16 million per year
- 20-year total of $320 million

Grants could accelerate schedule and benefits

How Can We Fund the Plan?

Option 3: Voter-approved County-wide Ad Valorem levy

- Save Our Lagoon Special Taxing District
- 1/2 mill (50¢ per $1000 of taxable value)
- 10 year sunset
- $16 million per year
- 10-year total of $160 million
- Must leverage $143 million from grants/Legislative appropriations

How Can We Fund the Plan?

Option 4: Voter-approved County-wide Infrastructure Sales Tax

- Save Our Lagoon Special Taxing District
- 1/2 cent
- 10 year sunset
- $34 million per year
- 10-year total of $340 million
- Negotiate municipal revenue sharing agreements, not statutory formula

Grants could accelerate schedule and benefits

How Can We Fund the Plan?

Option 5: Other combinations of

- Levies
- Timeframes
- Uses
- Matching funds

Acknowledgements

Scientist Subject Matter Experts:

- Dr. Duane DeFreese, Indian River Lagoon National Estuary Program and Indian River Lagoon Council Executive Director
- Dr. Richard (Grant) Gilmore, expert in Indian River Lagoon fisheries and ecology
- Dr. Charles Jacoby, St. Johns River Water Management District Supervising Environmental Scientist
- Dr. Kevin Johnson, Florida Institute of Technology Associate Professor, Marine and Environmental Systems
- Dr. Mitchell A Roffer, Florida Institute of Technology Adjunct Professor, President Roffer's Ocean Fishing Forecasting Service, Inc.
- Dr. Jonathan Shenker, Florida Institute of Technology Associate Professor of Marine Biology
- Dr. John Trefry, Florida Institute of Technology Professor of Marine and Environmental Systems
- Martin S. Smithson, Sebastian Inlet District Administrator
- Joel Steward, St. Johns River Water Management District Supervising Environmental Scientist (Retired)
- Dr. John Windsor, Florida Institute of Technology Oceanography and Environmental Science Professor Emeritus and Program Chair

Economic Impacts Subject Matter Experts:

- Eric Garvey, Brevard County Tourism Development Council Executive Director
- Herb Hiller, Brevard County Tourism Development Council Consultant on Ecotourism
- Vince Lamb, Indian River Lagoon Council Management Board, Florida Master Naturalist, Entrepreneur
- Dr. Michael H. Slotkin, Florida Institute of Technology Associate Professor, Nathan M. Bisk School of Business
- Laurilee Thompson, Brevard County Tourism Development Council, Commercial Fisheries Expert, Entrepreneur
- Dr. Alexander Vamosi, Florida Institute of Technology Associate Professor, Nathan M. Bisk School of Business
- Jim Brandenburg, Brevard County Property Appraiser Information Technology

Agencies:

- Florida Department of Environmental Protection
- St. Johns River Water Management District
- Florida Department of Health
- Space Coast Tourism Development Council
- Space Coast Association of REALTORS®
- Brevard County Natural Resources Management Department
- Brevard County Utility Services Department
- Brevard County Property Appraiser Information Technology
- Brevard County Budget Office
- Canaveral Port Authority

Municipalities:

- Titusville
- Cocoa
- Rockledge
- Melbourne
- West Melbourne
- Palm Bay
- Cape Canaveral
- Cocoa Beach
- Satellite Beach

County Natural Resources Management Staff


Vision of Success
Healthy Lagoon
Fiscally Responsible Plan
Science-Based
Data-Driven
Responsive
Transparent Citizen Oversight