Florida's Freshwater Condition: Lessons Learned from the First Cycle of a Statewide Rotating Basin Survey and Recycling with a New Design

Florida Department of Environmental Protection
Watershed Monitoring and Data Management Section

Acknowledgements and Co-Authors

- Watershed Monitoring Group HQ-Tallahassee
  Monitoring Staff – DEP, WMDs, Counties
- Geographic Information (Joe North, Kim Jackson)
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  Kevin Summers, Virginia Engle, Tony Olsen
- Council of State Governments

Florida DEP Monitoring History

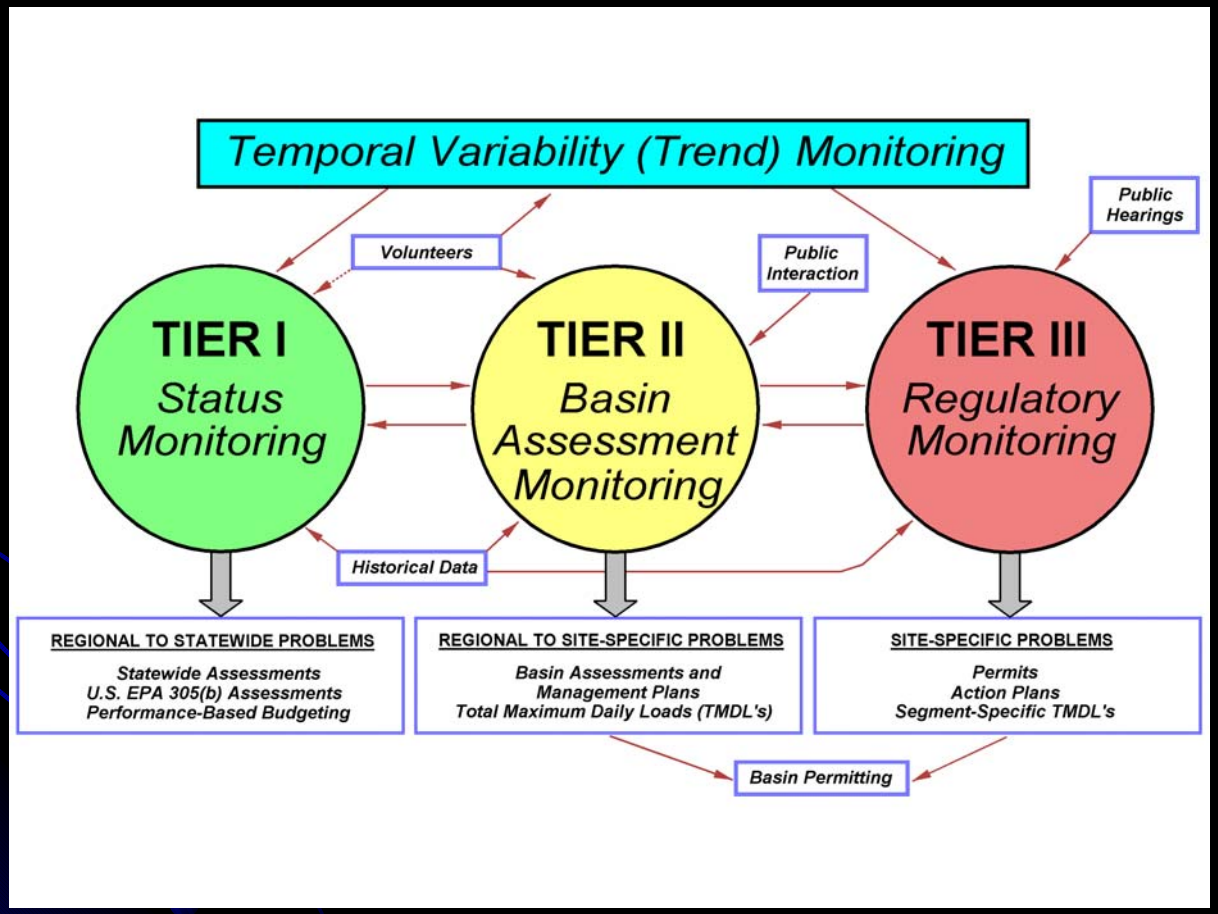
- Agency had surface and ground water monitoring groups in regional offices and Tallahassee. Designs changed with funding and policy. 305 (B) produced with “found” data. 20-25% of state waters assessed. No comprehensive design.
- Mid 90’s, “Ecosystem Management”. DEP tasked with establishing a statewide status and trend monitoring network for both surface and ground water.
- Steering group: EPA, state and other government agencies, private industry to establish design.
- **Communication and partnerships a key to success of program**

Integrated Water Resource Monitoring Network (IWRM)

Objective

To provide scientifically defensible, statewide and watershed (basin) information on important chemical, physical and pertinent biological characteristics from surface waters and major aquifer systems in Florida.

