April 16, 2026

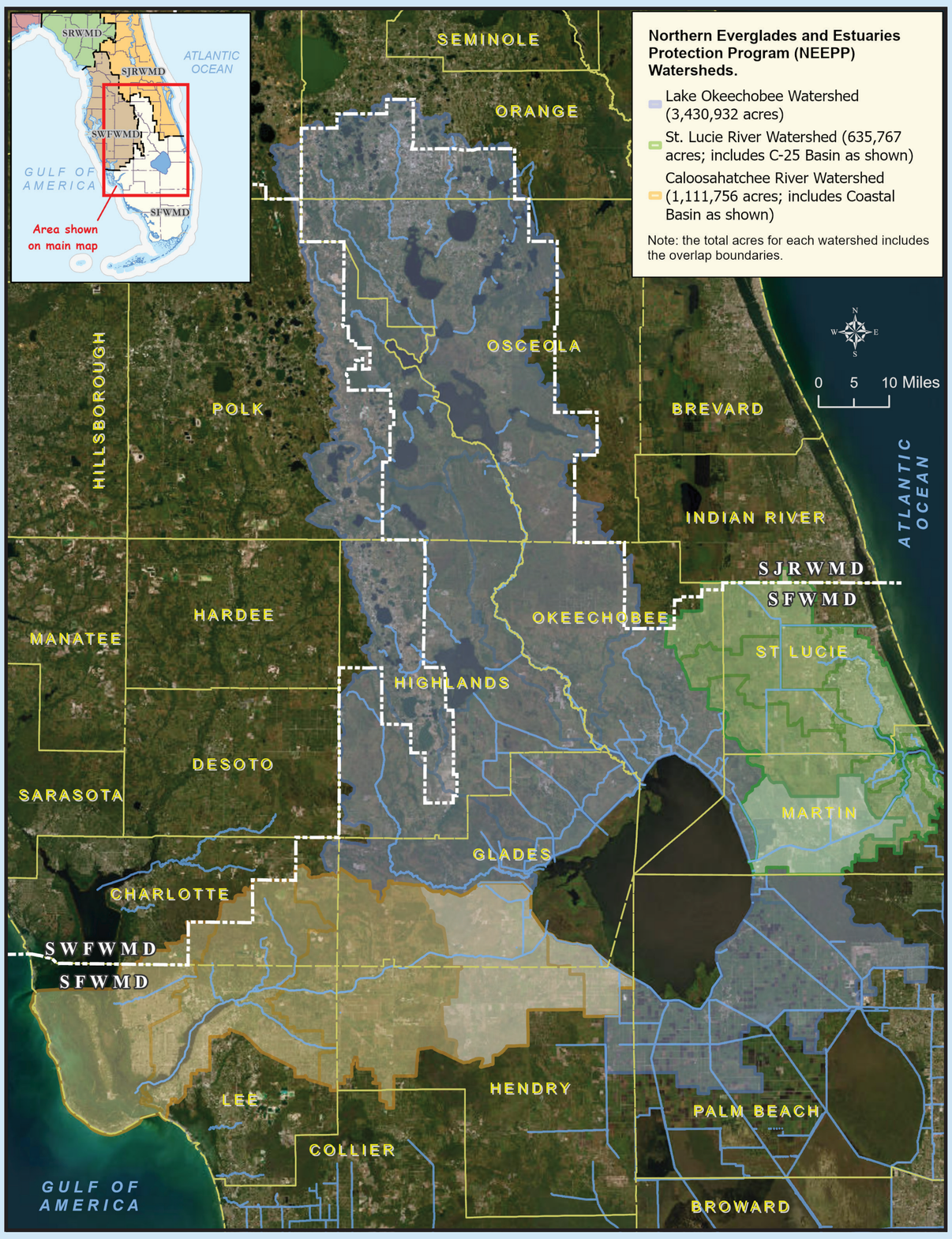
Northern Everglades and Estuaries Protection Program (NEEPP) Workshop

Encouraging Stakeholder and Public Engagement

The South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (DEP), and Florida Department of Agriculture and Consumer Services (FDACS), "the Coordinating Agencies," welcome you to the 2026 Joint NEEPP Workshop.

Caloosahatchee River Estuary

The purpose of NEEPP is to protect and restore surface water resources and achieve and maintain compliance with water quality standards in the Northern Everglades. The Northern Everglades include the Lake Okeechobee, Caloosahatchee, and St. Lucie River watersheds.



NEEPP requires watershed protection programs to improve the quality, quantity, timing, and distribution of water in the Northern Everglades ecosystem.

The programs are watershed specific and comprised of research and monitoring, development, and implementation of best management practices (BMPs), refinement of existing regulations, and structural and nonstructural projects.

The programs are driven by DEP's Basin Management Action Plans (BMAPs) and supported, in part, by the Watershed Protection Plans (WPPS). These plans are developed by the SFWMD and integrated with DEP and FDACS programs to control nutrient sources at the local, subregional and regional levels.

St. Lucie Estuary

Together, the Coordinating Agencies are jointly responsible for implementing NEEPP, each with specific areas of responsibility.

DEP is the lead on water quality protection measures through the Basin Management Action Plans; SFWMD is the lead on hydrologic improvements pursuant to the Watershed Protection Plans; and FDACS is the lead on agricultural interim measures, best management practices, and other measures.

Sandhill Crane, Lake Okeechobee

Water Quality Sample Collection, Methods, and Equipment

Mark Hinz, Danielle Tharin

Water Quality Monitoring Section, Office of Water Quality

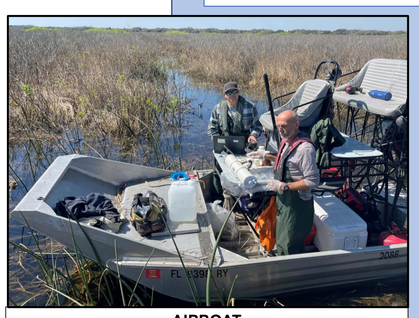
Water Quality Monitoring Workflow:

Monitoring Plan Development, Permit Coordination, Environmental Monitoring Review Team Approval → Site Reconnaissance, Station Installation, and Registration → Start-Up and Routine Sample Collection → Sample Collection, Audits, and Quality Assurance → Field Data Validation

Sample Collection and Processing

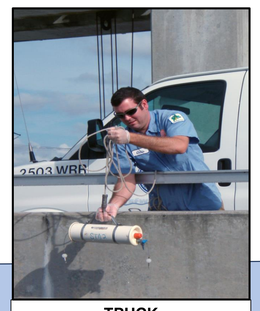
WHY DO WE MONITOR?
- Restoration projects
- Scientific studies
- Tracking progress towards meeting water quality standards

Site Access

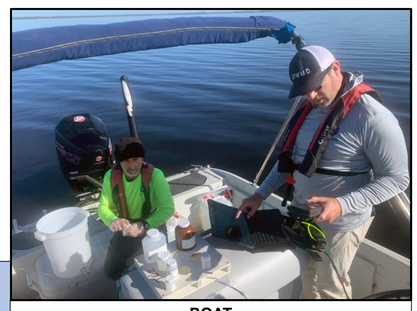


AIRBOAT
Station PC34 on the Kissimmee River floodplain. Collection of surface water samples and multi-parameter sonde data.

HELICOPTER
Taking depth readings at Station CA217 in Water Conservation Area (WCA) 2A using a "Paluga pole".

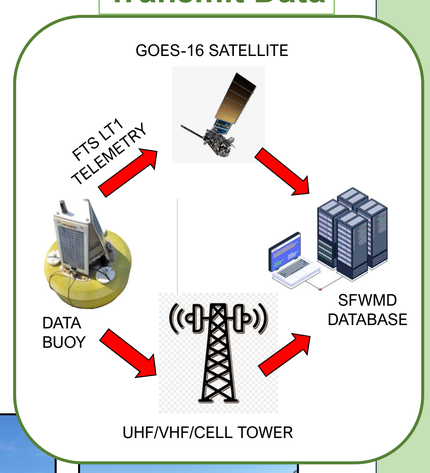


TRUCK
S5A-E on the C-51 Canal. Collection of samples upstream of the gates using a Van Dorn.

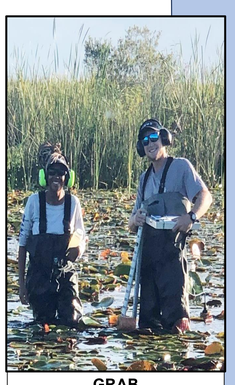


BOAT
Station A03 in East Lake Tohopekaliga. Collection of surface water samples and multi-parameter sonde data.

Two Ways to Transmit Data



Methods



GRAB
Surface water collection at Station LOXAZ2 in WCA-1.

GRAB
Water quality sample using a Van Dorn at L001 in Lake Okeechobee.

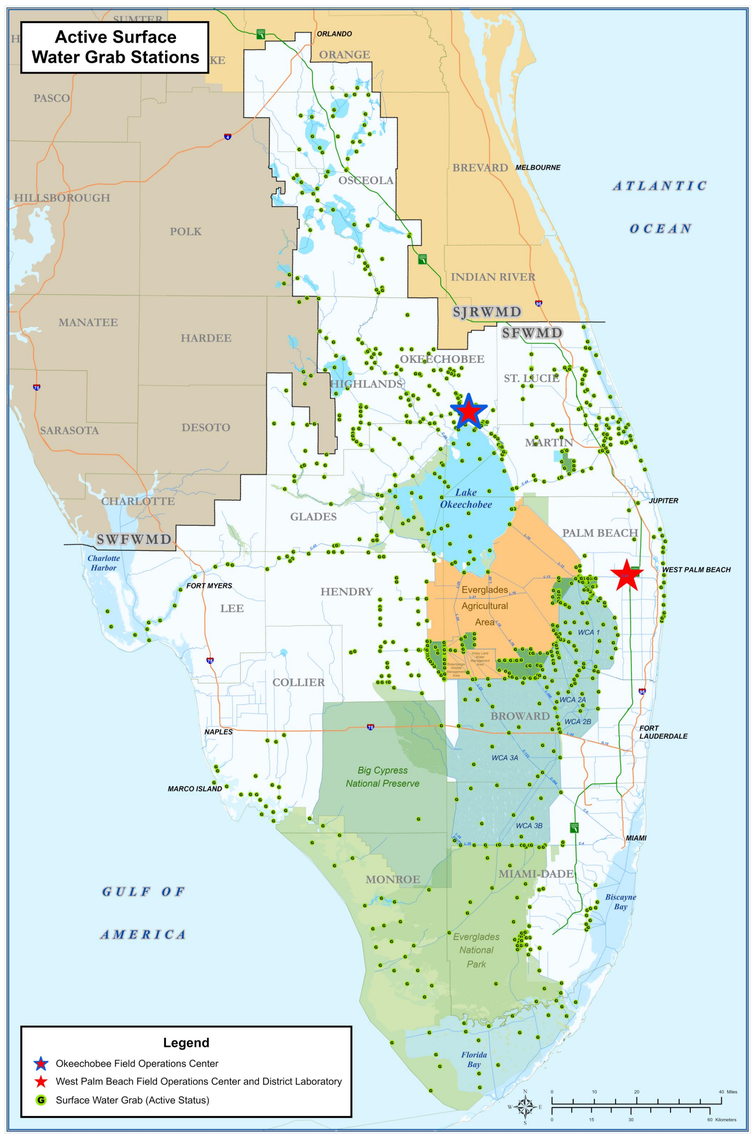
IN-SITU
Field instruments measure pH, dissolved oxygen, temperature, specific conductance, and more.

AUTOSAMPLER
Station S332DX of the Everglades National Park Inflow North project.

SEDIMENT
Sediment sampling using coring tube at FS transect in WCA-2A.

CONTINUOUS MONITORING
Station SGT5W1 in Collier County, 1 of 43 continuous monitoring locations.

FISH COLLECTION
Mosquitofish collection for mercury analysis at G-734 in Stormwater Treatment Area (STA) 1W Expansion 1.



Monitoring Site Type	Instrumentation Used	Stations				Total Annual Station Visits	Total Annual Station Visits Combined	Average Weekly Station Visits
		Helicopter	Boat	Truck	Total Stations			
Surface Water		101	226	820	1,242	22,098	22,409	431
Autosampler		0	0	95				
Continuous Monitoring (e.g., In-situ field data measurement)		0	27	2	29	311		

Sample Processing

Processing surface water sample at Station L001 on Lake Okeechobee.

Processing samples into specific lab analysis bottles at Station IRL06 in the Indian River Lagoon.

Sample preservation with acid at Station CA39 in WCA-3A.

Field Technology

At Station G390B in STA-3/4, field observations and instrument data are entered directly into computer to maximizes efficiency and minimizes errors through built-in cross-checks, which then are uploaded directly into the Laboratory Information Management System (LIMS).

End of Sampling Day

Samples are preserved (filtered, acidified, or chilled) in the field and ready for transport.

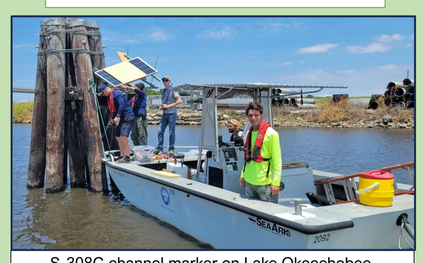
Samples are delivered to the District laboratory or shipped to an external laboratory for analysis.

Continuous Data Monitoring

Calibration

Continuous monitoring instrument calibration at the District's Field Operations Center.

Station Installation



S-308C channel marker on Lake Okeechobee. Installing solar panels to power the deployed continuous monitoring equipment.

Routine Maintenance

KBRN Platform in the Kissimmee River. Swapping out continuous monitoring instruments.

L006 water quality station on Lake Okeechobee. Interchanging continuous monitoring instruments.

Instrumentation

Lake Okeechobee instrumentation platform and telemetry tower

Manatee Mitigation Feature – North Pool Instrumentation buoy. Continuous Monitoring of temperature and specific conductance data.

In-Situ data collection and telemetry equipment for upload

Post-Calibration / Data Processing

Monthly Continuous Monitoring instrument calibration and review at the District's Field Operations Center.

Data Validation

Chemistry Laboratory

For more information:

Compliance Monitoring Plans — SCAN ME

Operational Monitoring Plans — SCAN ME

Quality First: The Environmental Laboratory Workflow, Analytical Methods, Techniques, and Applications

Thomas Boccio, Leidy Cruz, Anthony Denardo, Keith Herring, Josh Labrum, Lucrecia Poveda-lee

Analytical Services Section, Office of Water Quality

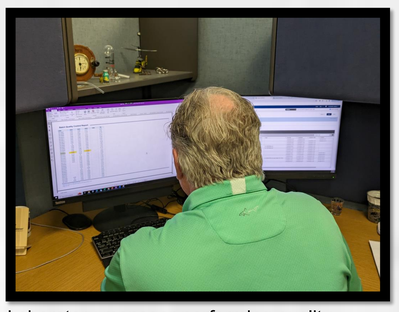
Path from Sample to Data:

Laboratory Client Services → Sample Receiving → Laboratory Analysis → Quality Assurance/ Quality Control Review → Data Validation → Database Loading → Data Accessible in DBHYDRO Insights and DataOne

Login analyst verifying number of samples and sample pH during sample receiving.

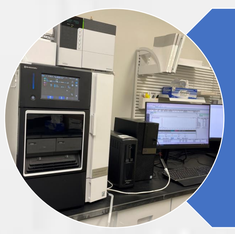
Login analyst storing received samples in walk-in cooler for future analysis. The lab has one cooler for water samples and another for sediment and tissue samples.

Chemist using ICP-OES to analyze various metals in the sample. See below for a list of the analytical instrumentation and associated procedures.



Laboratory manager performing quality review of data using the laboratory information management system (LIMS).

Quality assurance supervisor performing data validation review of LIMS data for approval to upload to the SFWMD DBHYDRO database.



High Performance Liquid Chromatography (HPLC)

- Chlorophyl *a* and *b*
- Pheophytin

Laboratory Production, Water Year 2025 (5/1/2024 through 4/30/2025)

Laboratory Customer	Work Orders Received	Field Tests Conducted	Parameters Collected (Laboratory Tests)	Total Parameters Collected (Field and Laboratory)
Water Quality Monitoring	2,644	52,417	118,803	180,197
Hydrology, Research and Co-op Agreement	470	2,229	13,019	16,006

Liquid Chromatography Tandem Mass Spectrometry (LC MS/MS)

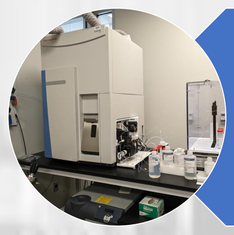
- Algal Toxins
- Research and Development

Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)

- Total Metals (Aqueous and Sediment/Tissue)
- Cations (Ca, K, Mg, Na, etc.)

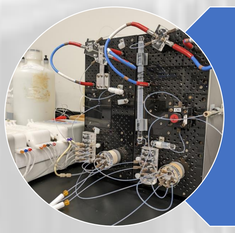
Additional Laboratory Production Metrics, Water Year 2025

Metric	Total
Laboratory Tests Performed	130,118
Field and Laboratory Total Parameters Collected	196,203
Work Orders Completed (includes external labs' WO)	3,302
DBHYDRO Records Loaded	224,848
Watershed Information Network (WIN) Florida Department of Environmental Protection (FDEP) Database Records Loaded	110,789



Inductively Couple Plasma-Mass Spectrometry (ICP-MS)

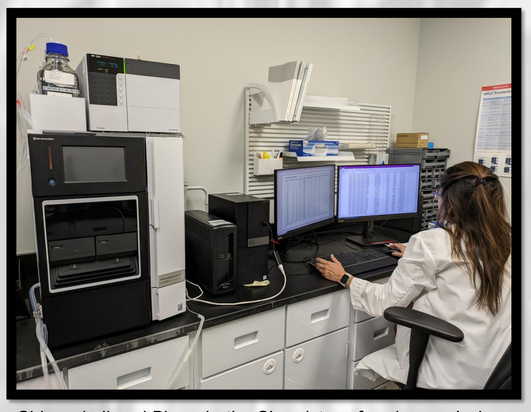
- Total Metals (Aqueous & Sediment/Tissue)



Flow Injection Analysis (FIA/Colorimetric)

- Total Phosphorus
- Total Nitrogen
- Orthophosphate
- Nitrate/Nitrite
- Ammonia
- Silica

Total Nitrogen: Chemist performs analysis using the FIALab FIAlyzer FLEX instrument. This instrument is versatile and is used by SFWMD laboratory analysts to perform a wide variety of inorganic nutrient analysis (TP, TN, OPO_4/NO_2, NH_4, SiO_2, etc.).



Chlorophyll and Pheophytin: Chemist performing analysis using a Shimadzu LC-2030C (High Performance Liquid Chromatography).

Ion Chromatography (IC)

- Anions (Chloride and Sulfate)

Titration

- Alkalinity
- pH

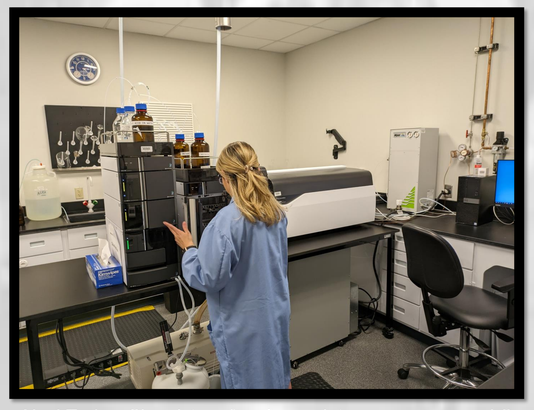
Thermal Decomposition and Atomic Absorption

- Total Mercury in Sediment and Tissue

Combustion Analysis

- Total Organic Carbon (Aqueous)
- Total Carbon (Sediment/Tissue)
- Total Organic Carbon (Sediment/Tissue)
- Total Nitrogen (Sediment/Tissue)

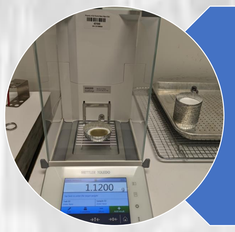
Total Suspended Solids: Chemist performing gravimetric analysis, a labor-intensive physical analysis to determine the amount of suspended matter in a fixed volume of a sample of surface water.



Algal Toxins: Chemist performing maintenance on a new LC MS/MS instrument used by SFWMD to analyze algal toxins.

Turbidimeter

- Turbidity



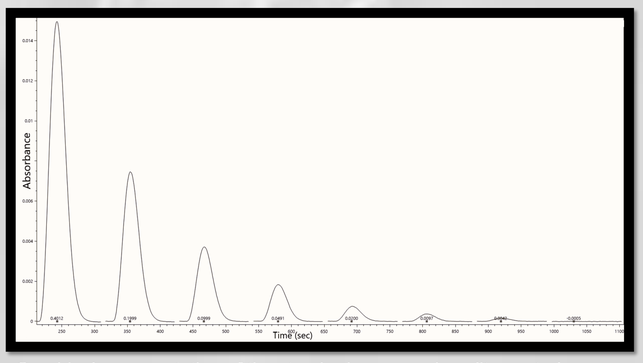
Physical

- Total Suspended Solids
- Volatile Suspended Solids
- Total Dissolved Solids
- Ash Free Dry Weight
- Conductivity
- pH

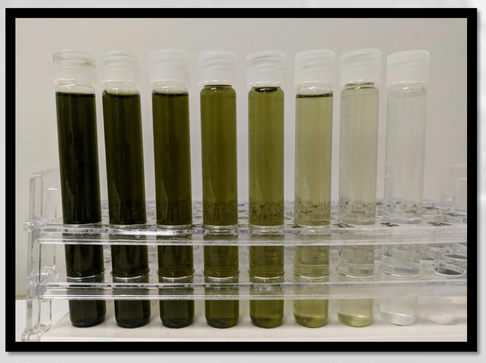
Lyophilization

- Freeze drying soil/sediment/biological tissue

The SFWMD Environmental Laboratory is accredited by the Florida Department of Health (FDOH) through the National Environmental Laboratory Accreditation Program following F.A.C 64E-1 (Certification for Environmental Testing Laboratories) and adheres to F.A.C 62-160 (Quality Assurance) to maintain the highest quality data possible.



Graphical representation of the standard curve and quality control samples produced while analyzing total phosphorus using flow injection analysis on the FIALab FIAlyzer FLEX instrumentation.



Visual representation of instrument calibration curve. Samples above range from the high concentration (left) to non-detectable concentrations (right).

For more information:

DBHYDRO Insights

SCAN ME

CERP SFWMD DataOne Portal

SCAN ME

DBHydro Insights: Enhancing Access to Environmental Data

V. Nechita[1], J. Larock[1], M. Breslin[2], B. Turcotte[3], M. Josan[1]

[1]Compliance Assessment & Reporting Section, Office of Water Quality; [2]Applied Sciences Bureau, Ecosystem Restoration Division; [3]IT Applications Section, Information Technology Division

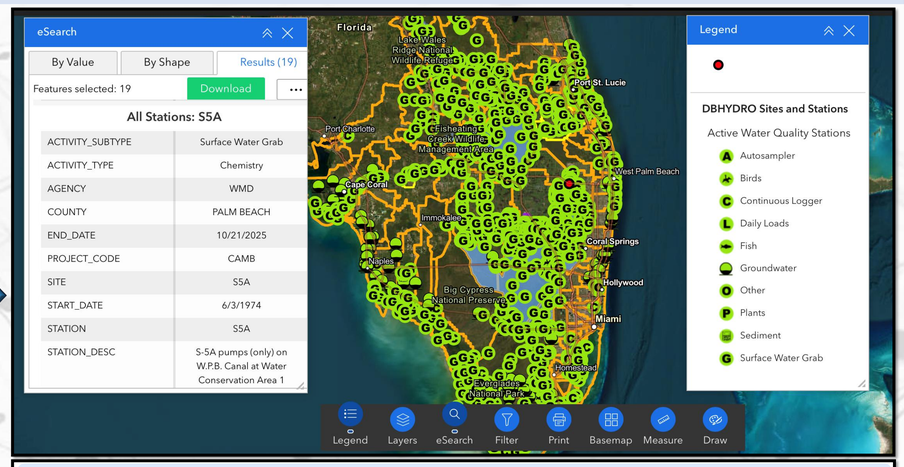
Discover DBHydro Insights (DBHI), the innovative web-based platform reforming access to South Florida Water Management District's environmental data. DBHI delivers an intuitive interface equipped with dynamic tools and customizable data "lenses" providing tailored perspectives for diverse user needs. Explore its enhanced capabilities and experience how DBHI streamlines data access and visualization through a more efficient and modern user experience.

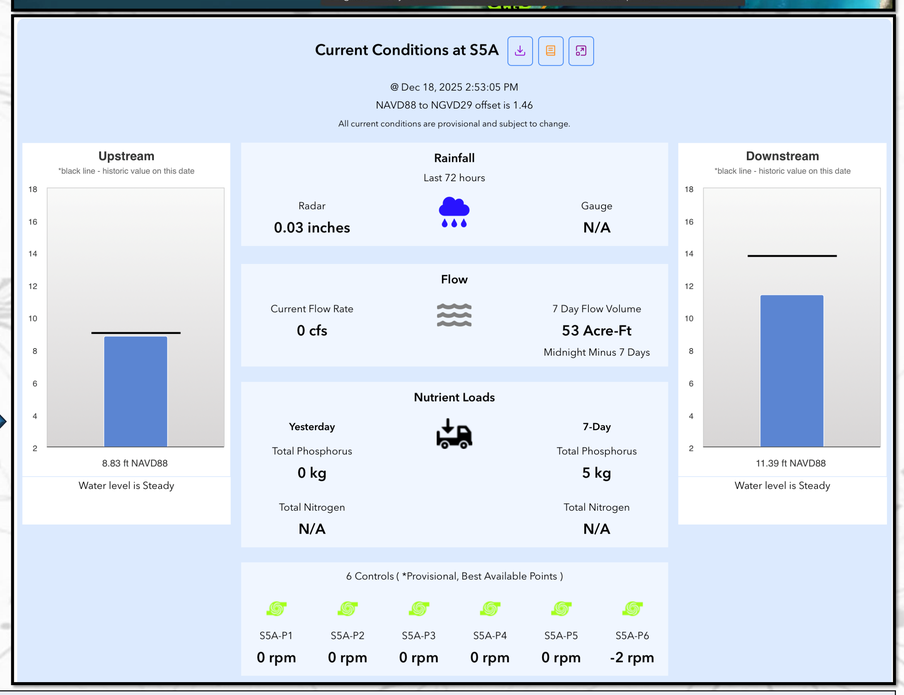
DBHI LENSES

Map-based search for specific and nearby monitoring locations

Easily locate and access data through a web-based interactive map

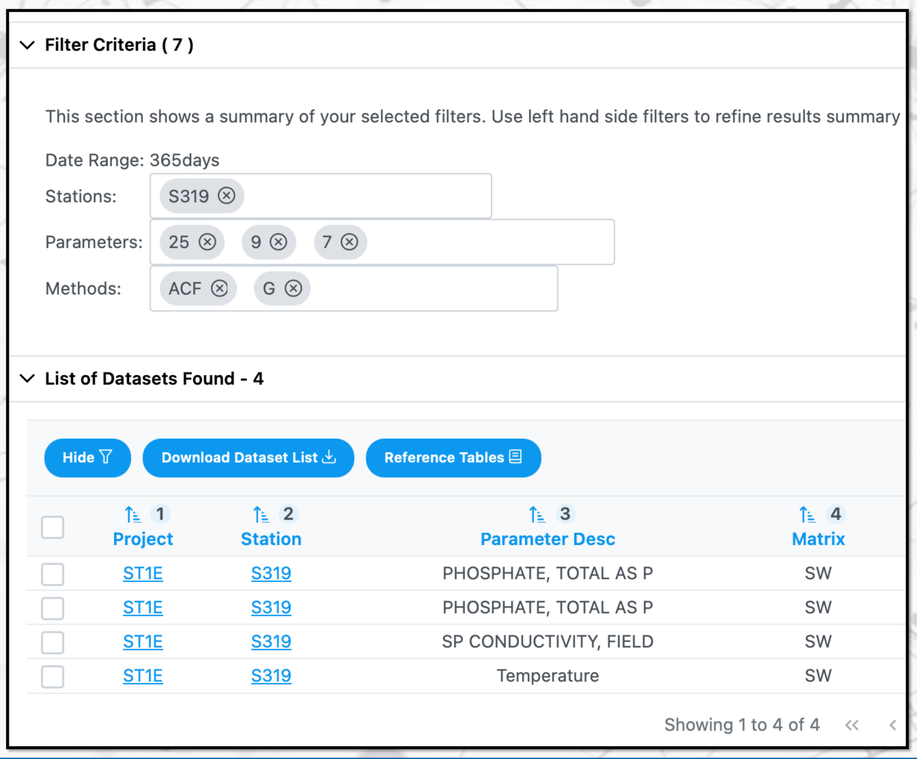
Real-time data visualizations for parameters like water levels, flow, nutrient loads, gate opening or pump revolutions per minute



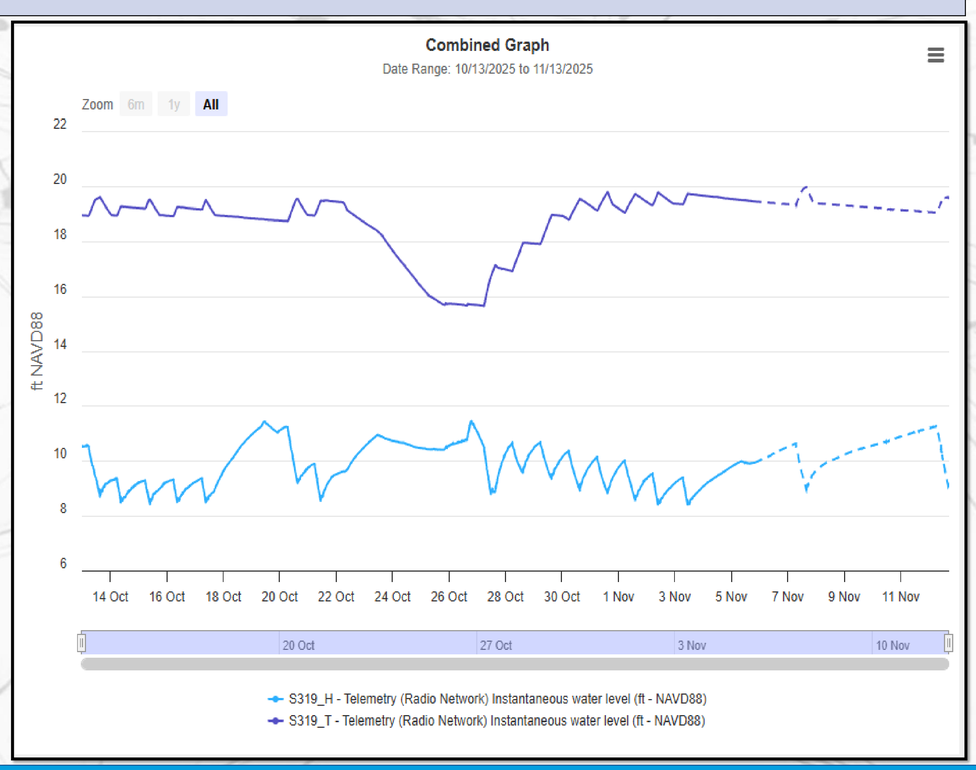


Access Types of Data:
Hydrologic
Water Quality
Hydrogeologic

Interactive Visualizations	Explore datasets through charts, graphs, and maps for deeper understanding
Customizable Filters	Apply filters to search data by locations, parameters, and custom time ranges
Export Options	Download visualizations or filtered datasets in multiple formats (e.g., .txt, .csv, .png)
URL Creation	Generate URL's that can be shared and be updated dynamically
Real-Time Updates	Access up-to-date data, including provisional data
Comparable with DBHydro Browser	Retain the functions of legacy DBHydro Browser interface along with some added features
Reference Tables	Explore Metadata and data attributes, find monitoring plans for active water quality sampling stations stored in DataONE
Multi-Chart Comparison	View and analyze multiple interactive charts either side-by-side or combined



Quickly create charts with the data lens for easy visualization



New in 2025-2026

- ✓ DBHydro Browser was officially retired
- ✓ Updated DBHydro online training videos and User's Guide for Insights
- ✓ Began modifications and updates to the DBHydro Insights "System Lens"
- ✓ Made significant improvements to the "Data Lens" to access Hydrogeologic data
- ✓ Improved the "Data Lens" Web-Based Interactive Map search feature

If you wish to provide feedback, please contact: datarequests@sfwmd.gov

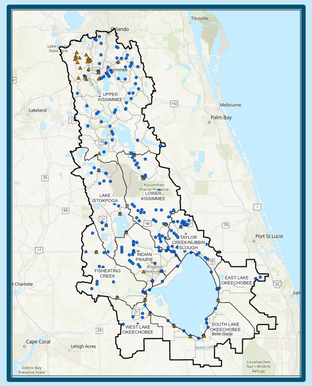
Access DBHydro Insights: https://insights.sfwmd.gov/#/homepage

For more information:

SCAN ME

LAKE OKEECHOBEE BASIN MANAGEMENT ACTION PLAN (BMAP)

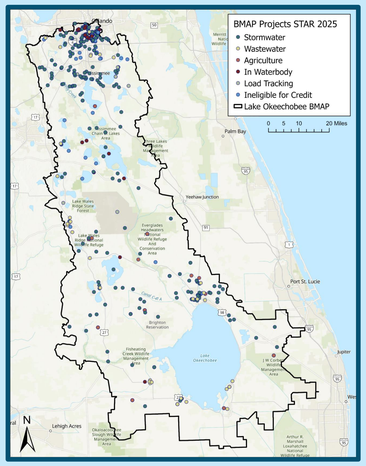
Water Quality Monitoring Network



Water Quality Parameters Monitored	
Alkalinity	Nitrate-Nitrite (N)
Ammonia (N)	Total Kjeldahl Nitrogen (TKN)
Biological Oxygen Demand (BOD)	Total Nitrogen (TN)
Organic Carbon	Orthophosphate (P)
Total Carbon	pH
Chlorophyll-*a*	Total Phosphorus (TP)
Color	Specific Conductance/Salinity
Dissolved Oxygen	Temperature
Dissolved Oxygen (Saturation)	Total Suspended Solids
Flow	Turbidity

Water quality is monitored at 309 stations throughout the watershed.

DRAFT Progress Statewide Annual Report (STAR) 2025



426 projects as of Dec. 31, 2025

Project Status	Number
Completed	245
Ongoing	74
Planned	47
Underway	60

DRAFT reductions and percent progress for each subwatershed are shown below.
The next 5 Year Milestone for is 75% of total required reductions.

Subwatershed	TP Load Required Reduction (mt/yr)	15-year (2029) TP Reduction Milestone (mt/yr)	TP Reduction Achieved	% TP Milestone Achieved
Fisheating Creek	50.9	38.2	10.0	26%
Indian Prairie	98.3	73.7	28.0	38%
Lake Istokpoga	33.8	25.4	2.7	11%
Lower Kissimmee	50.1	37.6	18.8	50%
Taylor Creek/Nubbin Slough	78.1	58.6	39.1	67%
Upper Kissimmee	72.4	54.3	18.8	35%
East Lake Okeechobee	21.7	16.3	2.9	18%
South Lake Okeechobee	27.1	20.3	2.9	14%
West Lake Okeechobee	3.5	2.6	0.7	28%
Multi-Basin	0.0	0.0	0.2	NA
Total	**435.9**	**312.4**	**110.7**	**38%**

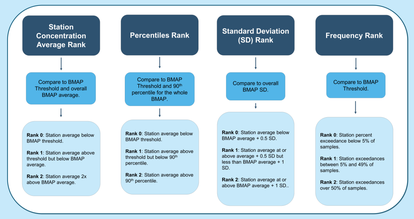
mt/yr = metric tons/year

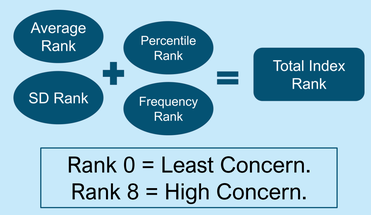
Featured Projects

- Innovative technologies are being investigated to recycle phosphorus-rich sediments as soil amendment on agricultural lands. If successful, these kind of projects aim to address internal loading and offset use of commercial fertilizer for crop production.
- Increased outreach to local governments within the Okeechobee basin resulted in new lead entities. Palm Beach County Utilities were able to identify and add new projects to this year's STAR related to wastewater upgrades and septic remediation in South Lake Okeechobee.
- Okeechobee Utility Authority completed Pine Ridge Park Septic to Sewer project in 2025, which eliminated 110 septic systems in Taylor Creek/ Nubbin Slough Subwatershed.

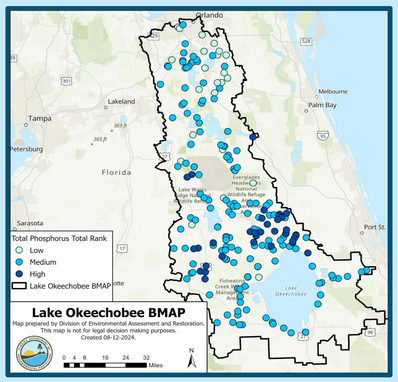
Hot Spot Analysis

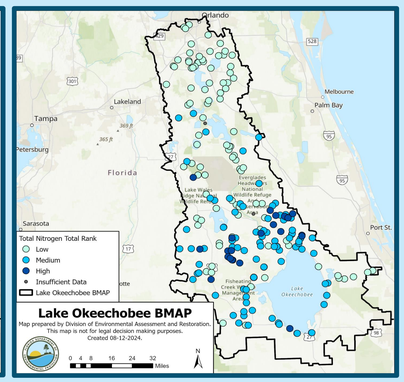
Analysis method for prioritization at a local scale.





Rank 0 = Least Concern.
Rank 8 = High Concern.

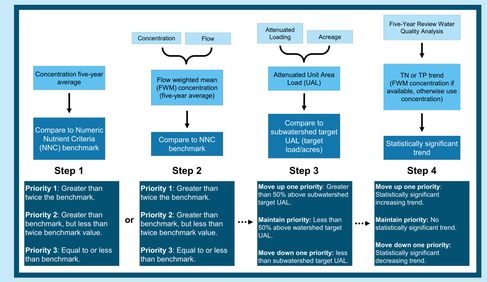


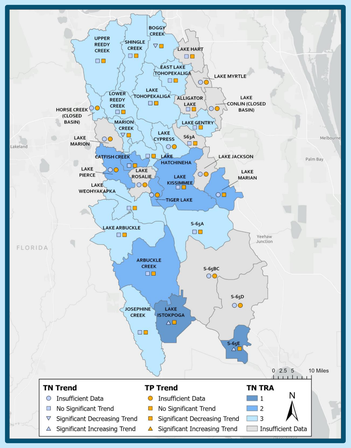


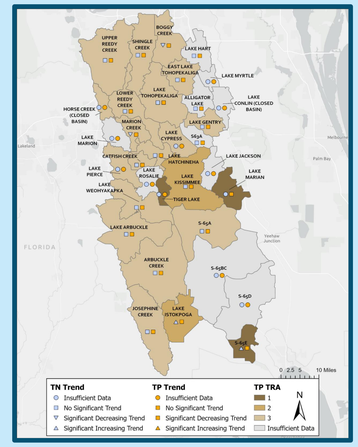
Targeted Restoration Area Evaluation and Water Quality Trend Analysis

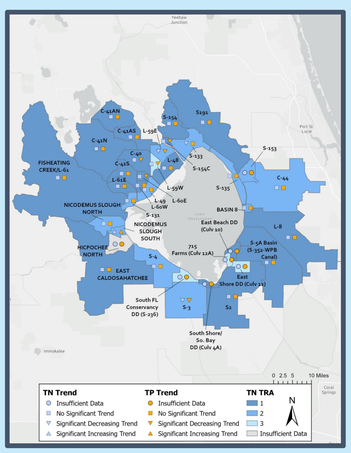
Targeted Restoration Areas (TRA) sequentially compare four parameters to determine priority basins for restoration projects.

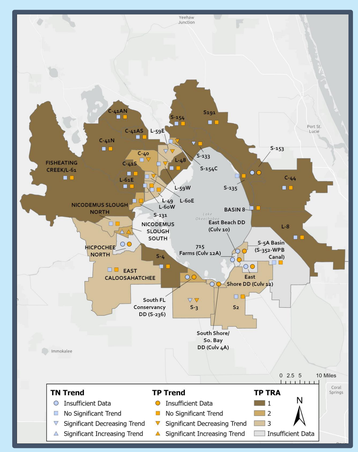
Seasonal Kendall trend analysis investigates trends in TN and TP concentrations for the basins and for the BMAP monitoring network stations.











Chandler Keenan, Environmental Administator
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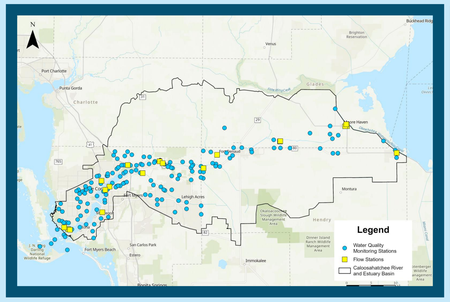
CALOOSAHATCHEE RIVER AND ESTUARY BASIN MANAGEMENT ACTION PLAN (BMAP)

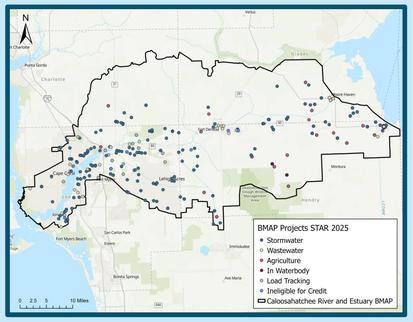
Water Quality Monitoring Network



Water Quality Parameters Monitored	
Alkalinity	Nitrate-Nitrite (N)
Ammonia (N)	Total Kjeldahl Nitrogen (TKN)
Biological Oxygen Demand (BOD)	Total Nitrogen (TN)
Organic Carbon	Orthophosphate (P)
Total Carbon	pH
Chlorophyll-*a*	Total Phosphorus (TP)
Color	Specific Conductance/Salinity
Dissolved Oxygen	Temperature
Dissolved Oxygen (Saturation)	Total Suspended Solids
Flow	Turbidity

Water quality is monitored at 62 stations throughout the watershed.

DRAFT Progress Statewide Annual Report (STAR) 2025



292 projects as of Dec. 31, 2025

Project Status	Number
Completed	165
Ongoing	45
Planned	57
Underway	25

DRAFT Reductions in Tidal Caloosahatchee Subwatershed.

The next milestone is 95% of total required reductions.

Entity	TN Required Reduction (lbs/yr)	15-year (2027) TN Reduction Milestone (lbs/yr)	TN Reduction Achieved (lbs/yr)
Agriculture	208,669	198,236	70,155
Charlotte County	5,847	5,554	1,180
City of Cape Coral	38,965	37,016	40,043
City of Fort Myers	19,493	18,518	18,234
DOT District 1	5,098	4,843	11,404
LA-MSID	34,716	32,981	28,718
Lee County	59,559	56,581	131,173
Lucaya CDD	88	84	4
Moody River Estates CDD	424	403	0
Sail Harbour CDD	127	121	28
Verandah East CDD	533	506	117
Verandah West CDD	824	783	180
Total	**374,343**	**355,626**	**301,236**

DRAFT Reductions in East and West Caloosahatchee Subwatershed.

The next milestone is 35% of total required reductions.

Entity	TN Required Reduction (lbs/yr)	10-year (2030) TN Reduction Milestone (lbs/yr)	TN Reduction Achieved (lbs/yr)
Agriculture*	1,358,401	475,441	810,004
Charlotte County	644	225	130
City of Clewiston	3,704	1,296	1,469
City of LaBelle	7,643	2,675	2,771
City of Moore Haven	1,026	359	231
Collier County	38	13	0
DOT District 1	5,333	1,867	289
Glades County	17,439	6,104	3,844
Hendry County/Port LaBelle CDD	40,451	14,158	0
LA-MSID	31,690	11,092	11,779
Lee County	4,925	1,724	27,464
Portico CDD	784	275	101
River Hall CDD	4,343	1,520	548
Total	**1,476,421**	**516,749**	**858,631**

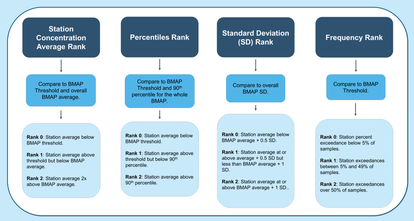
***Reductions from Agriculture in East and West include projects completed by DACS and SFWMD.**
lbs/yr = pounds/year

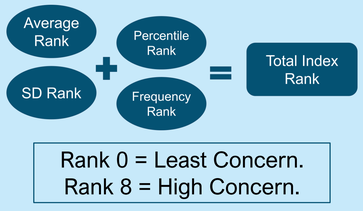
Featured Projects

- In 2025, the Florida Department of Agriculture and Consumer Services (DACS) updated their cost-share program's information in the BMAP, showing a significant increase in participation and reduction in agricultural nutrient loading.
- DEP completed updates to the BMAP's Hydrologic Simulation Program-FORTRAN (HSPF) model in late 2025, incorporating the latest water quality monitoring data and land use datasets. In 2026, DEP will begin meeting with stakeholders to discuss the resulting changes to reduction and allocation calculations.

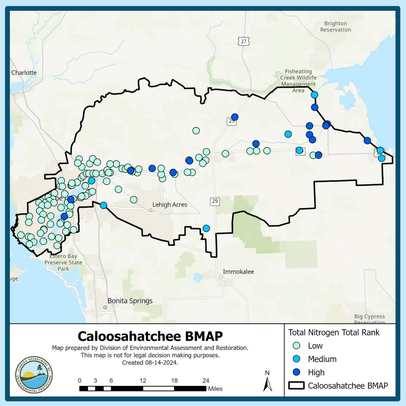
Hot Spot Analysis

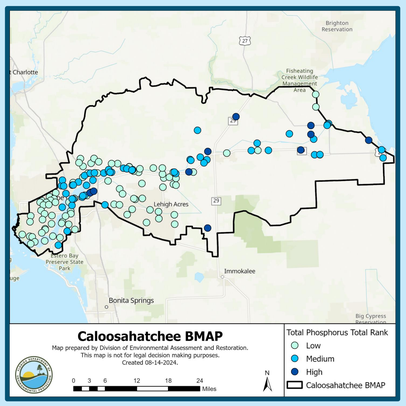
Analysis method for prioritization at a local scale.





Rank 0 = Least Concern.
Rank 8 = High Concern.

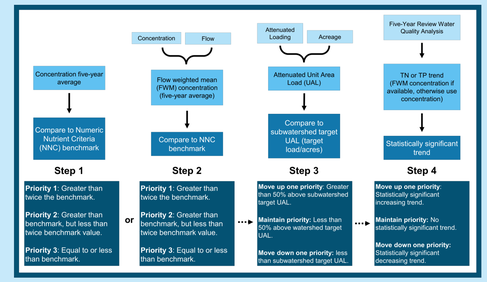


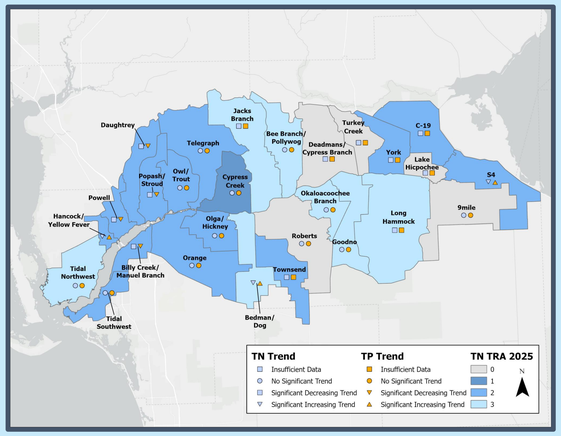


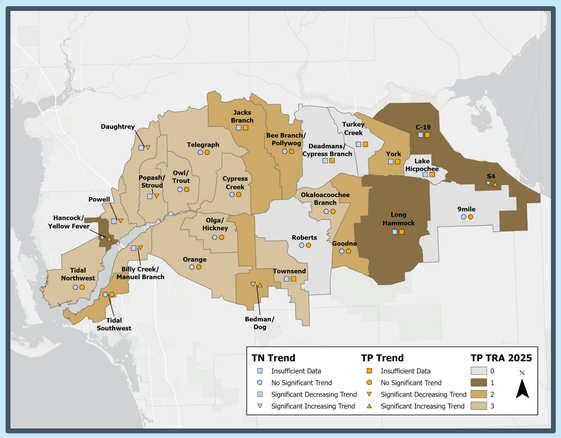
Targeted Restoration Area Evaluation and Water Quality Trend Analysis

Targeted Restoration Areas (TRA) sequentially compare four parameters to determine priority basins for restoration projects.

Seasonal Kendall trend analysis investigates trends in TN and TP concentrations for the basins and for the BMAP monitoring network stations.







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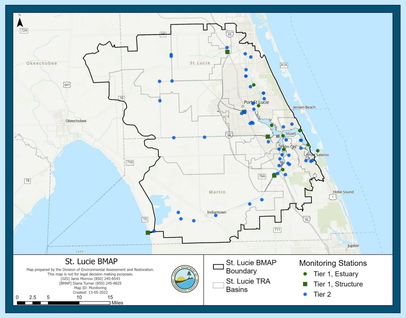
ST. LUCIE RIVER AND ESTUARY BASIN MANAGEMENT ACTION PLAN (BMAP)

Water Quality Monitoring Network



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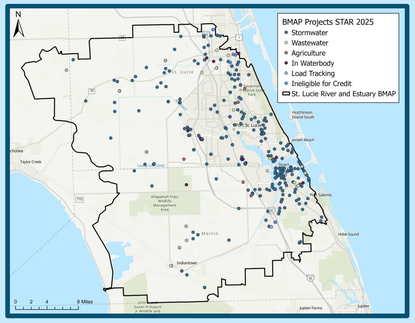
Chlorophyll-*a*	Total Phosphorus (TP)
Color	Specific Conductance/Salinity
Dissolved Oxygen	Temperature
Dissolved Oxygen (Saturation)	Total Suspended Solids
Flow	Turbidity

Water quality is monitored at 69 stations throughout the watershed.

DRAFT Progress Statewide Annual Report (STAR) 2025



372 projects as of Dec. 31, 2025

Project Status	Number
Completed	225
Ongoing	46
Planned	72
Underway	29

Entity	TN Required Reductions (lbs/yr)	TN Reductions Achieved	% of TN Milestone Achieved	TP Required Reductions (lbs/yr)	TP Reductions Achieved	% of TP Milestone Achieved
Agriculture*	884,700	554,102	63%	284,285	106,896	38%
City of Fort Pierce	16,205	3,889	24%	5,266	1,639	31%
City of Port St. Lucie	138,187	97,639	71%	44,277	25,629	58%
City of Stuart	6,003	11,519	192%	2,700	3,113	115%
Copper Creek CDD	1,500	155	10%	306	26	8%
Creekside CDD	475	0	0%	175	0	0%
DOT District 4	15,907	26,651	168%	4,801	7,202	150%
DOT District 1	594	0	0%	218	0	0%
Martin County	75,231	57,891	77%	31,786	16,821	53%
Okeechobee County	7,950	0	0%	1,966	0	0%
Portofino Isles CDD	1,271	131	10%	285	22	8%
River Place CDD	389	0	0%	127	0	0%
Southern Grove CDD	1,226	126	10%	310	25	8%
St. Lucie County	67,679	21,056	31%	21,398	5,371	25%
St. Lucie West Service District	13,469	1,925	14%	4,545	966	21%
Tesoro CDD	2,585	465	18%	829	76	9%
Town of Sewall's Point	417	2,313	555%	174	49	28%
Tradition CDD	8,396	0	0%	1,815	0	0%
Turnpike	4,163	466	11%	1,402	62	4%
Veranda CDD	1,012	182	18%	266	24	9%
Verano CDD	1,030	709	69%	260	240	92%
Village of Indiantown	3,600	0	0%	751	0	0%
Total	**1,252,108**	**779,219**	**62%**	**407,981**	**168,161**	**41%**

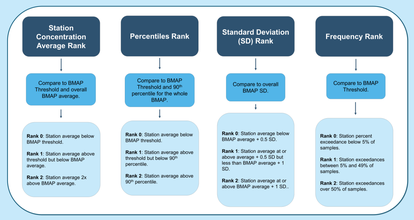
***Reductions from Agriculture include projects completed by DACS and SFWMD.** **lbs/yr = pounds/year**

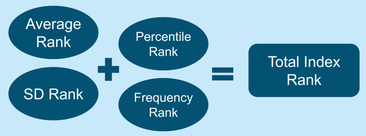
Featured Projects

- In 2025, the Florida Department of Agriculture and Consumer Services (DACS) updated their cost-share program's information in the BMAP, showing a significant increase in participation and reduction in agricultural nutrient loading.
- Nine stakeholders previously marked as *de minimis* were contacted about their BMAP requirements, all of which were able to identify and add new projects to this year's STAR.
- DEP is creating a new Hydrologic Simulation Program-FORTRAN (HSPF) model for the BMAP to include the most up-to-date land use and water quality data. The new model is expected to be completed in 2026.

Hot Spot Analysis

Analysis method for prioritization at a local scale.