Florida's Integrated Water Resource Monitoring Network (IWRM)



Integrated Water Resource Monitoring Network (IWRM)

Trend Variability Network:

Long term trend in surface and ground water at fixed stations. 79 surface water, 46 groundwater stations.

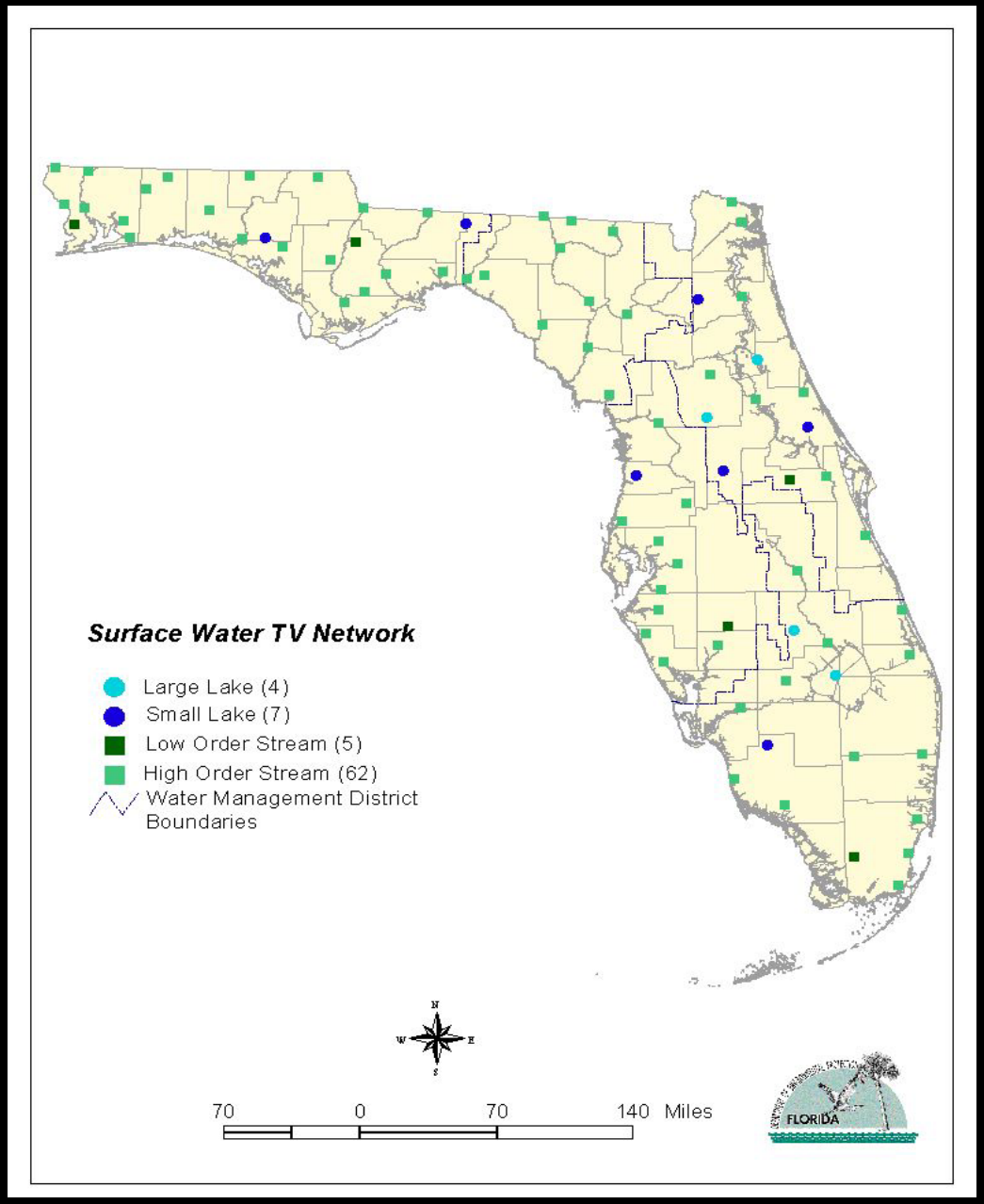
Status Network:

Report on statewide and basin condition for surface and ground water using freshwater indicators. Probabilistic design.