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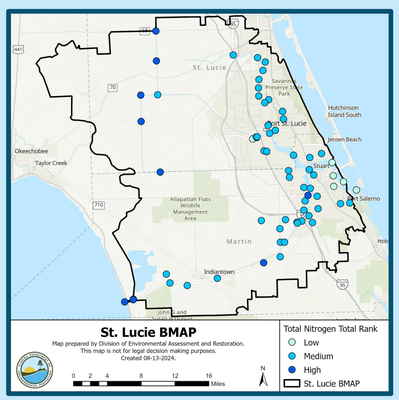

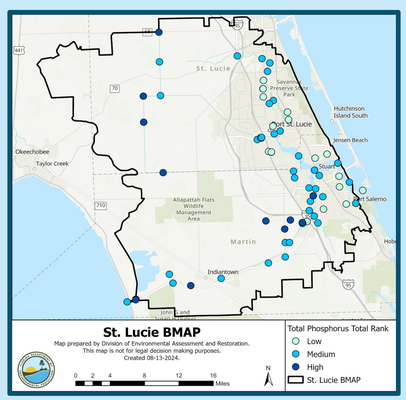

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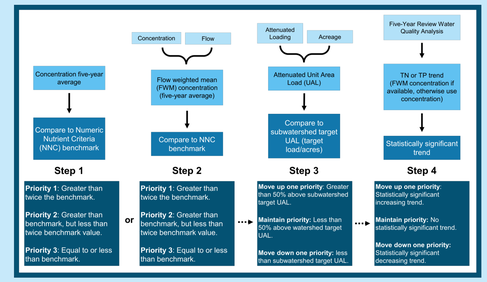

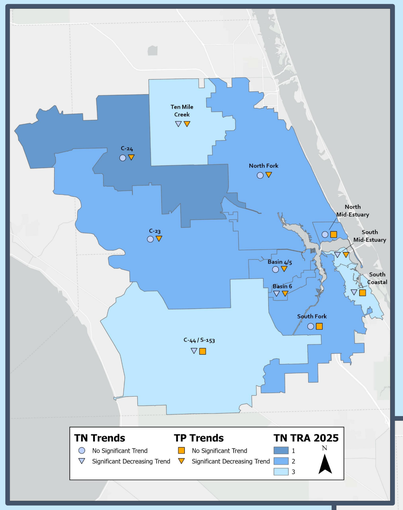

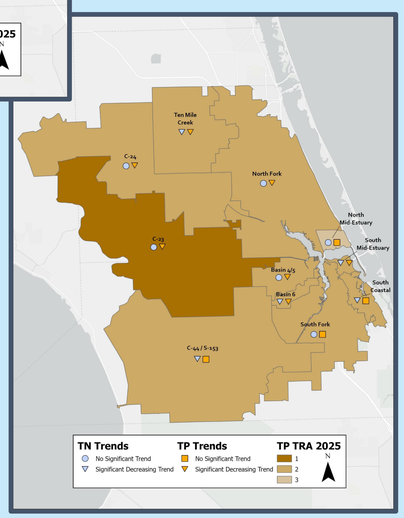

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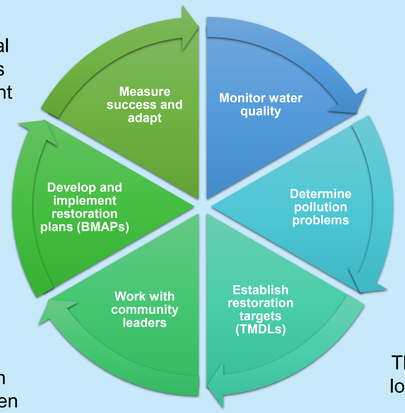
BASIN MANAGEMENT ACTION PLANS (BMAPS)

SOUTH FLORIDA BMAPS

Water Quality Restoration Cycle

The Florida Department of Environmental Protection's (DEP) Division of Environmental Assessment and Restoration (DEAR) monitors and assesses Florida's surface water and groundwater quality across the state.

The Statewide Annual Report (STAR) shows projects, management strategies, and progress made in BMAPs.



DEP and partner agencies maintain and expand water quality monitoring networks.

The BMAPs in South Florida target nitrogen and phosphorus.

The total maximum daily load (TMDL) is the water quality target.

Statutory Requirements

A BMAP is a framework for water quality restoration that contains a comprehensive set of solutions to achieve the pollutant reductions established by a TMDL. Authority and responsibility comes from several Florida Statutes (F.S.), with some highlights described below:

Florida Watershed Restoration Act (Section 403.067, F.S)
- Cooperative implementation of plans to restore our waters, known as BMAPs.

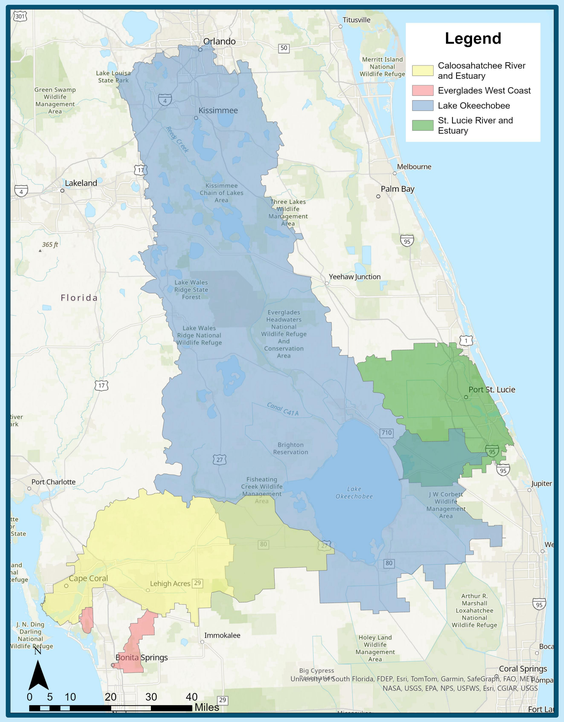
Northern Everglades and Estuaries Protection Program (Section 373.4595, F.S.)
- Strengthens provisions for implementing the Lake Okeechobee, Caloosahatchee and St. Lucie BMAPs.
- Clarifies the roles and responsibilities, coordination, implementation and reporting efforts among DEP, Florida Department of Agriculture and Consumer Services (DACS) and South Florida Water Management District (SFWMD).
- Includes five-, 10- and 15-year measurable milestones and targets to achieve the TMDLs addressed by the BMAPs. If achieving the TMDL within 20 years is not practicable, the implementation plan must include an explanation of the constraints that prevent achievement, an estimate of the time needed to achieve the TMDL, and additional five-year measurable milestones.

Clean Waterways Act (2020)
- Promotes resilient wastewater infrastructure and utilities and looks at future growth.
- Requires local governments within a BMAP to develop wastewater treatment plans and/or onsite sewage treatment and disposal system (OSTDS) remediation plans to be incorporated into BMAP updates.

House Bill 1379 (2023)
- Requires BMAPs be assessed and updated every five years as needed to include implementation milestones and other requirements.
- Requires a list of projects and strategies that will achieve the five-year implementation milestones to meet TMDLs, as well as agricultural cooperative regional water quality improvement elements.
- Requires facilities discharging to a waterbody impaired for nutrients or subject to a BMAP or reasonable assurance plan (RAP) area to upgrade to advanced wastewater treatment (AWT) within 10 years.
- Requires applicants for new septic systems serving lots of 1 acre or less within BMAPs and RAPs must connect to central sewer if available, or if unavailable, to install an enhanced nutrient-reducing system or other wastewater system that achieves 65% reduction.
- Requires local governments to include BMAP projects in their comprehensive plans so these projects can be prioritized to achieve restoration benefits.
- Expands grant opportunities to accelerate project implementation.

House Bill 1557 (2024)
- Requires advanced treatment of reclaimed water within BMAPs.
- Requires facilities (including private) to provide information to local entities developing domestic wastewater treatment plans and OSTDS remediation plans within BMAP or other restoration areas.

South Florida BMAPs




Source: SFWMD; Caloosahatchee River


Source: SFWMD; Lake Okeechobee


Source: SFWMD; St. Lucie Estuary


Source: DEP; Hendry Creek

Nutrient reduction is achieved by implementing projects addressing sources of nutrients. DEP critically evaluates many different types of data when verifying projects and assessing progress towards water quality goals.

The diagram to the right broadly categorizes the data considerations for management strategies at varying spatial scales.

All technical analyses or data evaluations support the ultimate objective of achieving the TMDL.

BMAP Data at Spatial Scales

Basin Assessments

Monitoring networks provide long term ambient water quality that is used for large scale basin assessments and evaluations. Ambient water quality data collected by DEP, SFWMD or local partners goes through extensive quality control and is publicly available through online portals.

Assessment of progress towards the TMDL.

Development and calibration of watershed loading models.

Water quality evaluations (i.e. Targeted Restoration Areas, Trends Analysis and Hotspot).

Regional Efforts

Efforts to address spatially diverse nonpoint sources may use finer resolution and/or specialized datasets to model water quality benefits. Large infrastructure projects often incorporate pre and post construction water quality monitoring.

Stormwater Treatment Areas (STAs) and regional projects.

Wastewater treatment facility and collection system upgrades.

Site Specific Projects

If monitoring is not feasible for projects completed by municipalities and other responsible entities, site specific data may be used to estimate nutrient reductions, though measured data is prioritized.

Urban stormwater Best Management Practices (BMPs).

Onsite Sewage Treatment and Disposal System (OSTDS) remediation.

Parcel level agricultural cost shares.

Nutrient reductions estimated or measured from site specific projects and regional efforts should be reflected in the basin assessments during periodic evaluation or modeling updates.

Results from basin assessments can be used to inform the location and potential reductions for regional and smaller scale nutrient reducing projects.

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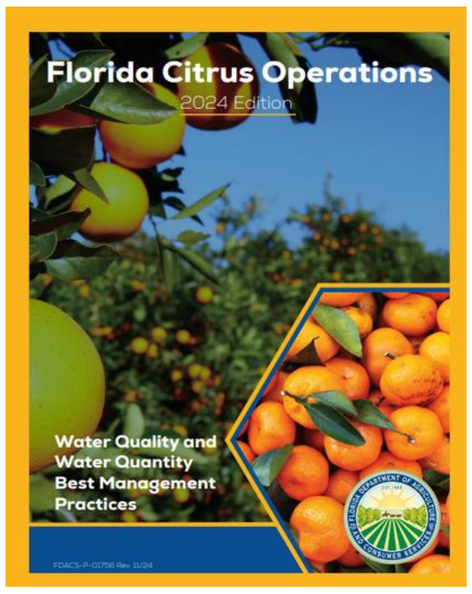
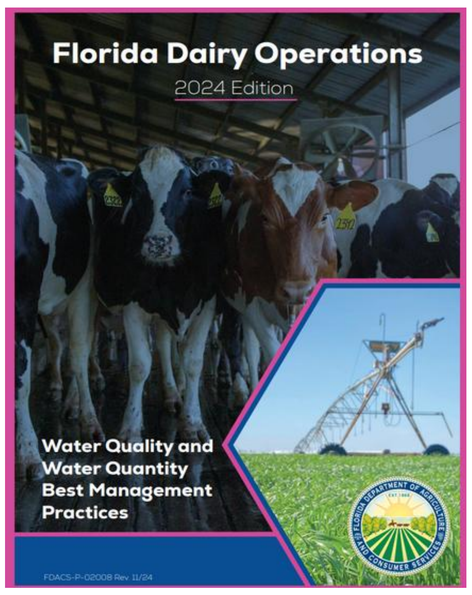
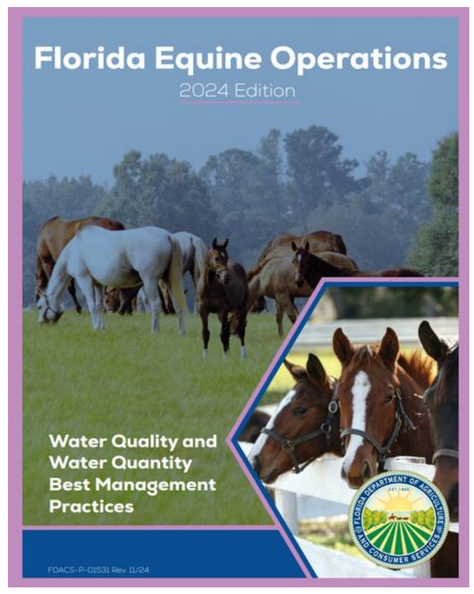
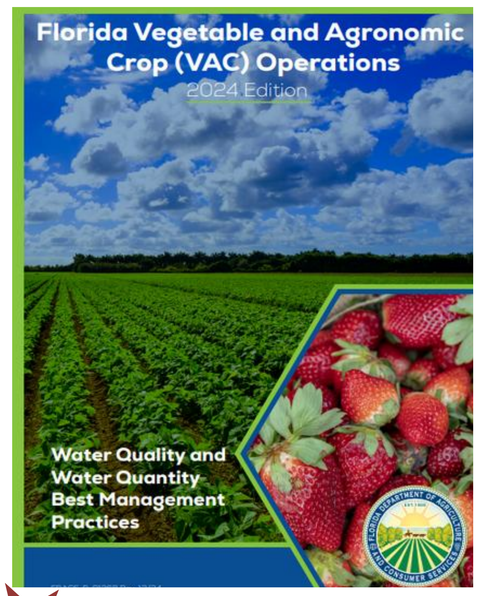
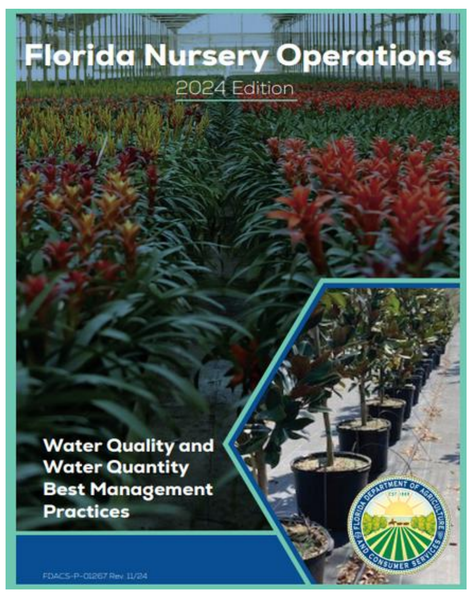
Agricultural Water Quality and Water Quantity Best Management Practices Manuals

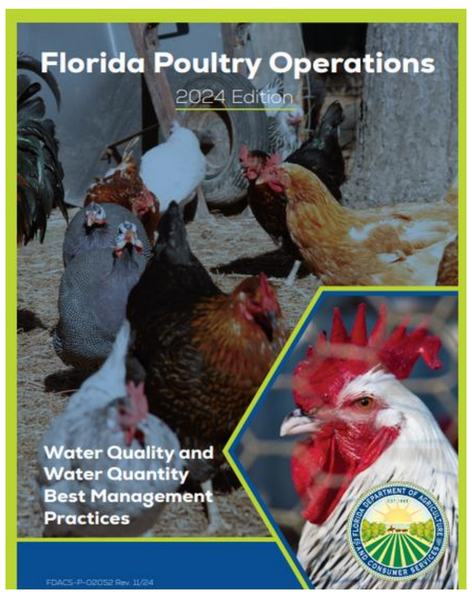


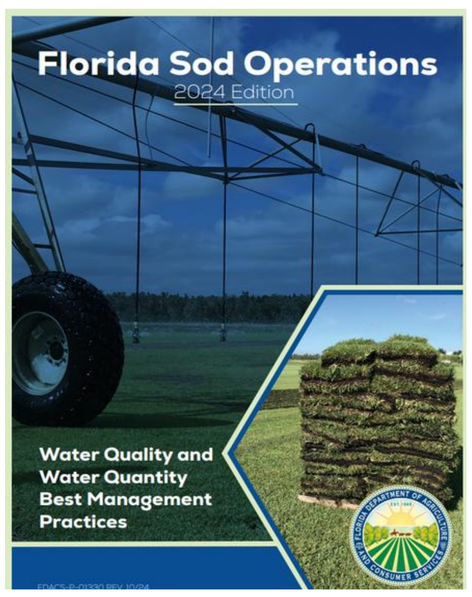


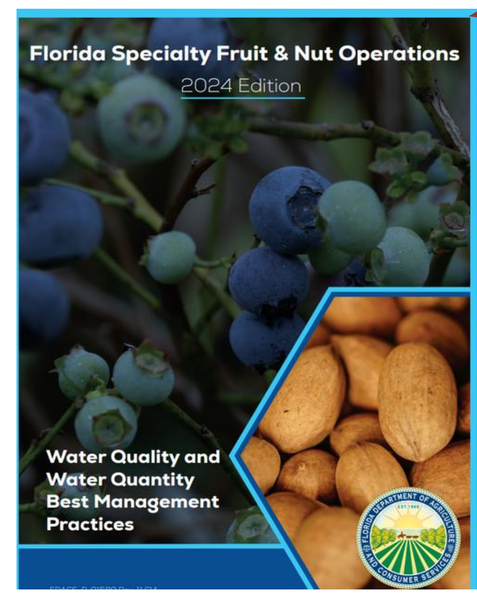


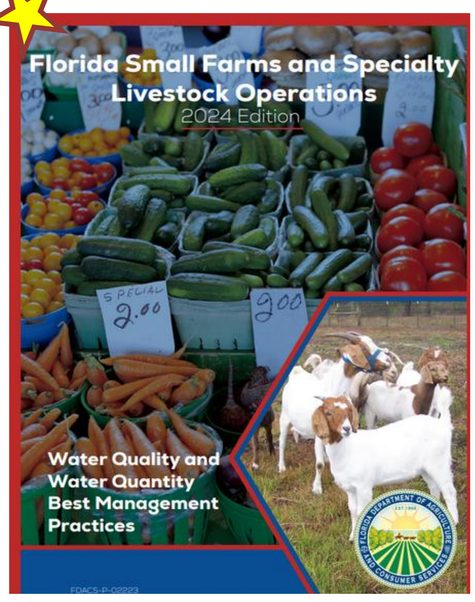












Best Management Practices (BMPs)

- Agricultural BMPs are practical, cost-effective actions that help agricultural producers conserve water and reduce the amount of fertilizers, animal wastes and other pollutants entering Florida's water resources
- BMPs are designed to maintain a balance between water quality and agricultural productivity
- Proper implementation of FDACS BMPs provides a "presumption of compliance" with state water quality standards
- BMPs fall into three categories: Nutrient Management, Irrigation Management, and Water Resource Protection
- During enrollment and implementation verification site visits, practices on the checklist are marked as "In Use", "Planned", or "Not-Applicable" helping document implementation and guide future improvements

New Small Farms Manual

- Developed for owners and operators of small farms producing specialty livestock, crops, or both
- Applies to operations that are 50 acres or fewer, whether contiguous or non-contiguous, that have minimal potential to impact water resources
- Operations may (1) produce more than one commodity, or (2) raise livestock not addressed in another BMP manual

Interested in learning more about the Office of Agricultural Water Policy?

Use the QR code to visit our website!

FDACS BMP Contacts

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Matt Warren – Environmental Administrator
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BMP Manuals Update (2024-2025)

Goals

- Create specificity in practice implementation (what, when, where)
- Reflect current law (e.g., 2016 and 2020 updates)
- Eliminate practices unrelated to water quality or conservation and avoid duplicate regulations
- Relate the narrative guidance to checklist producers must follow
- Consistency across manuals to better assess practice implementation

Best Management Practices Checklist for Cattle Operations

The producer agrees to perform the following items either checked as "In Use" or "Planned:

Nutrient Management				
Do you apply nitrogen (N) or phosphorus (P) or plan to apply N or P in any form on the operation associated with this NOI?		**Yes**	**No**	**-**
		In Use	**Planned**	**N/A**
1.1	**Right Source**			
1.2	**Right Rate**			
1.3	**Right Time**			
1.4	**Right Place**			
1.5	**Fertilizer Storage and Handling**			
1.6	**Additional Nutrient Management BMPs for Cattle Operations**			
Irrigation Management				
Do you have an irrigation system or plan to install an irrigation system associated with this NOI?		**Yes**	**No**	**-**
	If you answered "Yes" to the previous question, is the system pressurized?	**Yes**	**No**	**-**
		In Use	**Planned**	**N/A**
2.1	**Forage Water Requirements and Irrigation Scheduling**			
2.2	**Irrigation System Maintenance and Evaluation**			
Water Resource Protection				
3.1	**Stream and River Protection**			
3.2	**Springs and Sinkholes**			
3.3	**Wetlands and Lakes**			
3.4	**Ditch and Canal Maintenance and Water Management**			
3.5	**Erosion Control**			
3.6	**Wellhead Protection**			
3.7	**Non-Fertilizer Material Storage and Handling**			
3.8	**Additional Water Resource Protection BMPs for Cattle Operations**			

The updated manual checklists include standard practices shown in **purple** that apply broadly across commodities and production systems

Most manuals have commodity-specific practices shown in **green**.

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

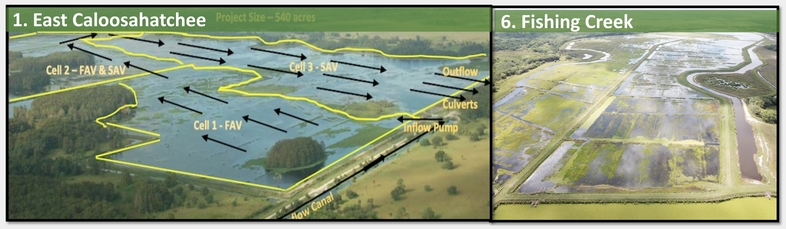
Agricultural Regional Projects in the Northern Everglades and Estuaries Protection Program (NEEPP)

Jessica Ferris & Letuzia De Oliveira
Agricultural Regional Projects Team

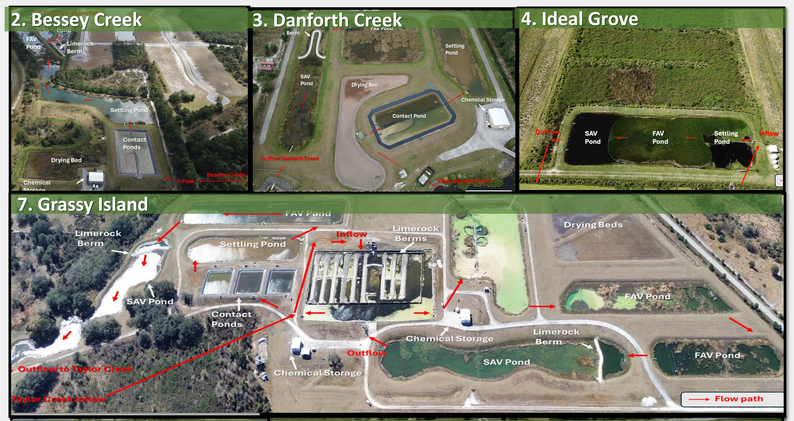
The FDACS Agricultural Regional Projects Program (ARPP) uses a regional approach to improve water quality and conservation at site-specific, regional, and watershed levels. Working with agricultural producers, water management districts, local governments, and other stakeholders, the program supports large-scale projects that help meet Clean Water Act TMDL requirements and enhance overall water quality and quantity.

ARPP Projects in NEEPP Watersheds

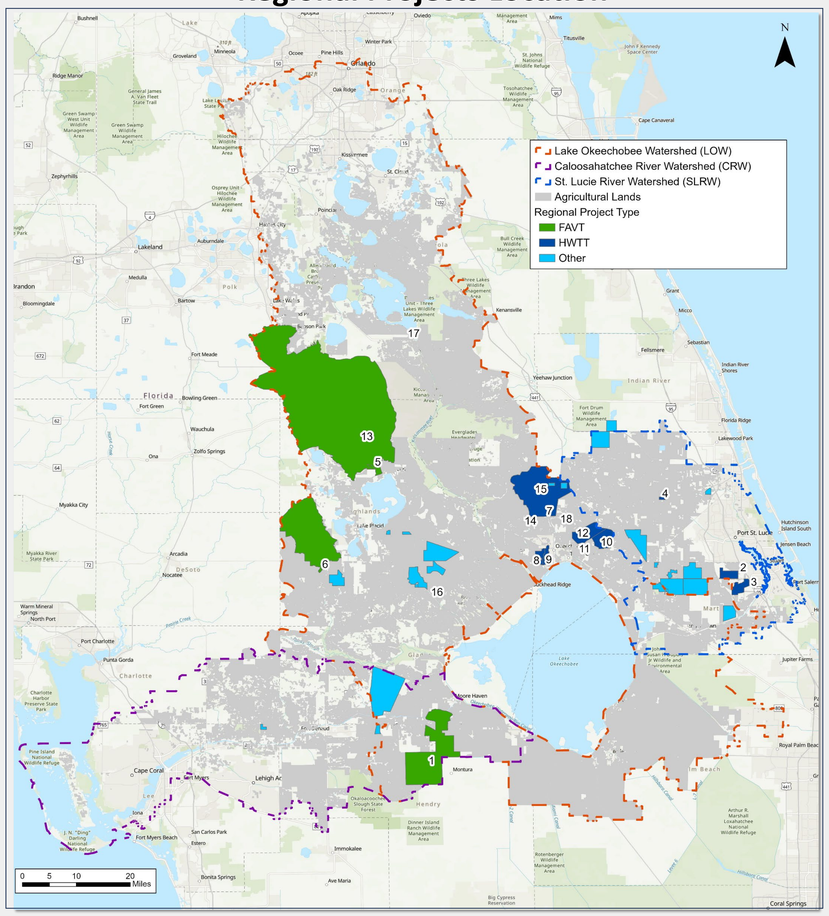
Floating Aquatic Vegetation Tilling (FAVT)



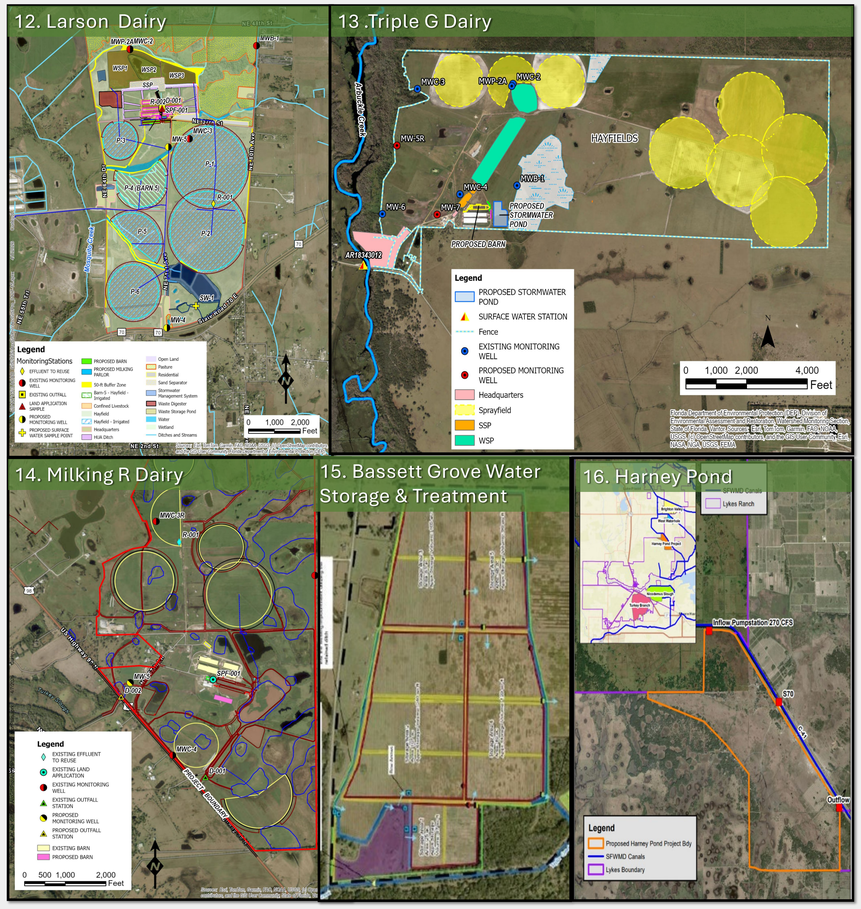
Hybrid Wetland Treatment Technology (HWTT)