IMAP : Florida Marine Research Institute

Assess the coastal marine waters of Florida using rotation and key ecological indicators

Surface Water Temporal Variability (Trend) Network



Status Monitoring Network

Objectives:

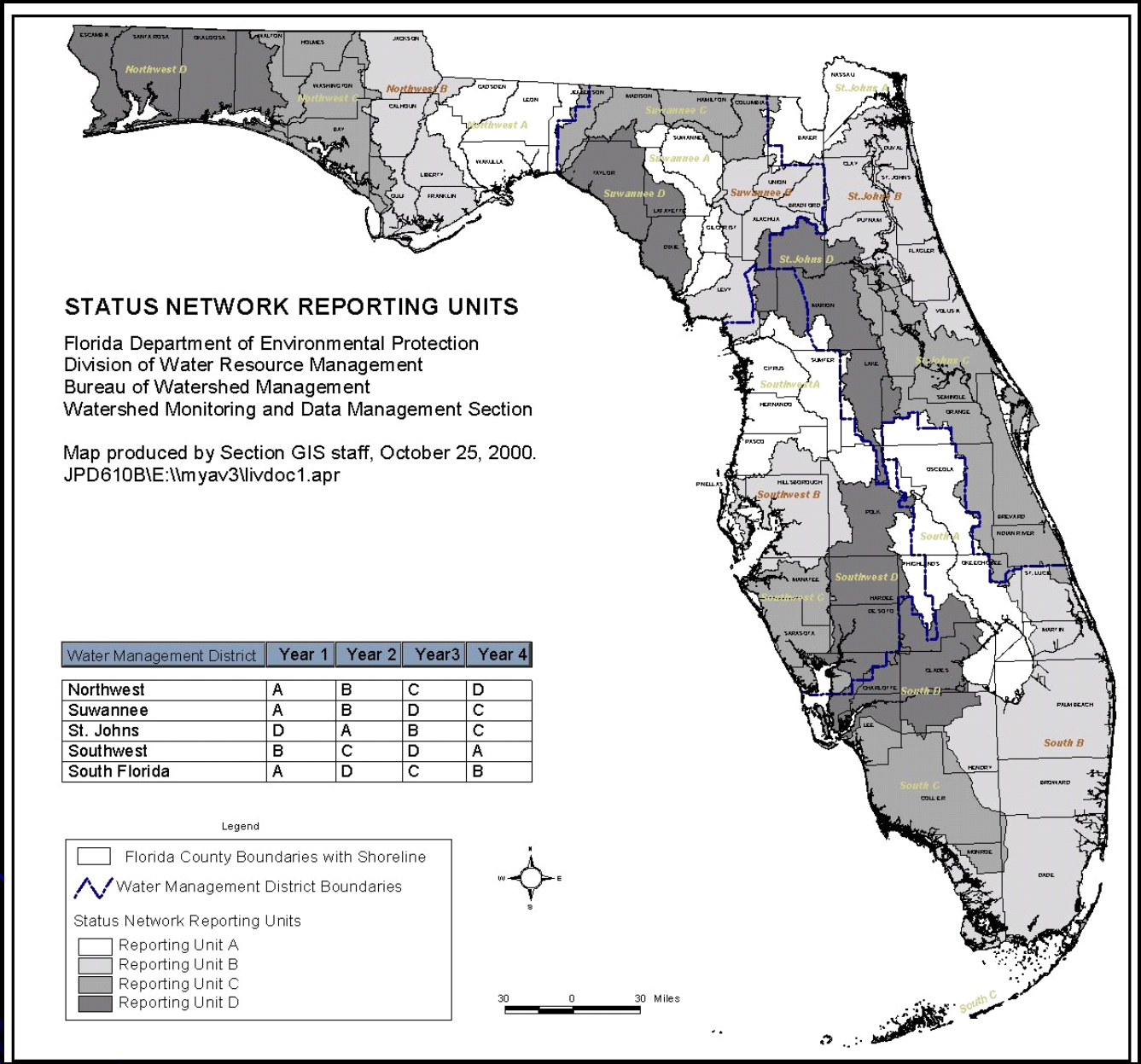
1) Characterize regional and statewide water resource conditions, using a rotating basin, multi-year probabilistic sampling approach;

2) Determine percentage of each resource within each basin which meets standards or designated use (surface & ground water) using core and supplemental indicators.