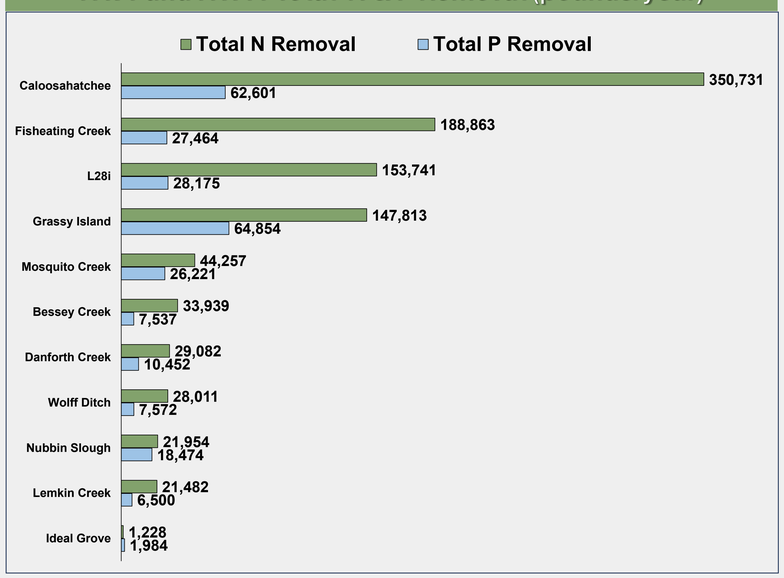
Regional Projects Location



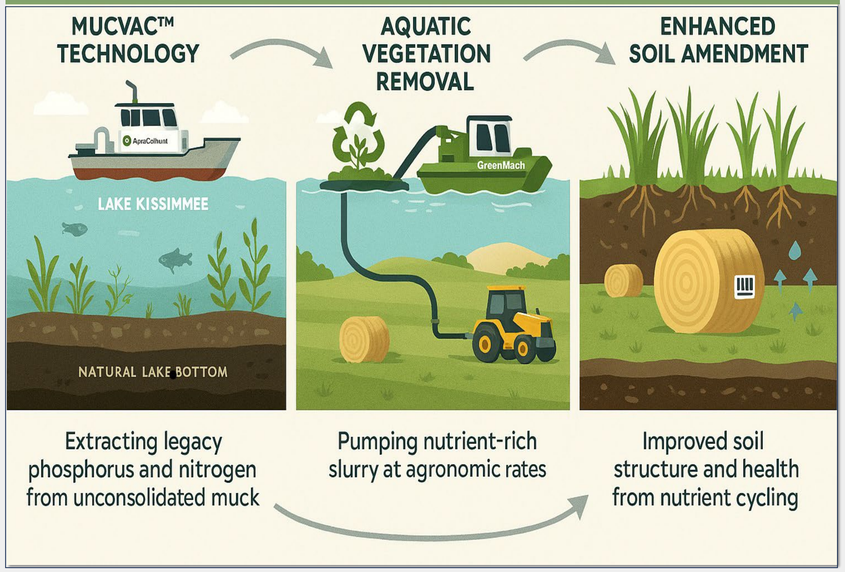
New Regional Projects



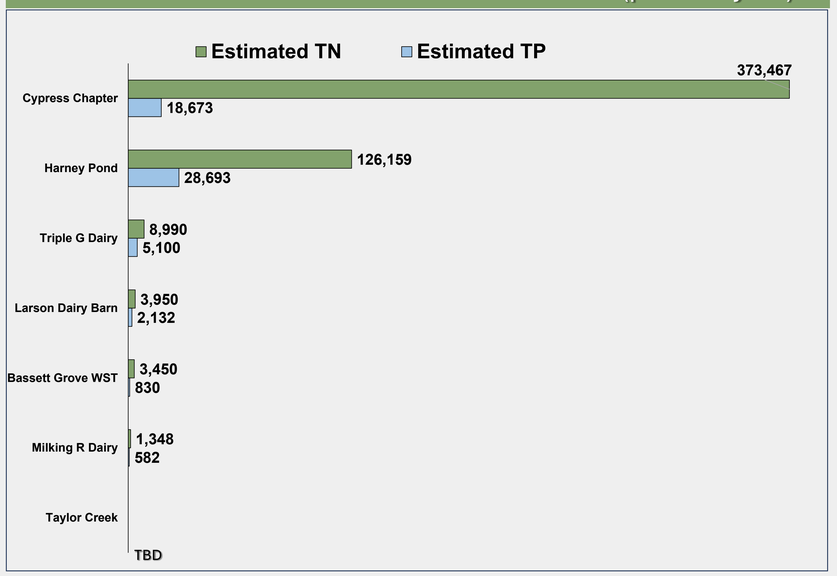
FAVT and HWTT Total N & P Removal (pounds/year)



17. Cypress Chapter, Izaak Walton League of America



FAVT and HWTT Total Estimated N & P Removal (pounds/year)



Chapter 8B: Lake Okeechobee Watershed Protection Plan

The Current State of Submerged Aquatic Vegetation in Lake Okeechobee

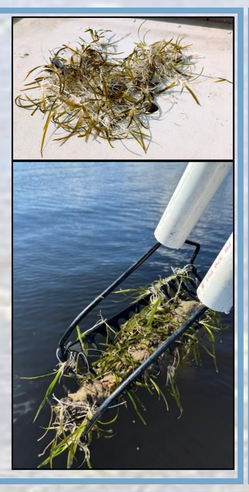
Daniel Marchio

Lake & River Ecosystem Section, Applied Sciences Bureau

Submerged Aquatic Vegetation (SAV) supports ecological functions in Lake Okeechobee by:

- Enhancing water clarity through reduction of suspended solids
- Improved water quality via sediment stabilization, nutrient uptake and organic matter processing
- Providing structurally complex habitat for wildlife

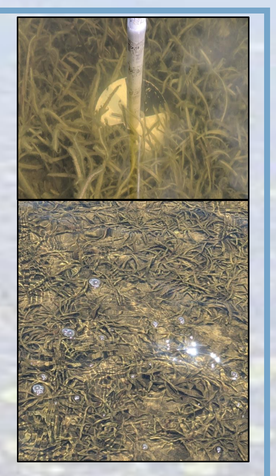
SAV community composition and areal extent are surveyed at the end of the peak growing season (August to September) using a 1-km grid that spans the nearshore zone

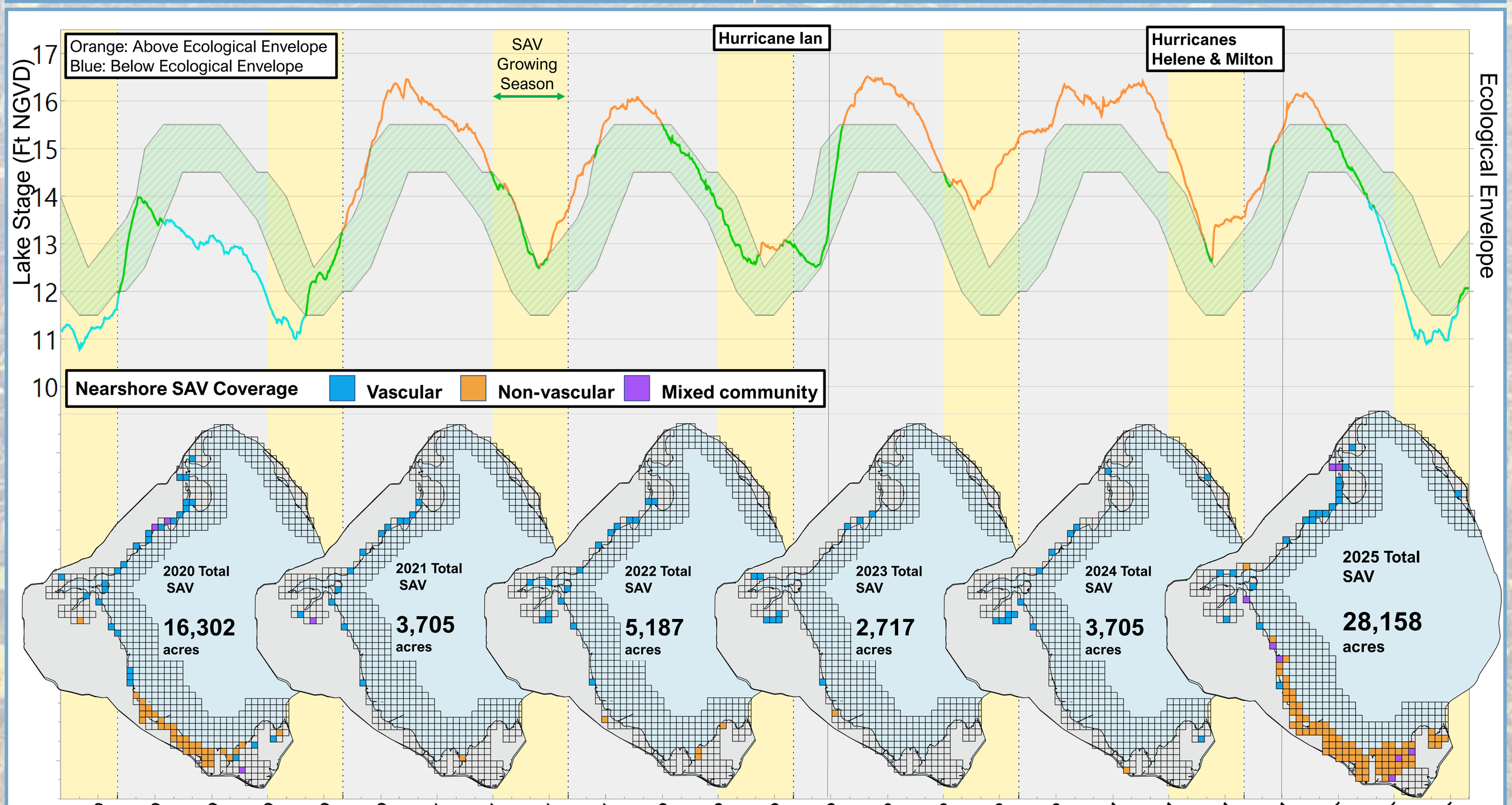


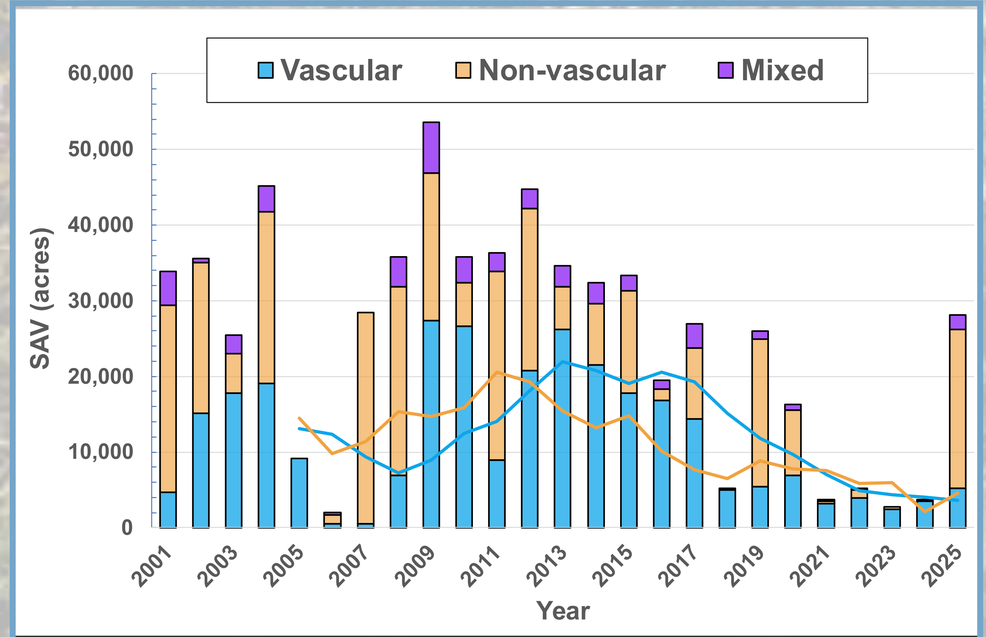
Water depth, through its influence on benthic light availability, is the dominant driver of SAV distribution and abundance in Lake Okeechobee.

Lake-wide SAV coverage has varied dramatically, in step with hydrologic conditions:

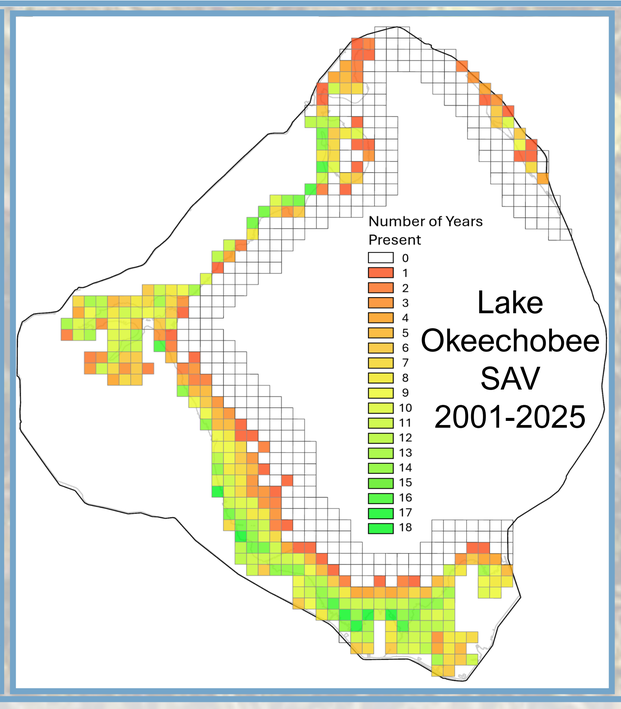
- SAV coverage generally peaks 1-2 years after periods of low lake stage, when reduced depth increases light availability at the lakebed
- SAV coverage generally declines after major hurricanes due to disturbance and prolonged high-water levels

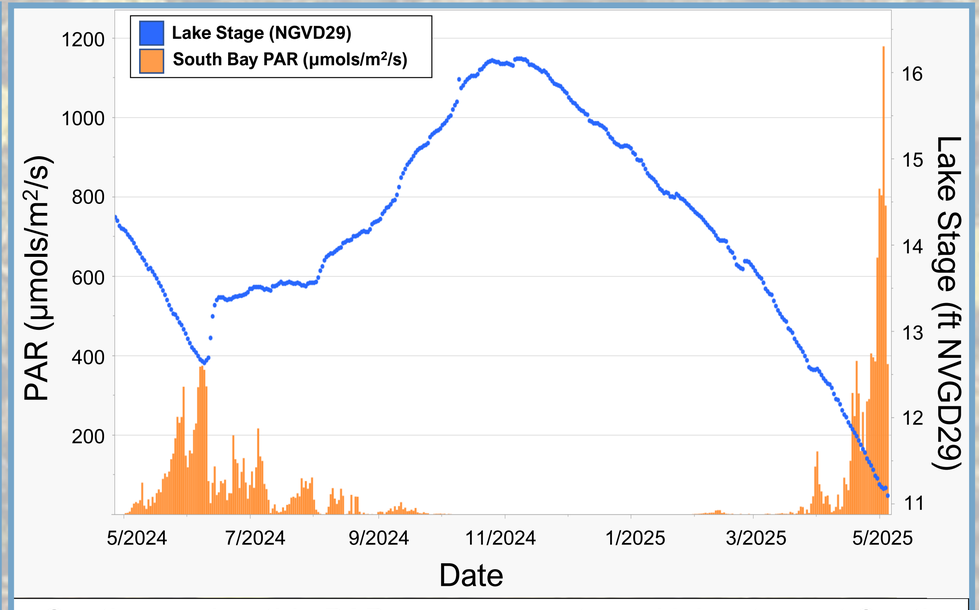






SAV coverage throughout our period of record.





Continuous benthic PAR measurements and lake stage at South Bay, Lake Okeechobee (May 2024-May 2025).

- Recent low lake stages within the Recovery Envelope triggered rapid SAV recruitment, with total coverage expanding from 3,700 to more than 28,000 acres between fall 2024 and fall 2025 – a 660% increase in a single year
- This recovery, following the lowest 5-year average on record since monitoring began in 2001, was dominated by non-vascular *Chara* species, consistent with their role as early successional colonizers responding to increased benthic light availability
- Historical patterns suggest vascular SAV expansion typically follows non-vascular peaks, indicating potential for continued *Vallisneria* recruitment if lake stages remain conducive to benthic light penetration

Chapter 8B: Lake Okeechobee Watershed Protection Plan Annual Progress Report

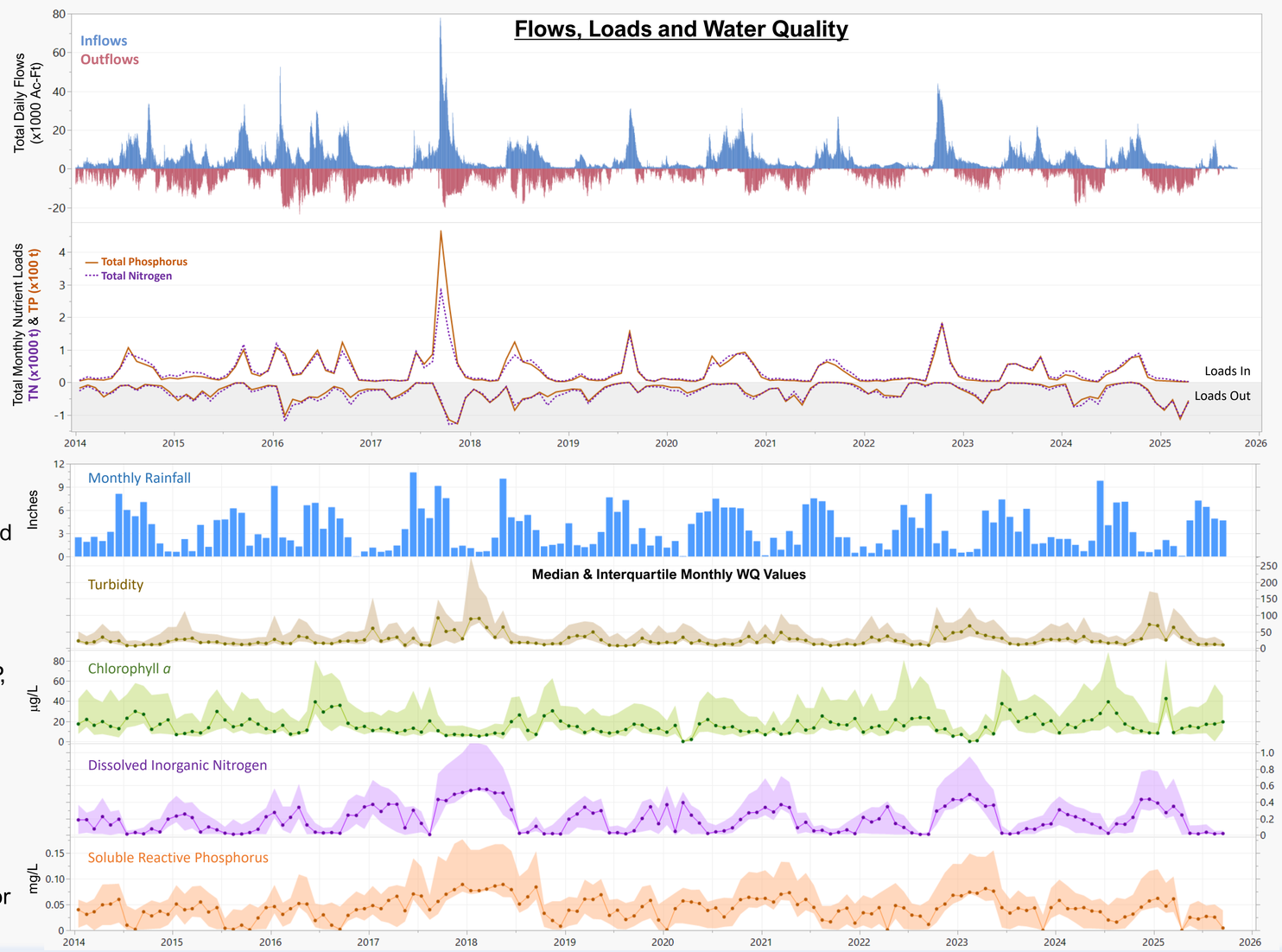
Lake Okeechobee Hydrology, Water Quality, and the Ecological Envelope

Paul Jones

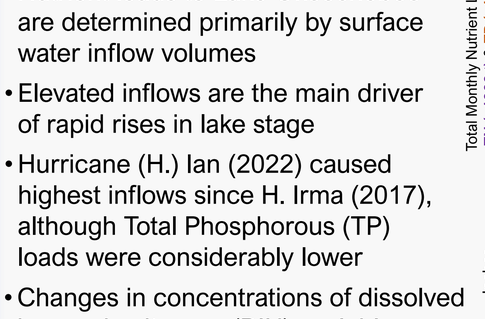
Lake & River Ecosystems Section, Applied Sciences Bureau

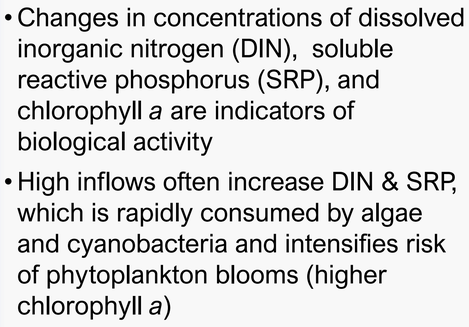
In-lake water quality sampling locations

- Nutrient loads to Lake Okeechobee are determined primarily by surface water inflow volumes
- Elevated inflows are the main driver of rapid rises in lake stage
- Hurricane (H.) Ian (2022) caused highest inflows since H. Irma (2017), although Total Phosphorous (TP) loads were considerably lower
- Changes in concentrations of dissolved inorganic nitrogen (DIN), soluble reactive phosphorus (SRP), and chlorophyll *a* are indicators of biological activity
- High inflows often increase DIN & SRP, which is rapidly consumed by algae and cyanobacteria and intensifies risk of phytoplankton blooms (higher chlorophyll *a*)
- Poor water clarity after strong storms, such as H. Irma (2017), may cause prolonged periods of low light and elevated DIN & SRP, until conditions for biological uptake improve



- Lake O has large surface area and shallow depth, so particulate levels are highly influenced by strong winds
- Total nitrogen (TN) and TP levels (not shown) follow similar pattern to turbidity, suggesting association with particulates
- Biologically available nutrients, e.g. DIN or SRP, can be sourced from particulates (internal loading) or from inflows and rainfall (external loading)

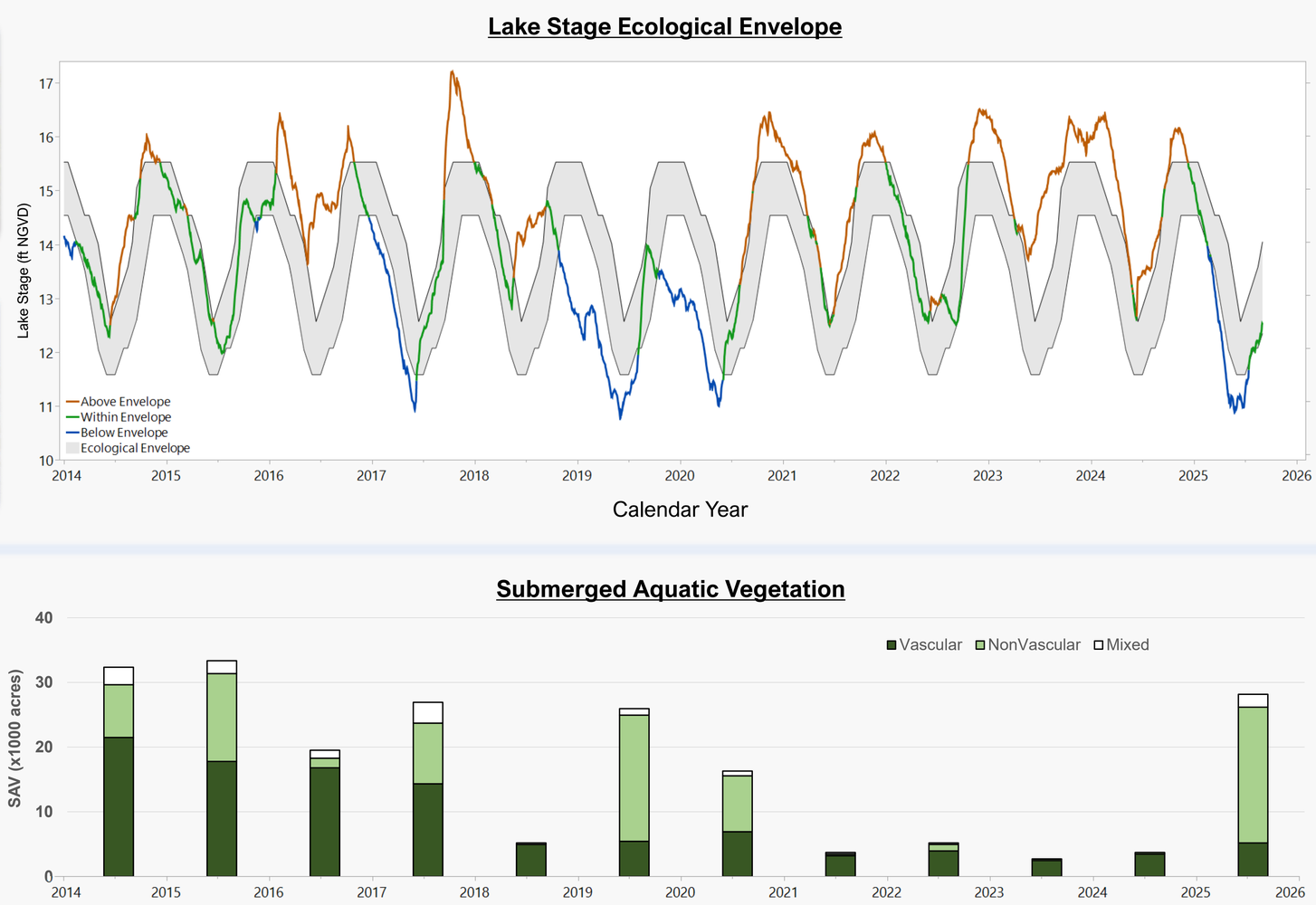


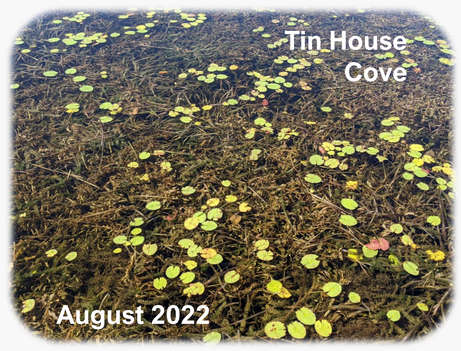


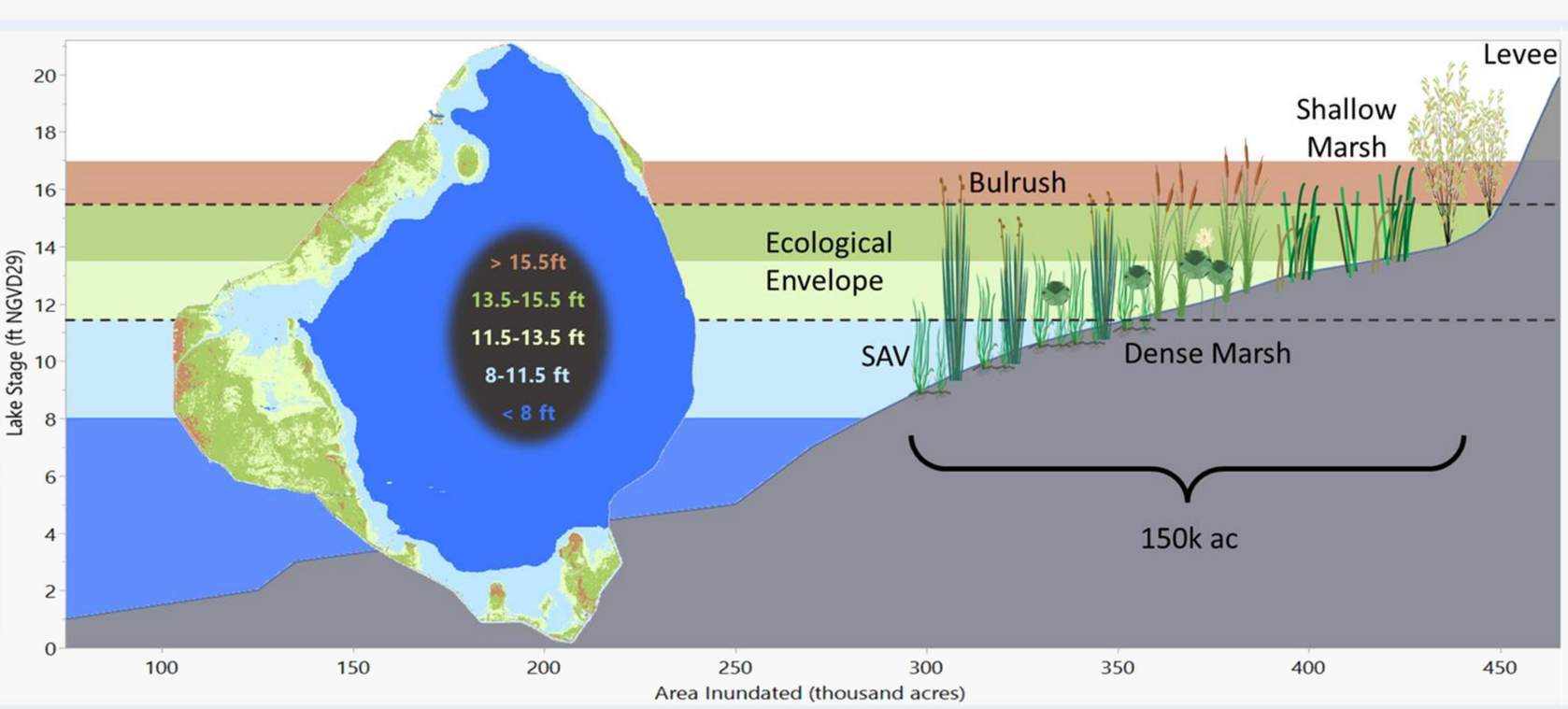
- Lake Okeechobee stage (line) fluctuates in response to changes in inflows, outflows, rainfall, and evaporation
- Ecological envelope (gray band) defines range of water levels that represent optimal conditions across seasons, habitats, flora, and fauna
- Short periods **above** or **below** envelope are not necessarily ecologically harmful, but slow rates of change are desirable
- Rapid and extreme variations in water levels are unnatural and a function of the highly channelized watershed

- Lower lake stages increase light reaching young/seedling submerged aquatic vegetation (SAV) and promote growth
- If stages stay too low, SAV beds may dry out and become dominated by emergent plants
- If lake stages stay too high, even tall and well established SAV can die out

SAV sampled in August, i.e. prior to incidence of most major hurricanes.





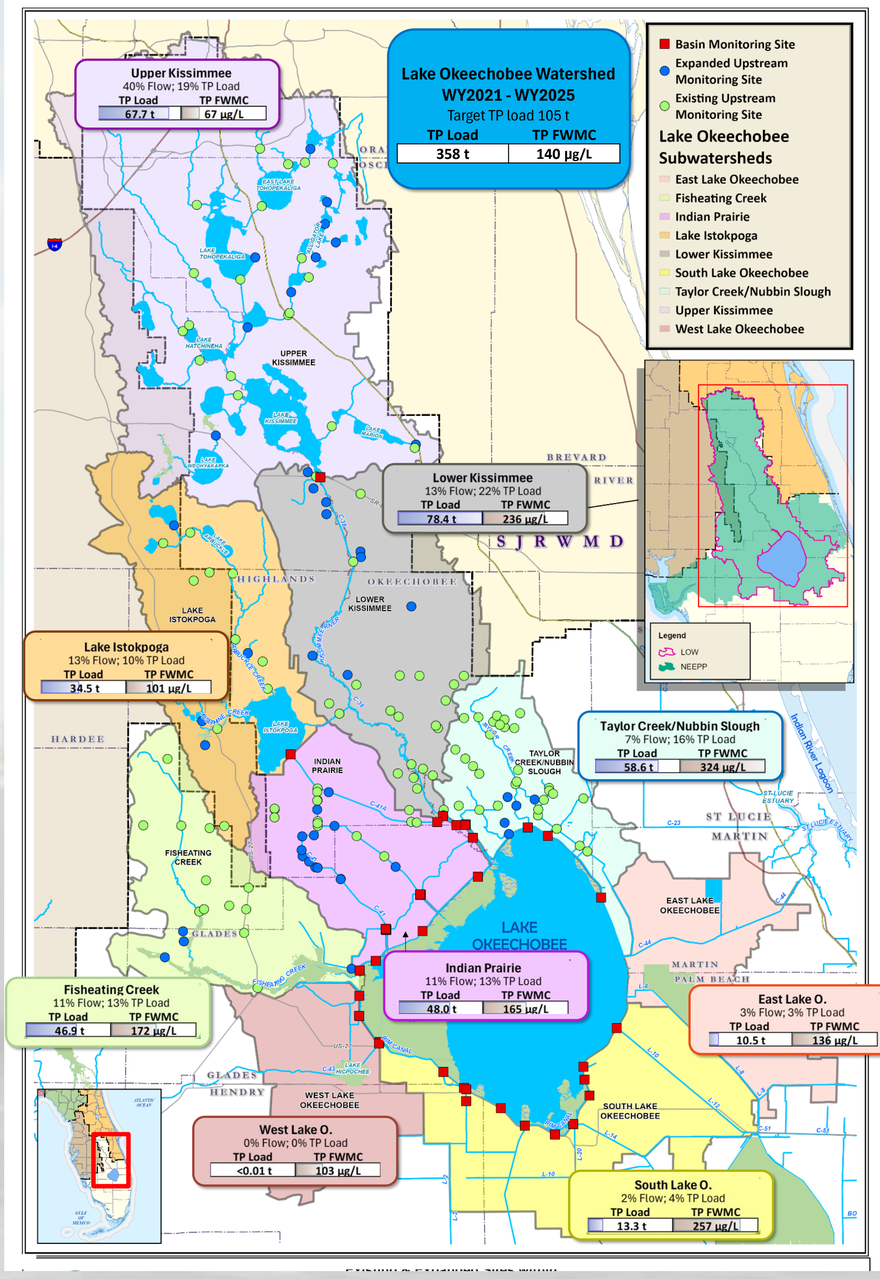


Chapter 8B & Appendix 8B-1
Lake Okeechobee Watershed Water Quality Monitoring

Steffany Olson
Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

Highlight Areas of Concern, Prioritize Resources, Track Progress

Water Quality Monitoring Network



Governing Board Expansion of Upstream Network

- Fully implemented in WY2021
- Increased:
  - Number of sites
  - Collection frequency to biweekly
  - Number of parameters collected

Monitoring Level	Total Sites
Basin	37
Upstream	150

Parameters	Definitions
TP	total phosphorus
OPO_4-P	orthophosphate
TN	total nitrogen
NH_3-N	ammonial nitrogen
NO_x-N	nitrate + nitrate
pH	potential of hydrogen
Temp	temperature
DO	dissolved oxygen
Conductivity	Measures the ability of water to pass an electrical current.

Upstream Monitoring Plan	
Frequency	Biweekly when flowing (some weekly)
Parameters	TP, OPO_4-P, TN, NH_3-N, NO_x-N, pH, Temp, DO, Conductivity

Acknowledgements: Thank you to the staff from the Okeechobee Water Quality Office and Analytical Services Section. Without their efforts, these data would not exist. Additionally, the maps were produced by Allison Lamb, Diana Alvarez, and Alexandra Hoffart of the Geospatial Services Section.

S-65E facing north (upstream).

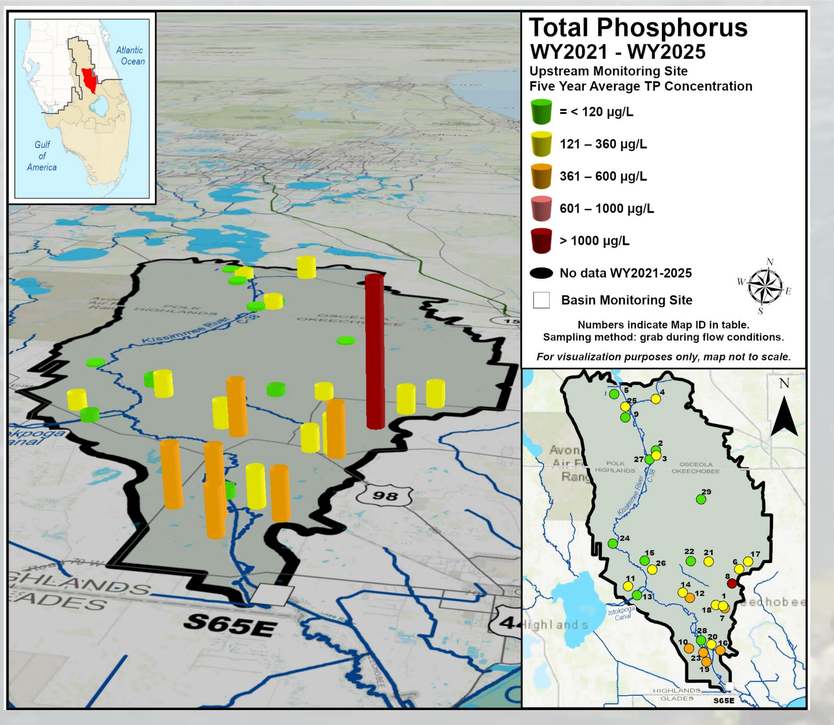
Focus on Lower Kissimmee

- For 5-year period WY2021-WY2025 contributed the highest TP load and 2nd highest TP unit area loading (lb/ac)
- 19 out of 29 stations had 5-year average TP concentration >120 µg/L (Florida Department of Environmental Protection nutrient numeric criteria)
- Site CY17353413 had a 5-year annual average TP concentration > 1,000 µg/L and a rapid assessment trigger for TN ≥ 10 mg/L resulting in a notification to Coordinating Agencies
- Upstream monitoring data indicate highest TP concentrations located in southern portion of subwatershed, and typically have higher OPO_4-P
- Had below average rainfall for WY2025
- Two passive and one active dispersed water management projects removed 2.6 t TP in WY2025
- Seeking additional projects through request for proposals

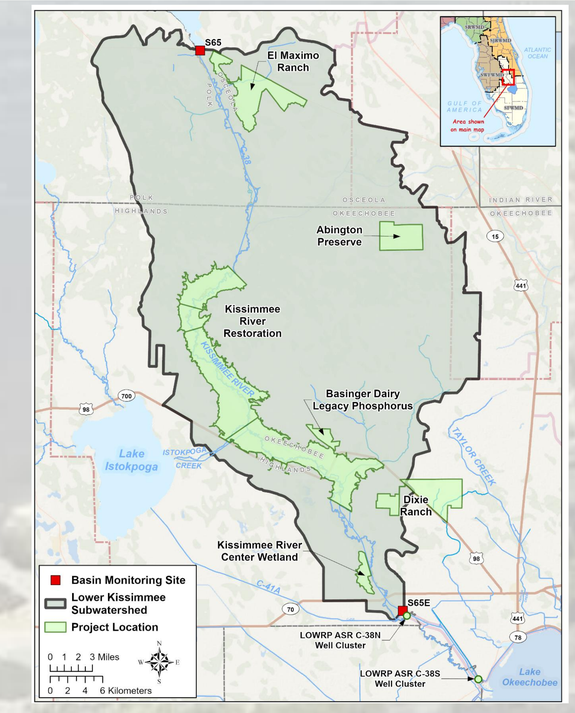
Nutrient Concentrations Water Years 2021–2025

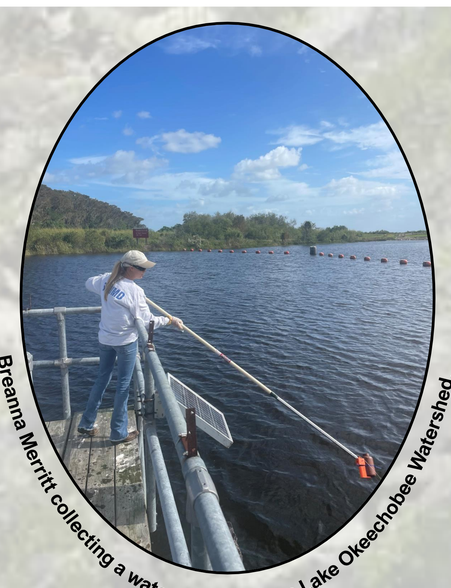
Lower Kissimmee		WY2021-WY2025									
		TP (µg/L)		OPO_4-P (µg/L)		TN (mg/L)		NH_3-N (mg/L)		NO_X-N (mg/L)	
Map ID	Site	No.	Avg.	No.	Avg.	No.	Avg.	No.	Avg.	No.	Avg.
1	02272676	61	334	58	294	62	1.41	62	0.04	61	0.02
2	AM22323213	38	51	10	10	38	1.49	11	0.05	11	0.01
3	AM27323211	8	150	7	85	8	1.51	8	0.05	8	0.02
4	BB16313214	24	262	24	159	24	2.07	24	0.17	24	0.04
5	BM15313111	27	38	9	5	27	1.43	11	0.05	11	0.01
6	CY05353444	26	242	0	-	26	2.32	0	-	0	-
7	CY06363411	41	466	19	450	41	2.13	19	0.17	17	0.01
8	CY17353413	41	1344	7	1872	41	3.30	7	1.20	6	0.01
9	IC35313112	51	50	46	5	51	1.02	51	0.04	51	0.02
10	KR05373311	30	500	21	413	30	2.60	21	0.61	19	0.13
11	KR24353114	32	152	4	45	32	1.84	4	0.08	4	0.01
12	KR29353334	9	499	7	424	9	1.32	8	0.10	8	0.05
13	KR30353214	12	85	10	26	12	1.47	11	0.10	11	0.06
14	KR30353312	14	246	7	185	14	3.04	7	0.70	6	0.13
15	KR32343214	28	110	24	46	29	1.84	29	0.09	27	0.01
16	KR36363312	17	395	12	229	17	1.93	13	0.11	13	0.01
17	KREA 01	67	226	66	144	69	1.57	68	0.14	68	0.11
18	KREA 04	31	208	30	140	31	1.51	31	0.06	31	0.01
19	KREA 14	45	392	42	318	45	2.08	43	0.13	42	0.02
20	KREA 17A	74	311	54	295	74	1.78	56	0.08	55	0.02
21	KREA 22	92	124	83	63	93	1.32	90	0.07	90	0.02
22	KREA 23	76	88	45	10	77	1.21	52	0.03	50	0.01
23	KREA 41A	82	555	18	908	83	2.54	19	0.86	18	0.15
24	KREA 100	122	32	49	13	123	2.26	49	0.06	51	1.76
25	LKRR-1	20	124	6	59	20	1.66	8	0.27	8	0.06
26	OK09353212	49	225	45	135	49	1.89	47	0.14	46	0.05
27	S65A	124	61	122	6	125	1.27	120	0.02	123	0.02
28	S65D	104	86	103	24	105	1.30	102	0.05	102	0.03
29	SM21333314	46	34	39	8	47	1.66	47	0.05	47	0.01

Lower Kissimmee Subwatershed Total Phosphorus Concentrations



Lower Kissimmee Subwatershed Projects





Breanna Merritt collecting a water sample in the Lake Okeechobee Watershed.

Unit of Measurement	Definitions
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
t	Metric Tons

Background image is S-65E facing north (upstream).

Chapter 8C & Appendix 8C-1: St. Lucie River Watershed Water Quality Monitoring

Amanda McDonald[1], Youchao Wang[1], Steffany Olson[1], and Danielle Taylor[2]

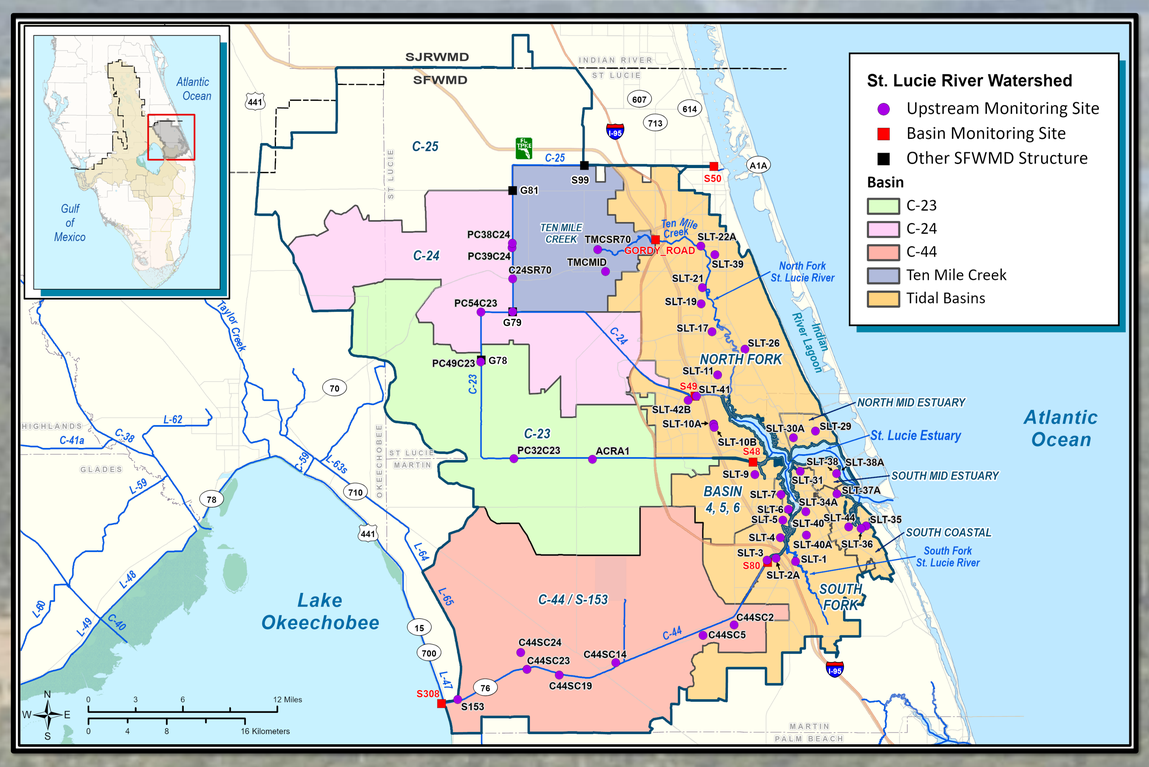
[1] Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

[2] Coastal Ecosystems Section, Applied Sciences Bureau

Highlight Areas of Concern, Prioritize Resources, Track Progress

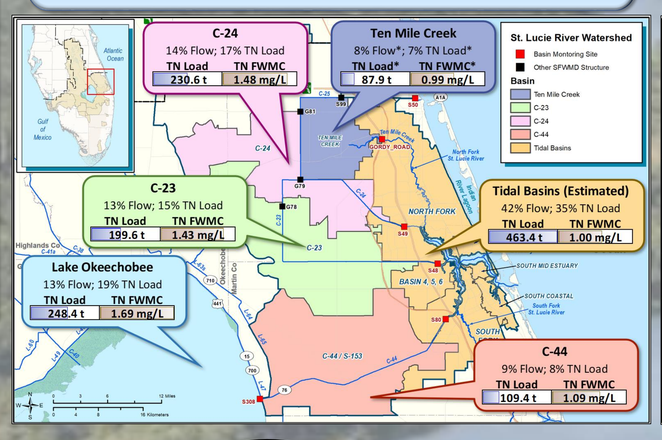
Acknowledgements: Thank you to the staff from the Water Quality Monitoring Section who collect the upstream monitoring samples and the staff in the Analytical Services Section. Without their efforts these data would not exist. Additionally, the maps were produced by Allison Lamb of the Geospatial Services Section.

Water Quality Monitoring Network

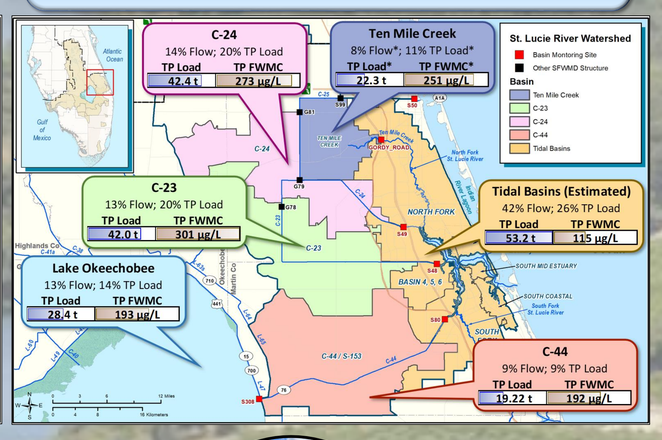


Basin Level Water Years 2021 - 2025

Average Nitrogen Load and Flow Weighted Mean Concentration



Average Phosphorus Load and Flow Weighted Mean Concentration



Nutrient Concentrations Water Year 2021 - 2025

		WY2021-WY2025									
		Total Phosphorus (µg/L)		Orthophosphate (µg/L)		Total Nitrogen (mg/L)		Ammonia Nitrogen (mg/L)		Nitrate + Nitrite (mg/L)	
Basin	Site	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.
North Tidal	SLT-10A	103	80	96	30	104	0.92	99	0.09	99	0.06
	SLT-10B	85	72	77	23	87	0.89	85	0.09	85	0.07
	SLT-11	94	83	90	21	95	0.83	91	0.04	92	0.04
	SLT-17	92	92	82	20	92	0.83	88	0.10	86	0.11
	SLT-19	115	63	109	15	118	0.81	115	0.07	116	0.02
	SLT-21	109	42	96	7	111	0.73	104	0.02	102	0.02
	SLT-22A	63	195	62	105	63	0.84	60	0.06	61	0.08
	SLT-26	106	56	97	22	108	0.82	101	0.03	102	0.10
	SLT-29	106	22	103	3	112	0.89	108	0.04	107	0.04
	SLT-30A	33	23	29	2	34	0.87	31	0.03	29	0.01
	SLT-39	77	187	63	105	77	1.06	62	0.18	60	0.06
	SLT-41	117	124	113	34	117	0.97	113	0.10	113	0.08
	SLT-42B	90	90	85	19	89	0.75	87	0.05	87	0.04
South Tidal	SLT-1	55	125	53	65	55	0.99	55	0.05	54	0.05
	SLT-2A	83	50	82	11	86	0.88	85	0.01	83	0.01
	SLT-3	100	371	99	294	100	1.09	98	0.07	98	0.24
	SLT-4	33	136	33	68	33	0.96	33	0.05	33	0.09
	SLT-5	56	110	12	67	56	1.38	12	0.05	12	0.16
	SLT-6	50	312	29	244	50	1.39	29	0.29	27	0.14
	SLT-7	65	95	58	37	66	0.88	62	0.07	61	0.11
	SLT-9	37	153	36	93	37	0.95	36	0.07	31	0.10
	SLT-31	110	103	100	7	110	0.91	107	0.02	110	0.02
	SLT-34A	121	112	75	33	120	0.97	74	0.12	73	0.10
	SLT-35	102	103	70	66	104	1.15	69	0.05	69	0.24
	SLT-36	18	136	18	103	18	0.88	18	0.03	18	0.10
	SLT-37A	85	22	85	3	88	0.61	88	0.06	87	0.04
	SLT-38A	131	38	127	6	133	0.65	129	0.06	131	0.06
	SLT-40A	80	64	46	19	81	0.94	47	0.03	45	0.01
	SLT-44	121	54	115	9	123	0.95	121	0.04	121	0.06
C44	S153	29	405	29	358	29	1.61	29	0.12	29	0.06
	C44SC24	18	247	17	158	18	1.35	15	0.08	17	0.18
	C44SC23	30	220	30	164	30	1.27	30	0.17	30	0.10
	C44SC19	77	283	77	203	77	1.34	74	0.15	77	0.10
	C44SC14	44	197	44	133	44	1.31	44	0.12	44	0.10
	C44SC5	36	172	35	104	36	1.59	35	0.09	33	0.03
	C44SC2	30	103	31	34	30	1.29	31	0.09	28	0.02
C23	PC49C23	27	474	27	358	26	1.99	26	0.16	25	0.09
	ACRA1	18	629	17	528	18	1.69	15	0.07	17	0.01
	PC32C23	12	514	11	405	12	2.35	10	0.15	11	0.01
C24	PC39C24	9	784	9	686	9	1.50	9	0.12	8	0.01
	PC38C24	33	185	33	122	33	1.65	31	0.13	27	0.03
	C24SR70	9	221	9	148	9	1.66	9	0.17	7	0.02
	G79	113	220	111	137	113	1.42	108	0.08	108	0.02
	PC54C23	47	320	47	179	47	1.99	44	0.11	43	0.01
Ten-Mile Creek	TMCMID	28	165	28	84	27	0.92	27	0.04	27	0.02
	TMCSR70	37	137	39	80	36	0.76	36	0.03	38	0.02

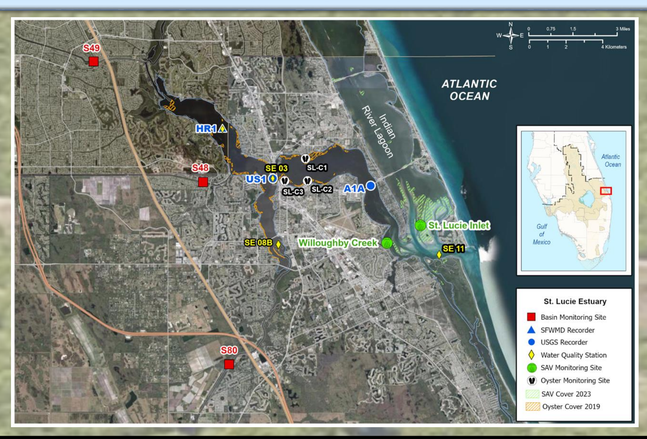

Sofia El-Rass collecting a sample at C44SC5


Sofia El-Rass filtering a sample at C44SC2

Key Findings

- St. Lucie Estuary received 1,339 tons of Nitrogen and 208 tons of Phosphorus averaged over the last 5 years
- SE 03 is the reference point for TMDL using the 5-year rolling average of TN and TP as specified in the 2025 BMAP for the St. Lucie River Estuary
  - TN = 0.79 milligrams per liter over the last 5 years (goal = 0.72 mg/L)
  - TP = 143 micrograms per liter over the last 5 years (goal = 81 µg/L)