First Cycle Design:

Stratified Random

- **Five Water Management District basins**
- **Four reporting units per basin with randomly assigned rotation**
- **1 repeat year**
- **30 samples per resource type**
- **Water chemistry**



Water Management District	Year 1	Year 2	Year3	Year 4
Northwest	A	B	C	D
Suwannee	A	B	D	C
St. Johns	D	A	B	C
Southwest	B	C	D	A
South Florida	A	D	C	B

Florida Water Resource Types

Resource	Design Type
Freshwater	
2 Groundwater Aquifers	Point
High / Low order streams	Linear
Small Lakes	Point
Large Lakes	Area
Marine	
Estuaries	Area

Index periods

N = North Florida (NWFWMD, SRWMD), P = Peninsular Florida (Alachua County, SJRWMD, SWFWMD, SFWMD)

Month	Confined Aquifer		Unconfined Aquifer		Streams		Rivers		Small Lakes		Large Lakes	
	N	P	N	P	N	P	N	P	N	P	N	P
Jan	Primary	Primary										
Feb	Primary	Primary										
Mar	Overflow	Overflow							Primary			
Apr				Primary	Primary				Primary			
May				Primary	Primary			Primary	Overflow			
Jun			Primary	Overflow	Overflow			Primary			Primary	
Jul			Primary				Primary	Overflow		Primary	Primary	
Aug			Overflow			Primary	Primary			Primary	Overflow	
Sep						Primary	Overflow			Overflow		
Oct **						Overflow						Primary
Nov												Primary
Dec												Overflow

Primary Index Period

Overflow Index Period

Dashed line indicates proposed Contract Period Start/Finish

Quality Assurance

- All samples analyzed at central laboratory
- Sampling protocols taught for samplers collecting samples. Required to attend course and pass exam, 5 year renewal.
- Q/A Officer oversees training and follows up with field audits of samplers throughout the state.

2002: Changes in Attitudes

- Changes in agency mission toward TMDLs
- Tweaking to realign network. Decided to drop the repeat year and focus on a major overhaul of the Status network.
- Major redesign includes shift from 20 basins to 29 TMDL basins, GIS coverage to 1:100,000 rHND with separate river and steam selections, changed core and supplemental indicators for all resources to better reflect designated use.

EPA: Ten Elements for State Water-Quality Monitoring Programs

- Monitoring Program Strategy
- Monitoring Objectives
- Monitoring Design
- Core & Supplemental Indicators
- Quality Assurance
- Data Management /Review
- Data Analysis /Assessment
- Reporting
- Review of Program
- Support and Infrastructure