In-Estuary Chlorophyll Water Years 2021 - 2025




Sierra Schaefer collecting sonde data at C44SC2

In-Estuary Chlorophyll a (µg/L)								
Wet Season (May–October)								
Period	HR1		SE 08B		SE 03		SE 11	
	Avg	SD	Avg	SD	Avg	SD	Avg	SD
POR	16.4	14.3	10.8	12.3	10.1	9.6	4.2	3.0
WY2021	12.5	8.0	7.1	3.2	6.0	3.2	4.7	2.0
WY2022	19.7	17.8	8.9	6.3	6.3	3.0	3.1	0.9
WY2023	16.1	6.9	7.0	4.4	8.0	3.5	2.7	1.3
WY2024	16.8	10.0	7.6	4.1	11.0	12.7	6.2	2.0
WY2025	10.7	4.0	7.6	5.2	4.9	2.4	5.1	3.2
Dry Season (November–April)								
Period	HR1		SE 08B		SE 03		SE 11	
	Avg	SD	Avg	SD	Avg	SD	Avg	SD
POR	8.7	5.9	8.4	4.8	5.9	3.7	2.9	2.1
WY2021	5.2	3.6	9.4	5.4	4.0	1.3	2.8	1.9
WY2022	5.6	2.3	9.2	3.0	5.0	1.9	2.3	0.9
WY2023	6.1	2.8	10.5	6.9	5.0	4.3	2.5	1.8
WY2024	11.8	8.6	7.5	4.1	9.2	5.8	3.8	1.6
WY2025	12.5	5.7	10.9	9.1	6.8	1.7	3.4	1.4

Background image is C-44 facing towards S-308 on Lake Okeechobee

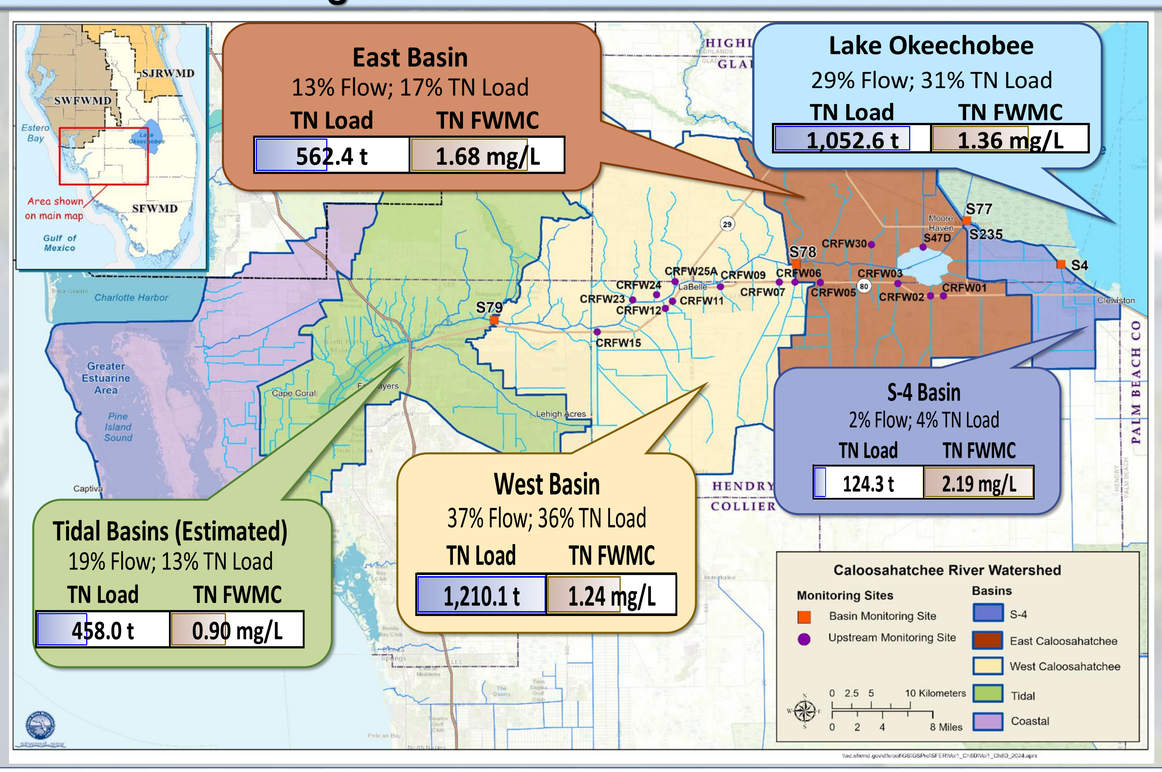
Chapter 8D & Appendix 8D-1
Caloosahatchee River Watershed Water Quality Monitoring

Santiago Acevedo[1], Steffany Olson[1], and Danielle Taylor[2]
[1] Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau
[2] Coastal Ecosystems Section, Applied Sciences Bureau

Highlight Areas of Concern, Prioritize Resources, Track Progress

Water Quality Monitoring Network

Basin Level
Annual Nitrogen Load and Flow Weighted Mean Concentration average from Water Years 2021 - 2025



Upstream Level
Nutrient Concentrations from Water Years 2021 - 2025

Caloosahatchee Upstream Level		WY2021-WY2025									
		Total Phosphorus (µg/L)		Orthophosphate (µg/L)		Total Nitrogen (mg/L)		Ammonia (mg/L)		Nitrate + Nitrite (mg/L)	
Basin	Site	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.
East	CRFW01	37	157	37	83	36	1.79	37	0.14	37	0.32
	CRFW02	44	186	44	117	44	1.53	43	0.14	43	0.03
	CRFW03	41	271	41	199	41	1.69	41	0.16	41	0.16
	CRFW05	48	142	48	76	48	1.30	48	0.08	48	0.05
	CRFW30	63	146	63	69	63	1.63	63	0.17	59	0.03
	S47D	45	251	44	148	45	2.19	45	0.54	43	0.08
West	CRFW06	111	113	111	51	111	1.25	110	0.10	111	0.06
	CRFW07	121	156	121	98	121	1.39	121	0.10	120	0.06
	CRFW09	111	79	106	23	111	1.10	109	0.06	109	0.02
	CRFW11	73	156	45	110	71	1.30	45	0.09	44	0.06
	CRFW12	102	168	84	153	99	0.98	84	0.04	83	0.05
	CRFW15	64	209	64	134	64	1.35	64	0.09	64	0.15
	CRFW23	58	121	58	87	58	1.19	57	0.03	58	0.07
	CRFW24	55	191	55	134	55	1.41	55	0.04	55	0.03
	CRFW25A	99	523	99	386	99	1.16	99	0.07	98	0.05

In-Estuary Chlorophyll *a* From Water Years 2021 - 2025

Chlorophyll *a* (µg/L)												
Wet Season (May–October)							Dry Season (November–April)					
Period	CES04		CES06		CES08		Period	CES04		CES06		CES08	
	Avg	SD	Avg	SD	Avg	SD		Avg	SD	Avg	SD	Avg	SD
POR	9.6	14.8	10.3	13.5	4.6	3.5	POR	8.7	11.0	6.5	7.2	2.5	2.7
WY2021	6.3	4.9	4.5	3.5	4.7	2.0	WY2021	8.6	5.4	4.5	1.9	2.6	0.4
WY2022	5.6	5.4	5.1	4.2	3.8	1.6	WY2022	7.2	7.5	3.6	0.6	2.8	1.6
WY2023	8.9	6.1	5.9	2.3	5.2	4.2	WY2023	5.5	3.6	4.7	2.9	2.5	1.2
WY2024	5.9	4.5	6.8	5.6	5.4	4.0	WY2024	16.1	17.5	13.3	20.0	7.1	9.1
WY2025	8.3	10.1	6.1	4.4	5.8	2.5	WY2025	4.6	3.6	4.3	2.1	1.9	0.5

Key Findings

High nutrient loading to the estuary
Over the past five years, the Caloosahatchee Estuary received about **3,400 t of Total Nitrogen (TN)** per year on average.


Caloosahatchee River Estuary


Michael Ruccolo collecting water sample with Nisken bottle at S79

Watershed loads exceed targets
Over the same 5-year period, the watershed (excluding Lake Okeechobee) delivered **~2,355 t of TN/year**, **above** the BMAP target (1,383 t/year).

Upstream hotspots identified
The highest TN concentration was at **S47D (2.19 mg/L)** in the East Basin, and the highest TP at **CRFW25A (523 µg/L)** in the West Basin.


Nathan Moreo collecting data with YSI unit and sonde at S79

Unit of Measurement	Definitions
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
t	Metric Tons

Acknowledgements: Thank you to the staff from the Water Quality Monitoring Section who collect the upstream monitoring samples and the staff in the Analytical Services Section. Without their efforts these data would not exist. Additionally, the maps were produced by Allison Lamb and Alexandra Hoffart of the Geospatial Services Section.

Background image is Caloosahatchee River Estuary facing west towards I-75

Chapter 9: Kissimmee River Restoration and Other Basin Initiatives
Long Term Trends in Littoral Vegetation on the Kissimmee Chain of Lakes

Camille Carroll

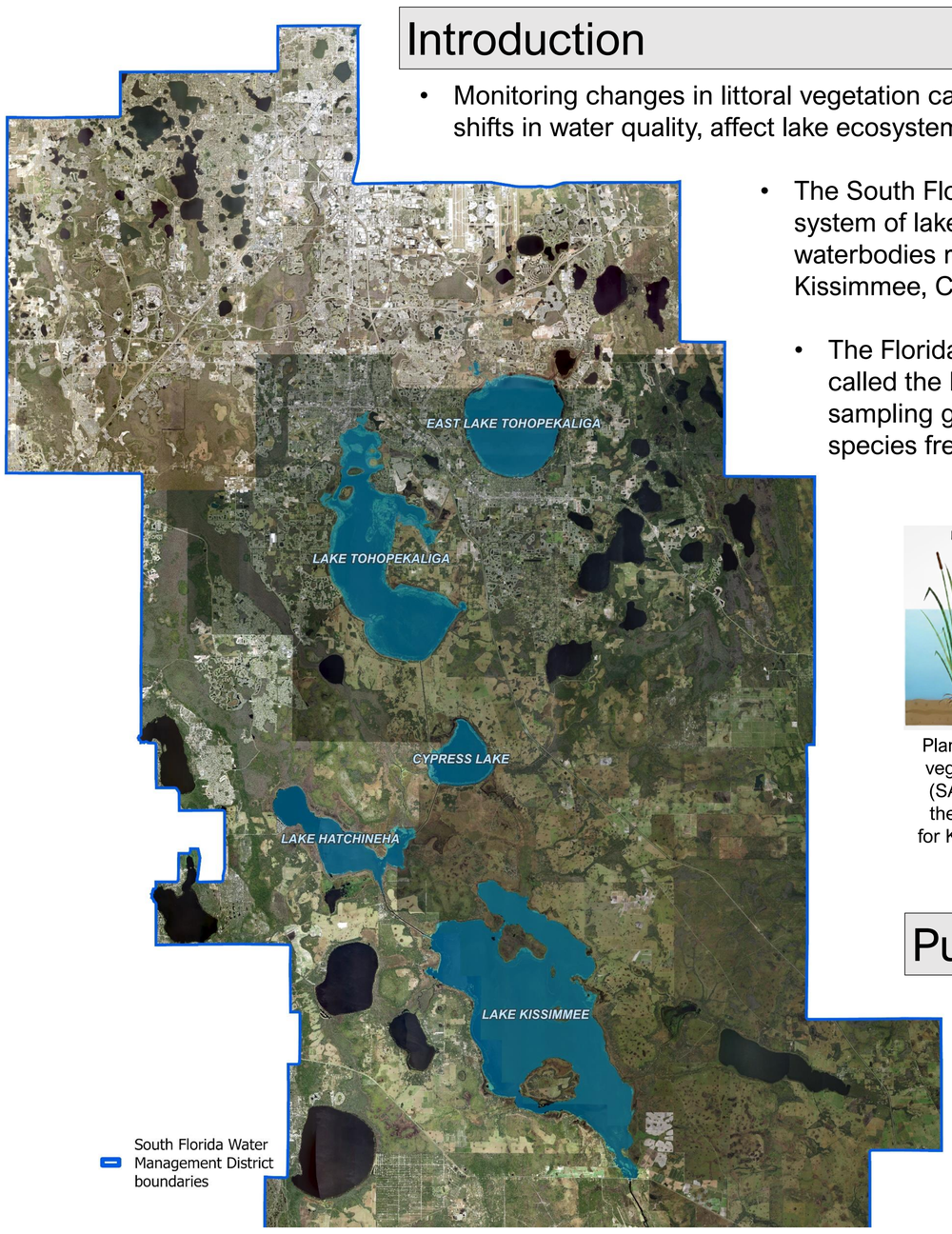
Lake and River Ecosystems Section, Applied Sciences Bureau

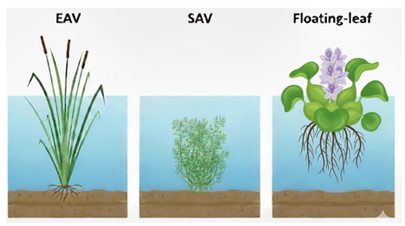
Introduction

- Monitoring changes in littoral vegetation can yield valuable insights into lake health and is critical to understanding how external factors, like hurricanes and shifts in water quality, affect lake ecosystems.

- The South Florida Water Management District's vast hydrologic network originates with the Kissimmee Chain of Lakes (KCOL), a system of lakes and connected marshes that occupies a 1,620 square mile watershed in Central Florida. The KCOL consists of 19 waterbodies regulated by the C&SF including five major lakes, three of which are the headwaters of the Kissimmee River (i.e. lakes Kissimmee, Cypress, and Hatchineha).

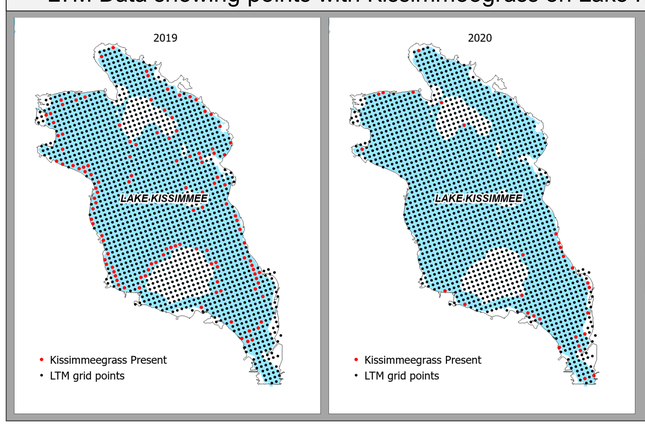
- The Florida Fish and Wildlife Conservation Commission (FWC) began a long-term monitoring program on the KCOL in 2015 called the Long-Term Monitoring Program Lake Vegetation Mapping Project or LTM. The LTM is based on a standardized sampling grid made up of points where plant species occurrence is recorded year after year, enabling users to track each species frequency over time and location.





Plant species represent 3 types of littoral vegetation: emergent (EAV), submersed (SAV), and floating-leaf; the example to the right compares two years of results for Kissimmeegrass, an emergent species

LTM Data showing points with Kissimmeegrass on Lake Kissimmee in 2019 and 2020

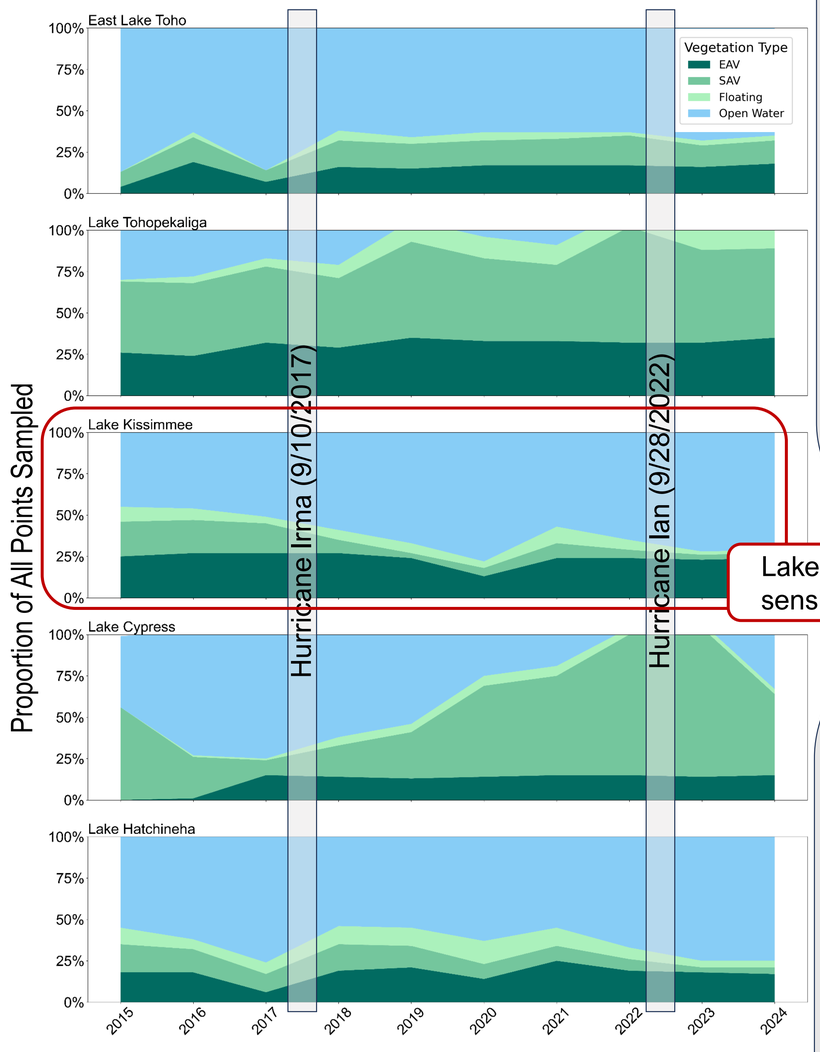


Kissimmeegrass, *Paspalidium geminatum*, on Lake Kissimmee

Putting LTM Data to Use

- District scientists are using FWC's LTM data to understand plant community trends on the KCOL and have integrated the data into other mapping projects, resulting in a more complete understanding of lake health
- Plant species frequency (proportion of points sampled) is tracked over time to examine trends in littoral vegetation (graph below, right). Frequency data are also used to identify the most common species of EAV, SAV, and floating-leaf vegetation on each lake (table below)
- Patterns and trends in littoral vegetation differ widely across the 5 lakes, affected by environmental conditions (e.g. hurricanes and water quality) and by lake management, namely invasive plant treatment

Trends in Littoral Vegetation by Type on 5 Major Lakes in the KCOL, 2015 to 2024



Type	Common Name	Species Name	East Lake Tohopekaliga	Tohopekaliga	Kissimmee	Cypress	Hatchineha
EAV	maidencane	*Hymenachne hemitomon*			✓		
	largeflower primrosewillow*	*Ludwigia grandiflora**				✓	
	spatterdock	*Nuphar advena*		✓	✓		✓
	American white waterlily	*Nymphaea odorata*		✓			
	torpedograss*	*Panicum repens**	✓				
	Kissimmeegrass	*Paspalidium geminatum*		✓	✓		
	bulrush	*Schoenoplectus sp.*	✓			✓	✓
	cattail	*Typha* sp.	✓			✓	✓
SAV	coontail	*Ceratophyllum demersum*			✓	✓	✓
	hydrilla*	*Hydrilla verticillata**		✓	✓	✓	✓
	Illinois pondweed	*Potamogeton illinoensis*	✓	✓			
	bladderwort	*Utricularia sp. (Utricularia foliosa)*	✓	✓			
	tapegrass	*Vallisneria americana*	✓		✓	✓	✓
Floating-leaf	common water-hyacinth*	*Eichhornia crassipes**	✓	✓	✓	✓	✓
	water-lettuce	*Pistia stratiotes*	✓		✓	✓	✓
	salvinia*	*Salvinia sp.**	✓	✓	✓	✓	✓

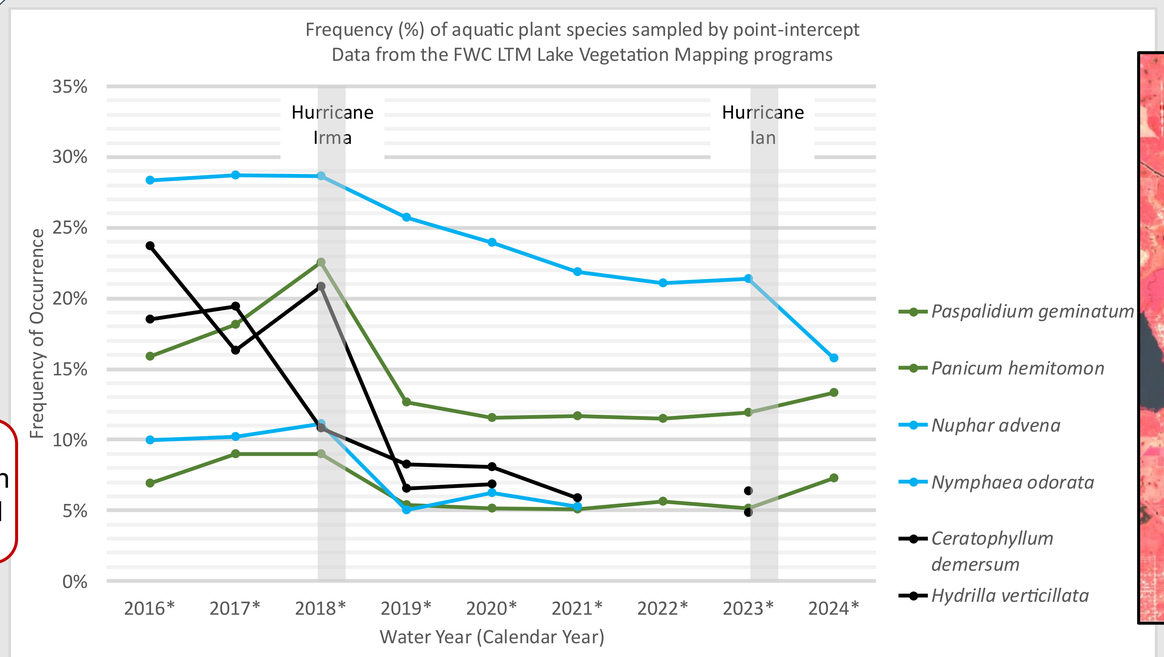
Floating-leaf communities on all 5 lakes include the same 3 invasive species; patterns in the frequency of these species are likely governed by lake management activities.

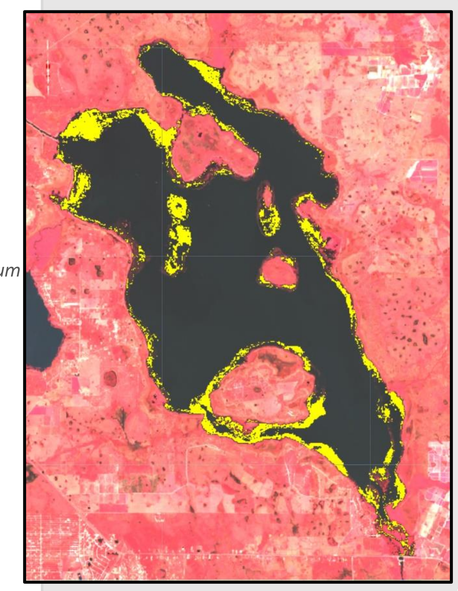
Lakes Tohopekaliga and Kissimmee dominated by deepwater grasses and pads, while cattail and bulrush were common on the other lakes

Dominant torpedograss was unique to ELT

Hydrilla and eelgrass dominant throughout; pondweed and bladderwort common in upper lakes, coontail common in lower

Lake Kissimmee experienced declines in vegetation; changes in EAV and Floating-leaf were further investigated using remote sensing and applying the LTM data to spatial analysis; results shown below





Between 2015 and 2024 there was a decrease of ~3,000 acres of vegetation on Lake Kissimmee, with notable decreases in pads, deepwater grasses, and SAV after Hurricane Irma in 2017.

Special thanks to Jennifer Moran and Kevin Johnson of the Fish and Wildlife Research Institute, FWC, and James Leary of the Lake and River Ecosystem Section, SFWMD for furnishing and organizing data

Chapter 9: Kissimmee River Restoration and Other Basin Initiatives
Adaptive Resource Management: Using Science to Manage Invasive Grasses within the Kissimmee River Restoration Project

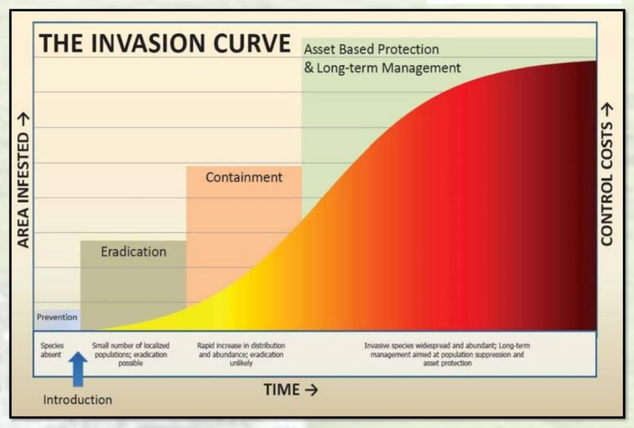
Rich Botta[1], Alex Onisko[2], Stephen Enloe[3] and James Leary[1]

[1]Applied Sciences Bureau, [2]Land Resources Bureau, [3]University of Florida, IFAS

Kissimmee River Restoration Project

- Reconnect, reconstruct physical form of the river by backfilling C-38 canal and degrading - completed 2021
- Modify headwater inflows to mimic historical patterns with the Headwaters Revitalization Schedule ~2027
- Invasive grasses have dominated natural vegetation communities that provide vital habitat for fish and wildlife primarily West Indian marsh grass (*Hymenachne amplexicaulis*, WIMG) and para grass (*Urochloa mutica*)

The need for adaptive restoration - the canal has been backfilled, hydrology is being modified, but need to address invasive grasses to complete restoration



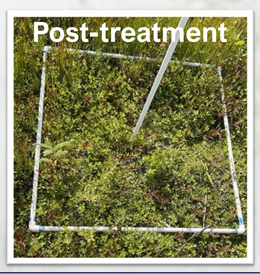
Invasive Grass Management

- Can the invasive grasses be suppressed?
- Can we do it efficiently?
- Will it accelerate native plant recruitment?
- Can we develop a long-term strategy?

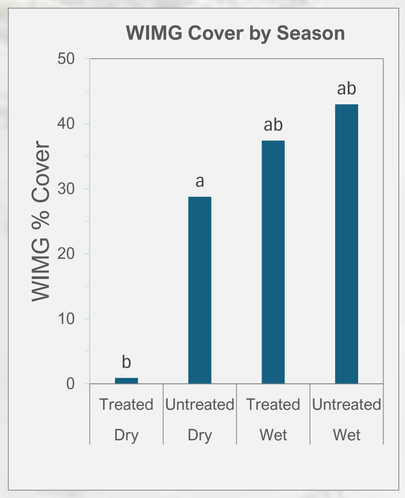
University of Florida & SFWMD Partnership

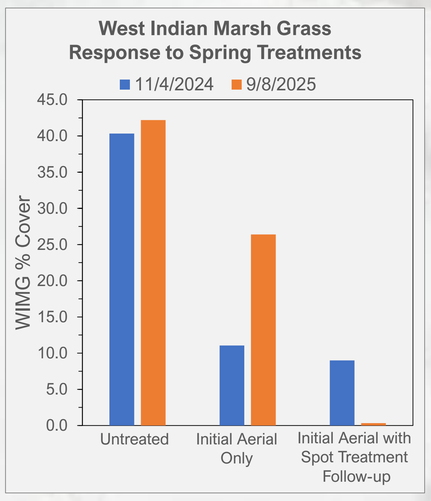
- Investigate the influence of seasonality and inundation with invasive grass treatments
- Investigate treatment outcomes in plots dominated by WIMG vs plots with native species mixed with WIMG
- Evaluate the response of target and native vegetation

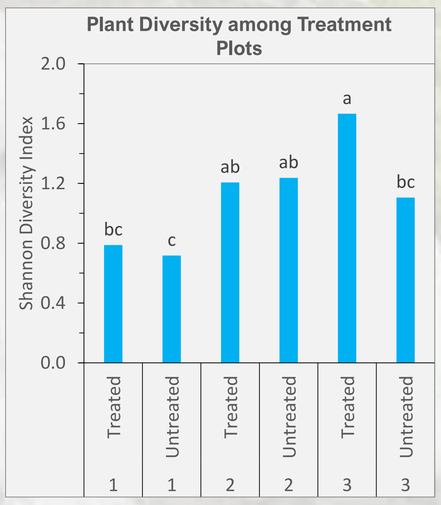
Early Responses



Aerial treatments are a precise and accurate delivery system offering landscape-level management of critical District resources

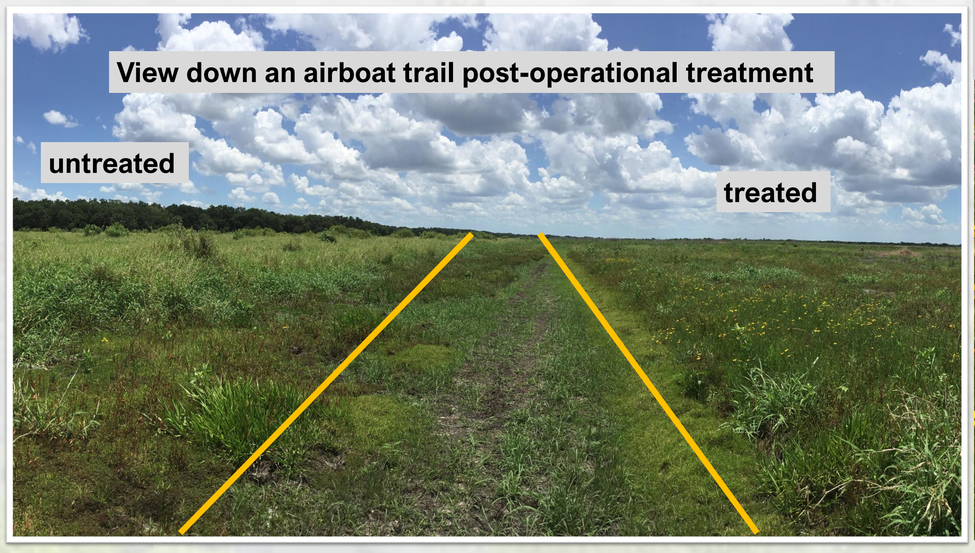


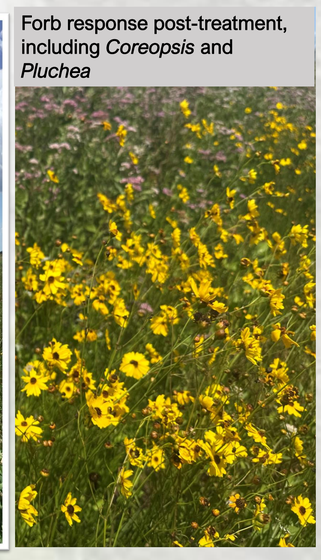




Dry season treatments provide best response with dry ground application, short, low WIMG cover

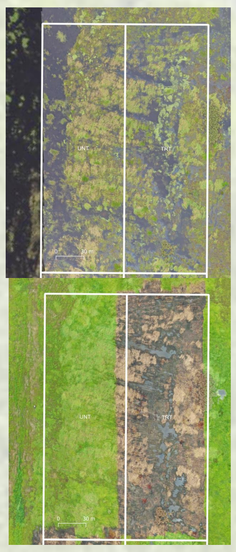
- Consistent control at 390 days after treatment (DAT) across sites
- Cover at 540 DAT lower in treated than non-treated
- Non-WIMG cover: high at initial, even higher at 390 DAT
- Species richness increased at the site that started with high species richness
- Higher diversity of spring species than fall species
- Treatments either increased or did not change plant diversity the year after treatment - indicative of both positive treatment effects at high diversity sites and a lack of negative impacts on initially lower diversity sites

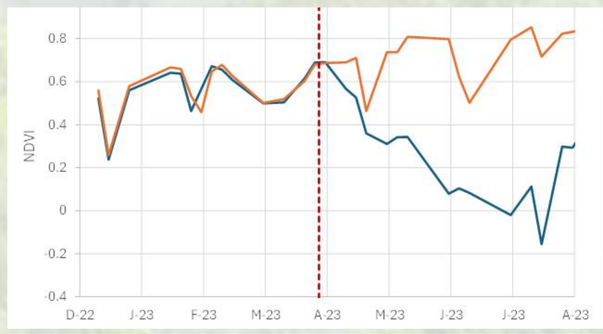


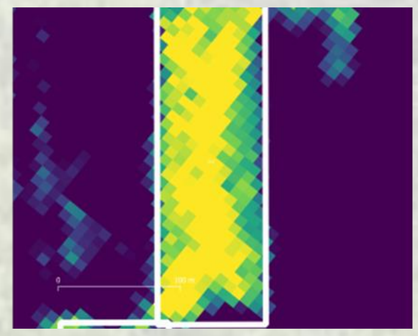


Future Direction

- Explore herbicide reductions for more economical treatments that are safer for the environment
- Measure the effects of repeated treatments improving long-term suppression efficacy
- Integrated Management - implement other cultural practices into long-term control and adoption
- Develop remote sensing techniques to broadly monitor landscape-level management of District assets







On the left: Treated (TRT) and untreated (UNT) plots one month before treatment (top, 03/15/2023) and 3 months after treatment (bottom, 06/08/2023). Above: Median NDVI profiles for treated (blue) and untreated (orange) plots over an 8-month timeline. Red dash is the date of treatment. Raster NDVI map showing treatment affect 2 months post-treatment. NDVI values created from Sentinel-2 imagery, cloud-free between March-August 2023

Chapter 9: Kissimmee River Restoration and Other Basin Initiatives

Where's the water? Ask the Hydroperiod Tool

Lawrence Spencer, Rich Botta, and Darryl Marois

Lake and River Ecosystems Section, Applied Sciences Bureau

Google

Got questions …?

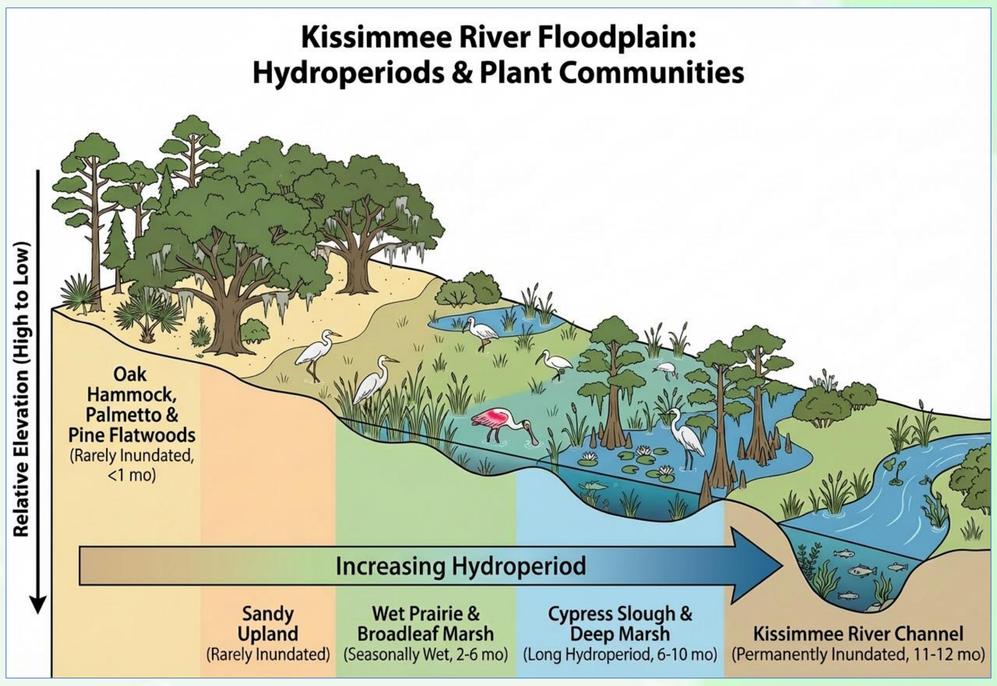
What is hydroperiod?

The duration and depth of inundation in a wetland or water body

Why is hydroperiod important?

It is integral to Kissimmee River restoration objectives:

- Target vegetation communities
- Habitat for fish and other aquatic species
- Nesting and foraging for wading birds, snail kites, waterfowl



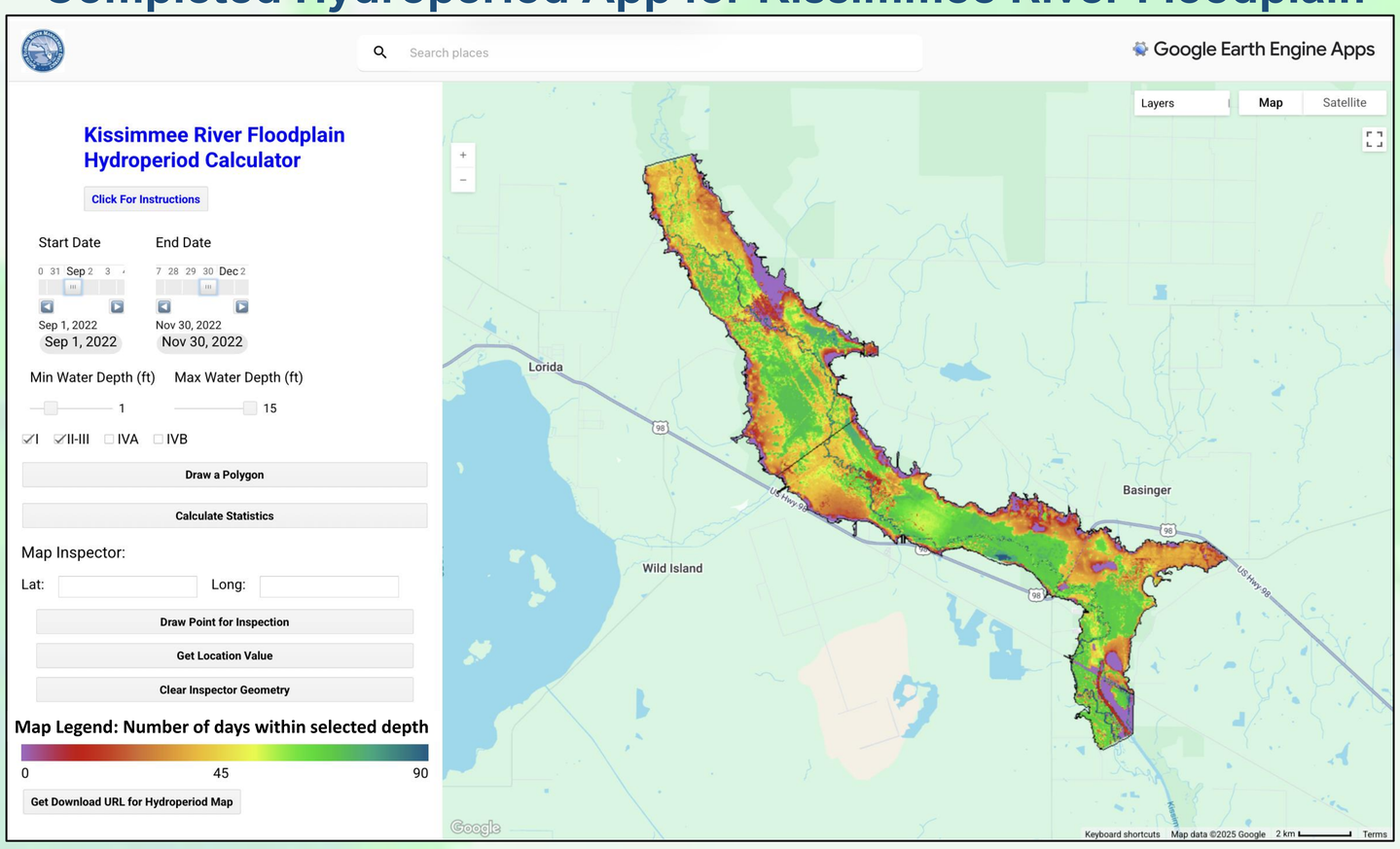
Example of an Annual Floodplain Inundation Cycle

There's an app for that…

Hydroperiod App Features

- Web-based app that calculates hydroperiod maps
- Easy-to-use tool, no steep learning curve
- Runs quickly using cloud computing resources
- Automatic DBHydro updates
- Selectable preset areas of interest
- Exportable time series plots and hydroperiod maps

Completed Hydroperiod App for Kissimmee River Floodplain

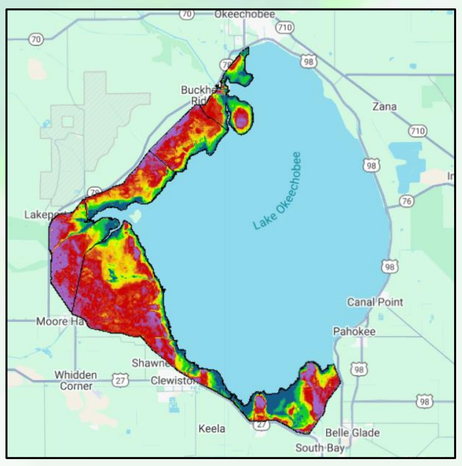


App can create hydroperiod maps for any period contained in the record. Outputs maps and plots for display or analysis.

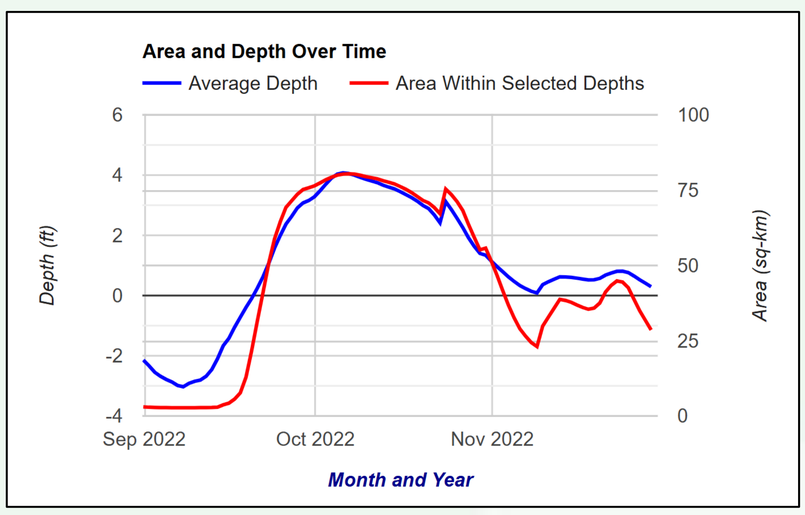
How did we create this tool?

Using modules of Google Cloud Platform, including Google Earth Engine, BigQuery, and Colab Enterprise, we developed an adaptable, easy-to-use app that produces hydroperiod maps and outputs that can be displayed and analyzed outside the app. Similar apps can be developed for water bodies in South Florida.

Roseate spoonbills and other wading birds using the restored Kissimmee floodplain



Early output from Lake O tool



Future Development

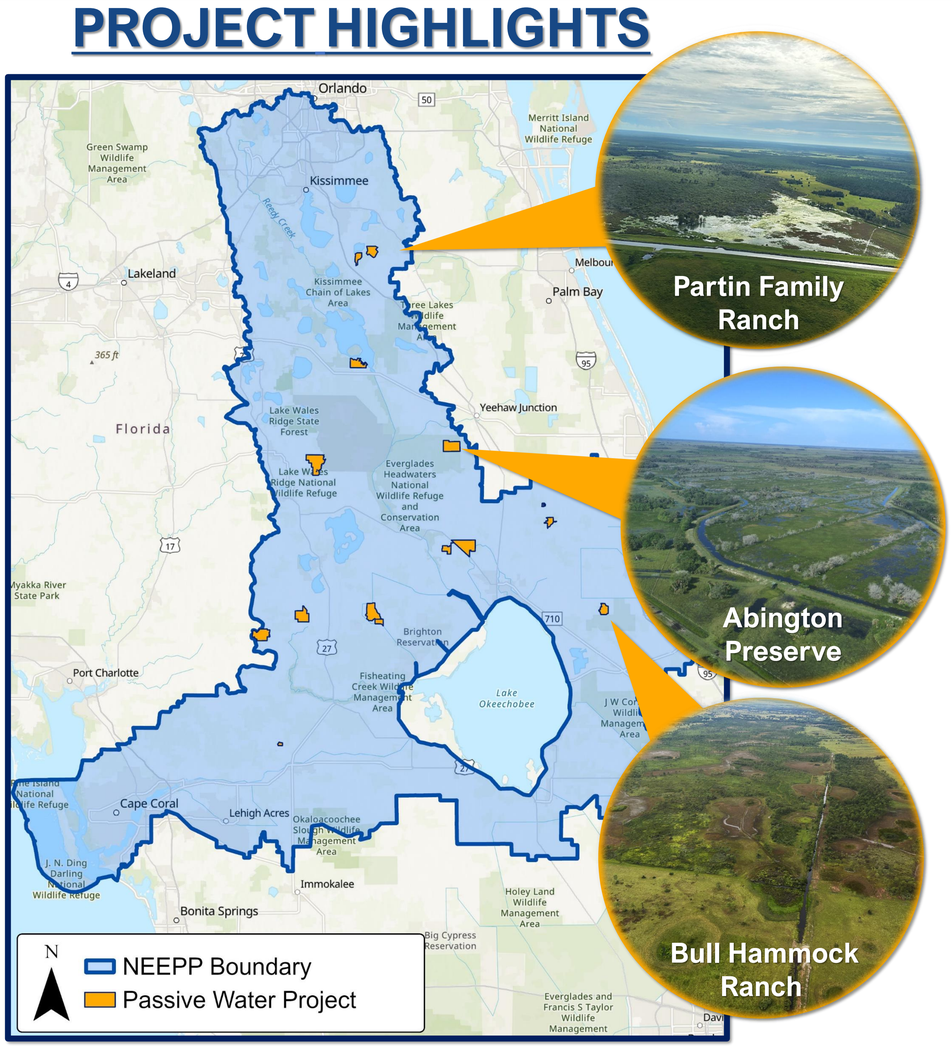
We have developed a similar tool for the Lake Okeechobee littoral zone and are working with other District stakeholders to make tools for other wetlands in South Florida. Turn-around time for developing apps has dropped to weeks rather than months.

Chapter 8: Northern Everglades and Estuaries Protection Program
Working with Nature: Passive Storage Projects

Jacob Landfield
Everglades and Estuaries Protection Bureau

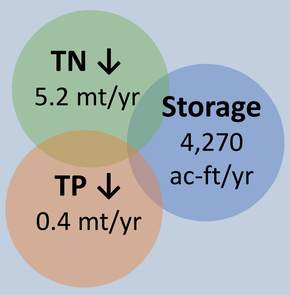
Natural Water Storage Solutions for the Northern Everglades

PROJECT HIGHLIGHTS



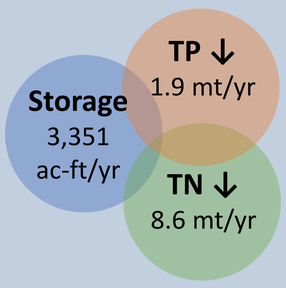
Partin Family Ranch

Launched in March 2024, this **3,000-acre passive DWM project** in Osceola County (south of Lake Gentry) has become a regional success. By capturing direct rainfall and stormwater runoff within two management areas, the project significantly enhances local water retention and environmental health.

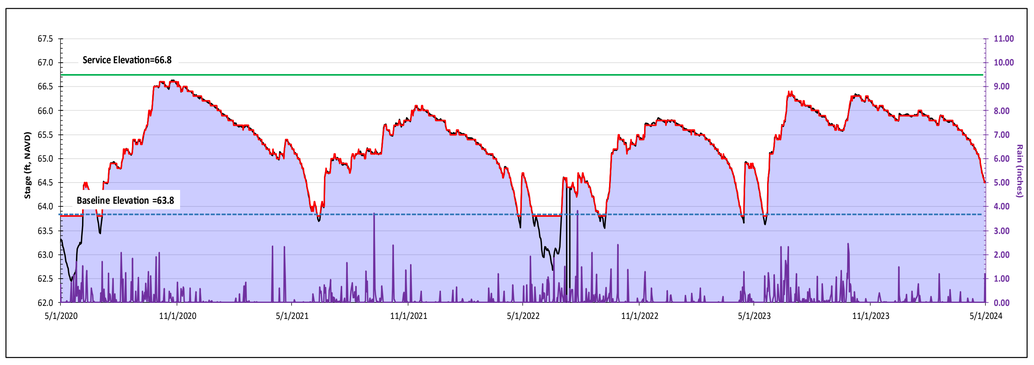


Bull Hammock Ranch Water Management Area

This **1,674-acre passive DWM project** in Martin County prevents on-site runoff from entering the C-23 Canal by utilizing a ditch network to retain water. These on-site retention efforts effectively lessen stormwater runoff and extend the hydroperiods of local wetlands.



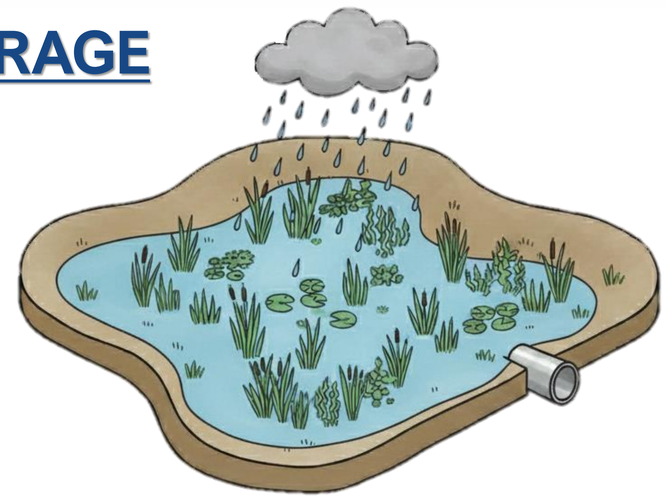
Project Hydrographs



Project Hydrographs relate rainfall, service & baseline elevations, and stage to project storage benefits. In this example, the project storage is the shaded area between the baseline elevation and the service elevation.

WHAT IT IS: PASSIVE STORAGE

Passive Dispersed Water Management (DWM) projects use **simple structures** like culverts and berms to hold and retain rainfall on private lands, **slowing runoff** and **reducing flows** to the regional drainage system



KEY BENEFITS

Rehydrating the System

Passive **projects replenish groundwater reserves** by restoring natural flow paths and holding water on the landscape

Cost-Effective Designs

Passive projects are an **efficient way to achieve** water management **goals** by leveraging **existing natural features** and requiring **minimal mechanical infrastructure**

Slow the Flow

Storing the water on the **landscape gives time for water** to **soak** into soils, **encouraging** natural **filtering** and **reducing nutrient transport**

Environmental Services on Private Land using Public Funds

Since the **land stays** on the local **tax roll**, the community receives property **tax revenue** while also **benefiting** from a **solution to critical water challenges**

Grazing and Green

Since **passive projects rarely discharge** water, **landowners can** continue to **use** their **property for compatible uses,** like low-density cattle grazing, **keeping the land productive** while **managing water resources**

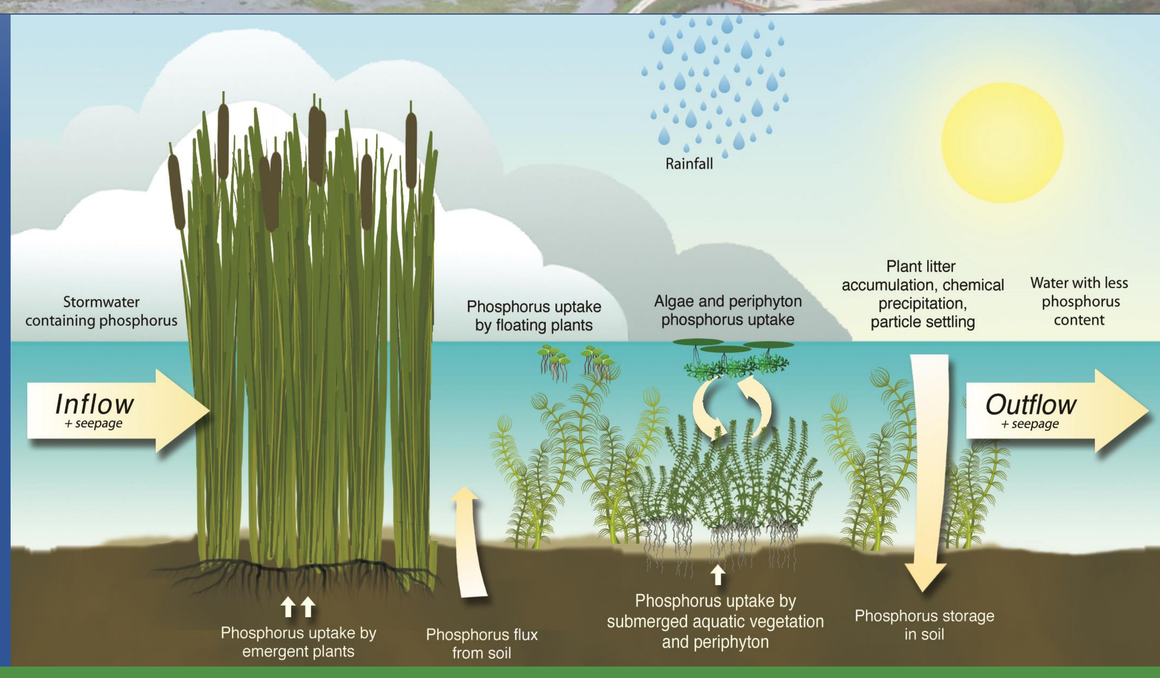
Learn more about NEEPP projects in SFER Chapter 8 →

Chapter 8B: Lake Okeechobee Watershed Protection Plan
The Power of Plants: Northern Stormwater Treatment Areas

Matthew Biondolillo and Rebecca Dougherty
Everglades and Estuaries Protection Bureau

WHAT IT IS:

Northern Stormwater Treatment Areas (STAs) are specially constructed wetlands in the Northern Everglades that use Emergent (EAV) and Submerged Aquatic Vegetation (SAV) in conjunction with naturally occurring microbes to treat nutrient-rich stormwater before it enters Lake Okeechobee: the Liquid Heart of Florida



Constructed Treatment Wetlands Provide Multiple Ecosystem Services

KEY BENEFITS

The Power of Plants & Microbes

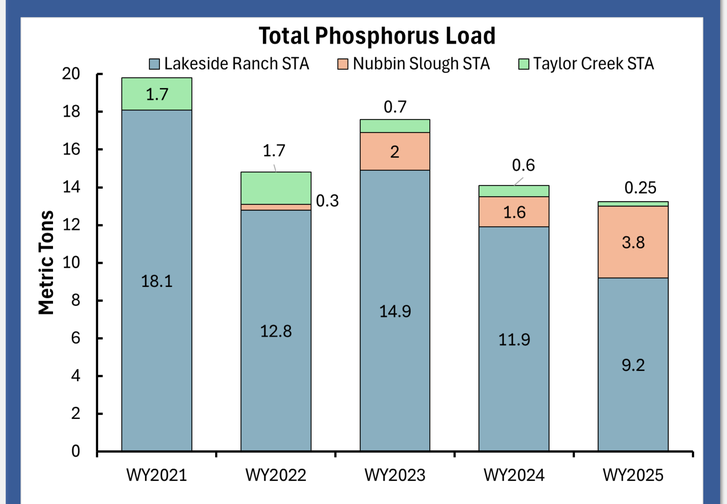
STAs use wetland plants, like cattails and bulrush, and **microbes** to drive biogeochemical processes **to filter and retain nutrients,** especially total phosphorus (TP), from surface water runoff at relatively low cost.

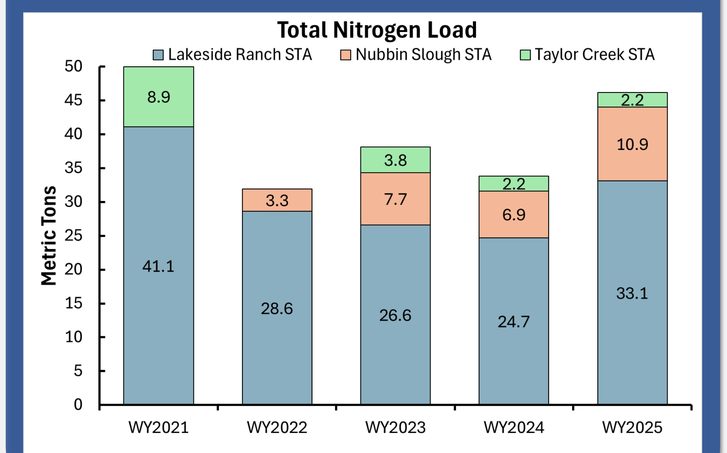
Tilting the Scale: Removing Tons of Nutrients

Northern **STAs** altogether **retained** an estimated **80** and **197 metric tons** of **total phosphorus** and **total nitrogen**, respectively, over the past 5-year period.

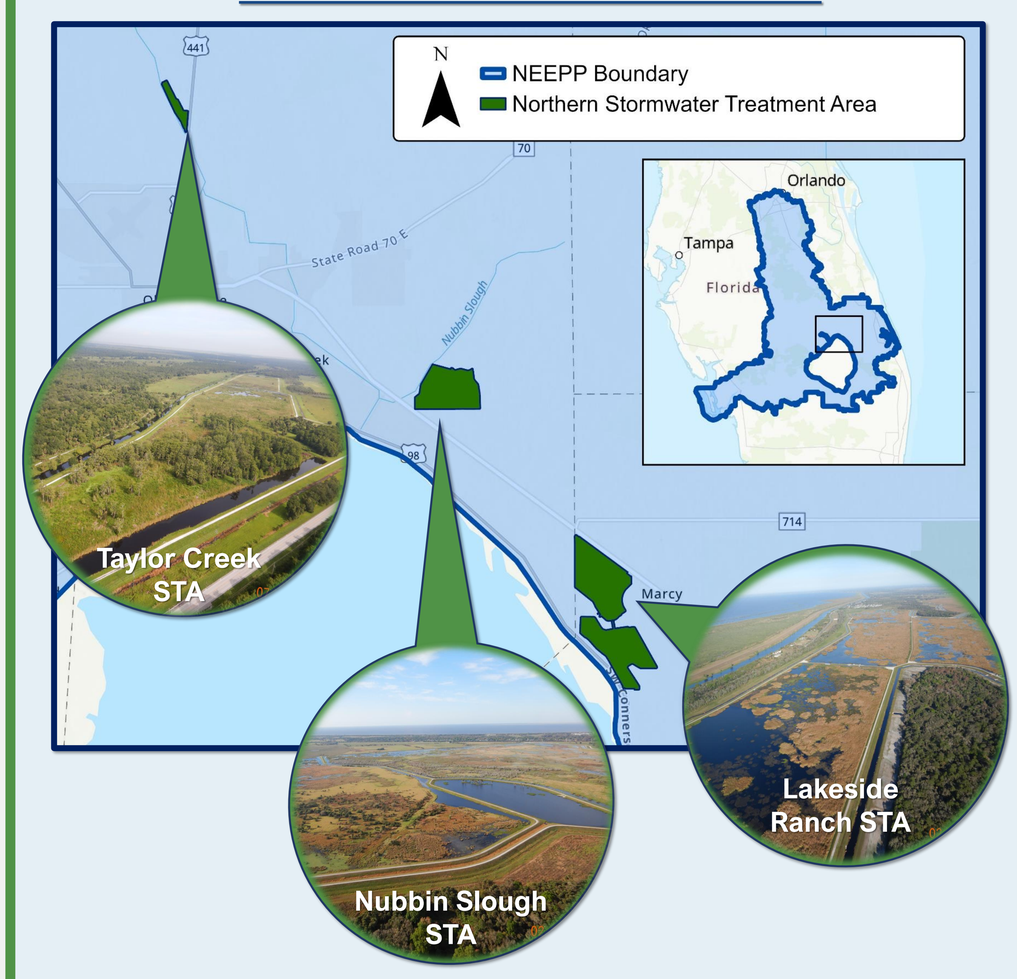
They're **making a difference** in the overall health of the Lake Okeechobee Watershed.

Nutrient Load Retention in Northern STAs over the Past 5-year Period





PROJECT HIGHLIGHTS



TAYLOR CREEK STA

RECREATIONAL ACTIVITIES

- Two wetland cells with 118-acres of effective treatment area treating stormwater from the Taylor Creek basin.
- Features a stand of ancient cypress trees and a chikee hut shelter, and offers many recreational activities including bicycling, hiking, bird watching, picnicking and wildlife viewing.

NUBBIN SLOUGH STA

RECREATIONAL ACTIVITIES

- 30 acre storage pond and two wetland cells with 773 acres of effective treatment area treating stormwater from the Nubbin Slough basin.
- Perfect place for hiking, bicycling, fishing, and seeing wildlife such as Florida Sandhill cranes, snapping turtles, American bald eagles, and eastern meadowlarks.

LAKESIDE RANCH STA

RECREATIONAL ACTIVITIES

- Eight wetland cells with 1,707 acres effective treatment area treating stormwater from the S-191 basin.
- S-191A pump station supports wetland rehydration during drier periods and provides flood control for S-135 subbasin.
- Offers hiking, bicycling, wildlife viewing, or simply relaxing.


River Otter at Lakeside Ranch STA


Chickee Hut Shelter at Taylor Creek STA


Great Blue Heron at Nubbin Slough STA

KEY BENEFITS

Essential Ecosystem Services

Removing nutrients is **critical** because they **can cause harmful algal blooms. Clean water from STAs is vital for** the recovery of **Lake Okeechobee health,** including fish habitat.

Science in Action

Ongoing **research projects**, such as Taylor Creek Nutrient Removal Test project, **are underway to find effective ways** to **enhance nutrient reduction** performance of these constructed treatment wetlands.

Supportive Services and Ancillary Benefits!

In addition to cleaning water flowing into Lake Okeechobee, the Northern STAs offer a variety of recreational activities for the public. SFWMD partners with the Florida Fish and Wildlife Conservation Commission to offer specialty hunts aimed at introducing young people to hunting and conservation as well as Wounded Warriors Outdoors to provide wounded servicemen and women with therapeutic outdoor adventures.

Visit myfwc.com for hunting dates, regulations, and license information.

"We develop specialized rehabilitation programs tailored to support the integration and recovery of military veterans returning home from service, offering a multifaceted approach to healing that addresses physical, mental, and emotional well-being."

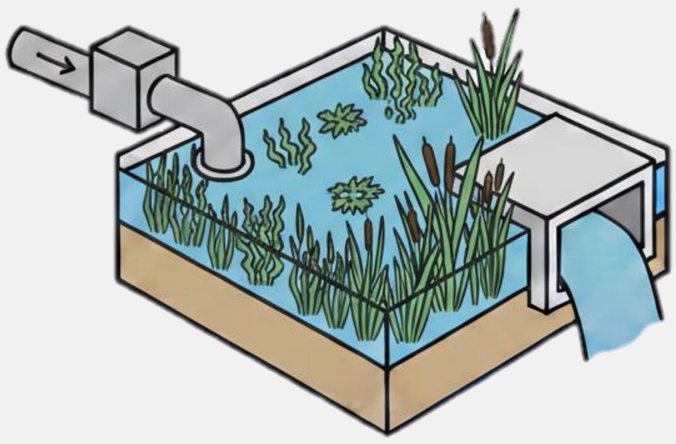
-Wounded Warrior Outdoors

Learn more about NEEPP projects in SFER Chapter 8 →

Chapter 8: Northern Everglades and Protection Program
The Power of the Pump: Strategic Storage for Healthy Estuaries

Aubrey Frye
Everglades and Estuaries Protection Bureau

Controlling Harmful Runoff and Delivering Clean Water

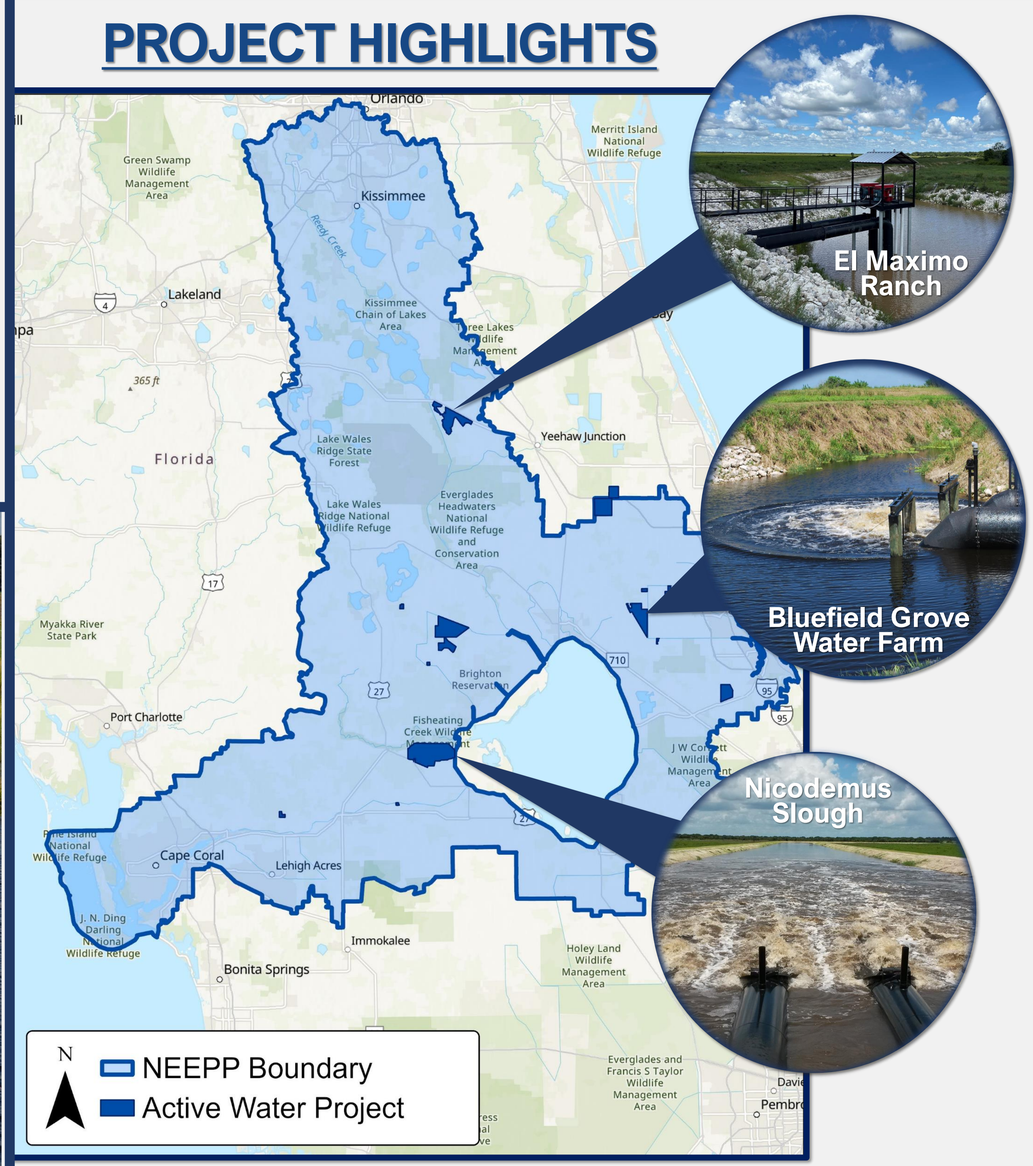


WHAT IT IS: ACTIVE STORAGE

Active Dispersed Water Management (DWM) projects use mechanical pump stations to efficiently move and store huge amounts of regional water. We can even control when the water goes in and when it comes out!

Photo: Brighton Valley
Dispersed Water Management (DWM) Project

PROJECT HIGHLIGHTS



KEY BENEFITS

Precision Timing For Ecosystem Health

Projects like Caulkins Water Farm allow **management** of regional water **with precision,** quickly **pumping water** off the landscape **during heavy rains or lake discharges** and saving beneficial freshwater to **release slowly** during the **dry season,** helping to keep **salinity** the St. Lucie Estuary at a **healthy** level for oysters and sea grasses.

Big Storage, Big Protection

Active projects are designed to hold massive amounts of water **preventing** excess water from **flooding** or **being discharged** into downstream estuaries.

Nutrient Reduction is a Bonus

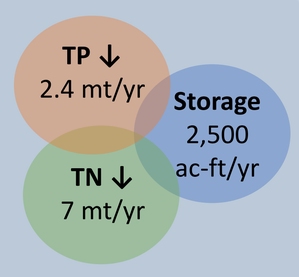
By holding water for a longer time, these large projects allow some excess **nutrients to settle out**, contributing significantly to the overall goal of **reducing Total Phosphorus (TP) and Total Nitrogen (TN)** in the watershed.

Local Economy Boost: Environmental Services, Private Land, Public Funds

DWM projects partner with **private landowners** to store water, keeping the land on the local **tax roll**, thus ensuring the community continues to receive valuable property tax revenue while **solving water challenges.**

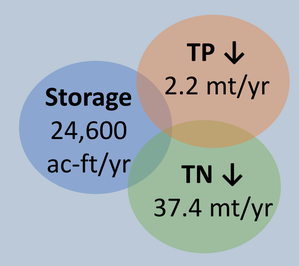
EL MAXIMO RANCH

This **active treatment and flow attenuation project** retains water from the Kissimmee River and Blanket Bay Slough before discharging to the Kissimmee River downstream of S-65.



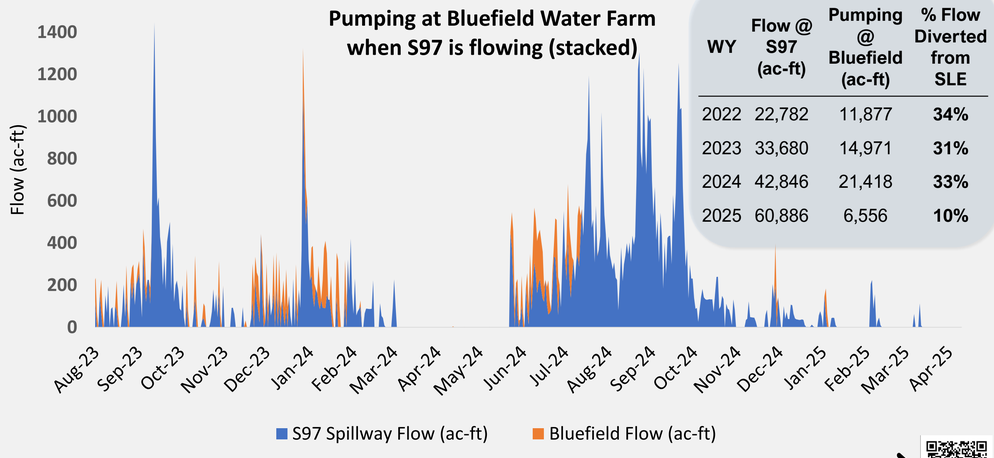
NICODEMUS SLOUGH

This **active DWM project** pumps water from Lake Okeechobee into the west side of the project impoundment. Local runoff and pumped volume sheet-flow east and discharge either back to Lake Okeechobee through the S-282 structure or south through the S-342 structure.



BLUEFIELD WATER FARM

As a public-private partnership, this **active DWM project** pumps excess water from the C-23 Canal and stores it within a 6,104-ac aboveground impoundment located on former agricultural lands. The project only pumps in water when the S-97 structure is discharging, reducing the total flow to the St. Lucie Estuary during high flow events.



WY	Flow @ S97 (ac-ft)	Pumping @ Bluefield (ac-ft)	% Flow Diverted from SLE
2022	22,782	11,877	**34%**
2023	33,680	14,971	**31%**
2024	42,846	21,418	**33%**
2025	60,886	6,556	**10%**

Learn more about NEEPP projects in SFER Chapter 8 →

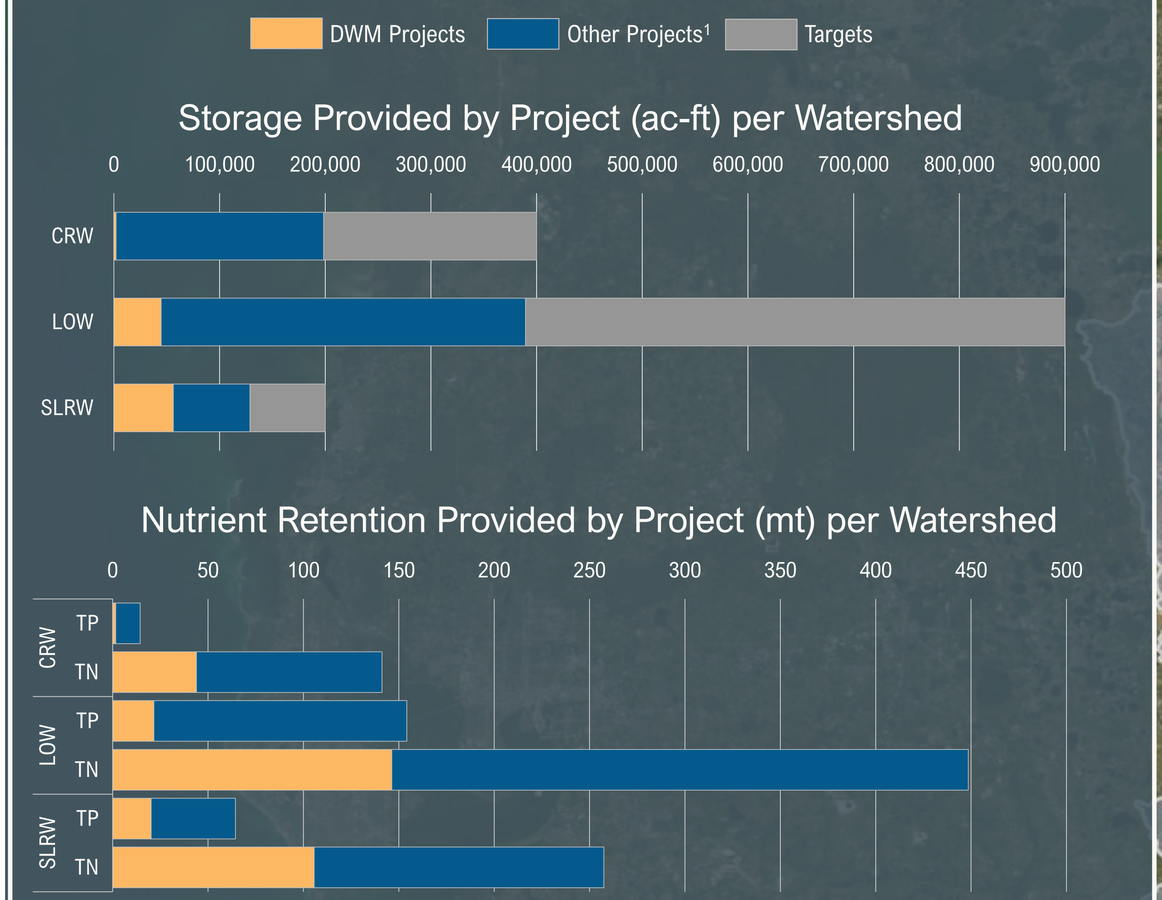
Chapters 8B, 8C, and 8D
Northern Everglades Dispersed Water Management Projects

Cristina Gauthier, Manuel F. Zamorano, Christian L. Avila
Project Operations and Assessment, Everglades & Estuaries Protection Bureau

Dispersed Water Management Projects

- Implemented on public or private lands through public-private partnerships to distribute shallow water across land using simple structures
- Landowner involvement typically includes cost-share cooperative projects, easements, or payment for environmental services
- Over 100 monitoring stations covering 24 operational projects across 85,000 acres

Visualizing DWM Project Contributions:
Northern Everglades and Estuaries Protection Program Projects and Targets



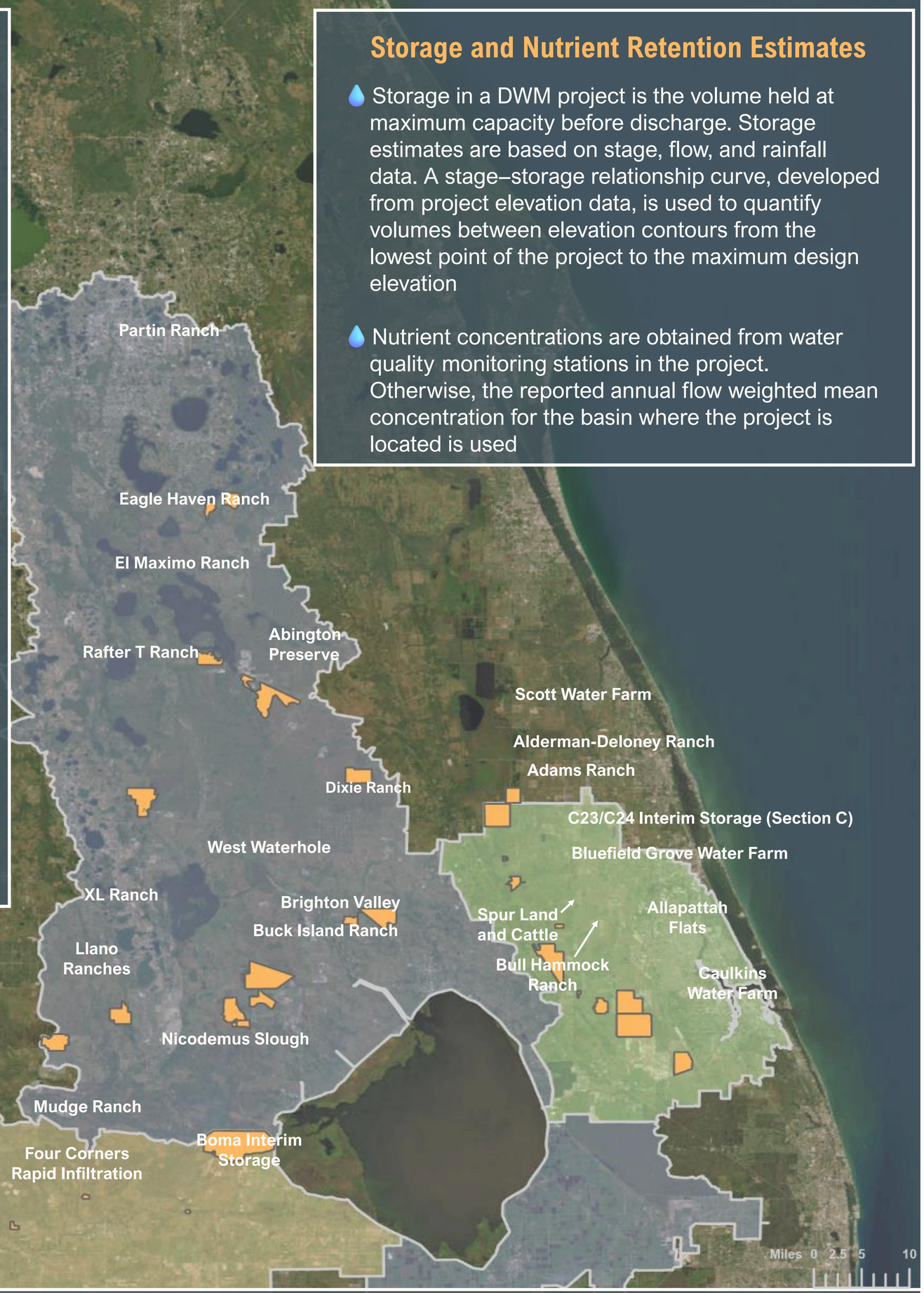
[1]*Other Projects* refers to Infrastructure Improvements, Stormwater Treatment Areas, Reservoirs, Alternative Technologies, etc.

Data is shown for:

- 52 projects in Operation & Maintenance of which 24 are DWM
- 8 projects in Planning of which 3 are DWM
- 14 projects in Design
- 3 in Construction
- 2 in Operational Testing

Storage and Nutrient Retention Estimates

- Storage in a DWM project is the volume held at maximum capacity before discharge. Storage estimates are based on stage, flow, and rainfall data. A stage–storage relationship curve, developed from project elevation data, is used to quantify volumes between elevation contours from the lowest point of the project to the maximum design elevation
- Nutrient concentrations are obtained from water quality monitoring stations in the project. Otherwise, the reported annual flow weighted mean concentration for the basin where the project is located is used



More than Storage: DWM Project Performance