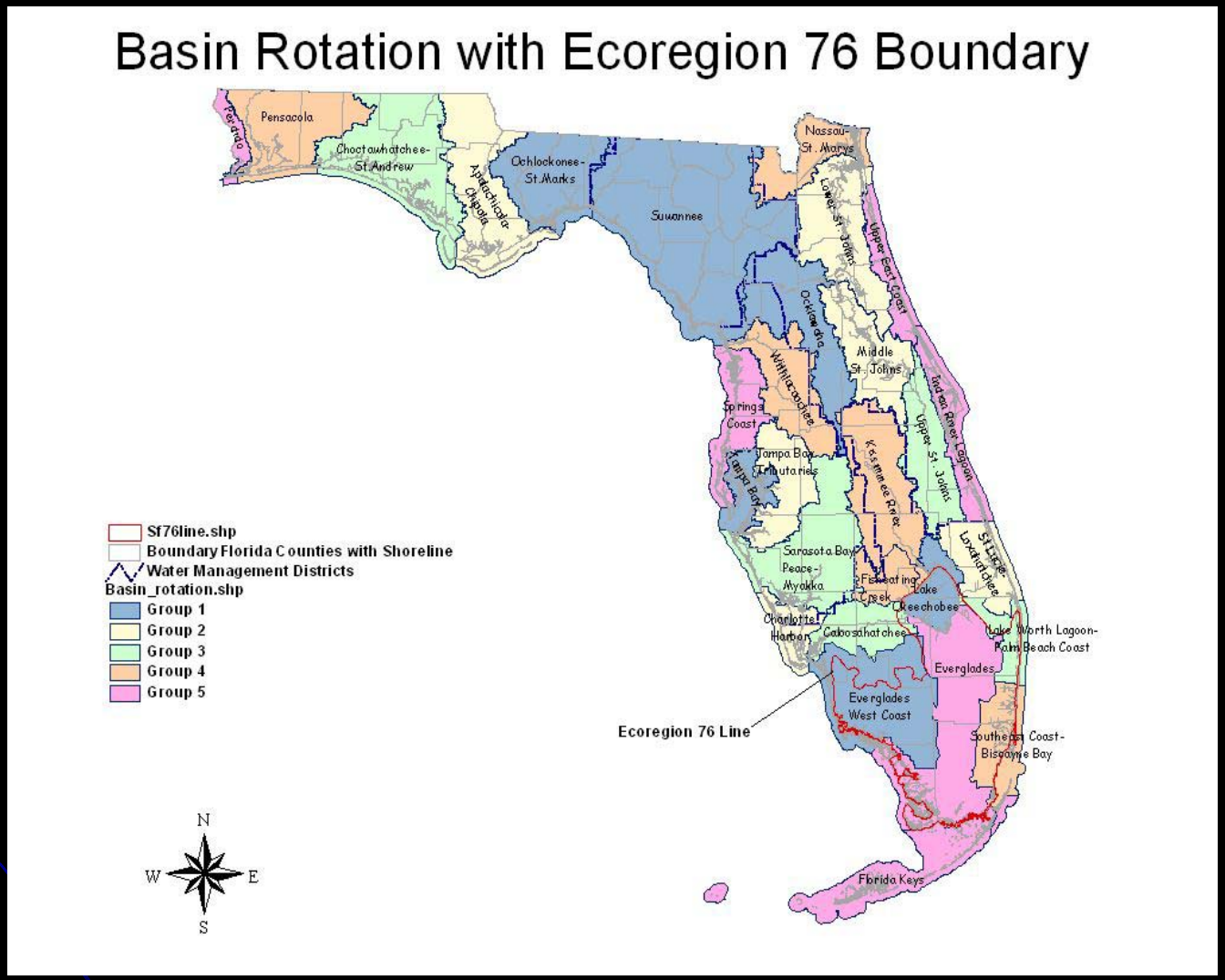
Building on strengths of Cycle 1

- Kept program goals and objectives
- Keeping some indicators to transition between Cycle 1 and 2, adding more integrators such as biology and sediment metrics.
- Adding updated data tracking and reconnaissance procedures

Second Cycle Design:

GRTS

- **29 TMDL Basins**
- **6 resources**
- **30 samples per resource type**



Status Network: Cycle 2

New Cycle 2004-2008 Design Changes:

- Generalized Random Tessellation Stratified (GRTS) Design for all resource types
  - Site selection for rivers, streams and large and small lakes generated for all 5 years, in communication with WMDs, DEP and EPA Corvallis.
- Groundwater sites generated by EPA on an annual basis. Well selections are updated in the listframe.

Lakes: Redefined Population

Limit population to systems where Water Quality Standards apply. Develop well defined exclusion criteria.

- Small lakes (1-9.9 hectares).

  Does not include lakes that are not considered waters of the state.

- Large lakes(> 10 hectares).

  Natural lakes and large impoundments

Rivers and Streams Cycle 2

- Selection of sites is based on 1:100,000 RNHD.

- Selected distinct river and stream resource types using a major rivers coverage. Allows adequate representation of river resource, as stream miles far exceed river miles.

Rivers and Streams Cycle 2

- “Head of Salt” (HOS) line developed using salt-tolerant and intolerant vegetation patterns from National Wetlands Inventory. Isolated fresh water lakes seaward of the HOS line will be included in the list frame.
- This line will remain fixed - will use exclusion criteria to better delineate the population of interest. Allows determination of changes from draught or sea level rise.

Status Network: Cycle 2
Core and Supplemental Indicators: Surface Water

Rivers and Streams:

•Stream Condition Index

Large and Small Lakes:

•Sediments

Bacti's:

- Enterococci
- Fecal Coliform

Small lakes:

•Phytoplankton community

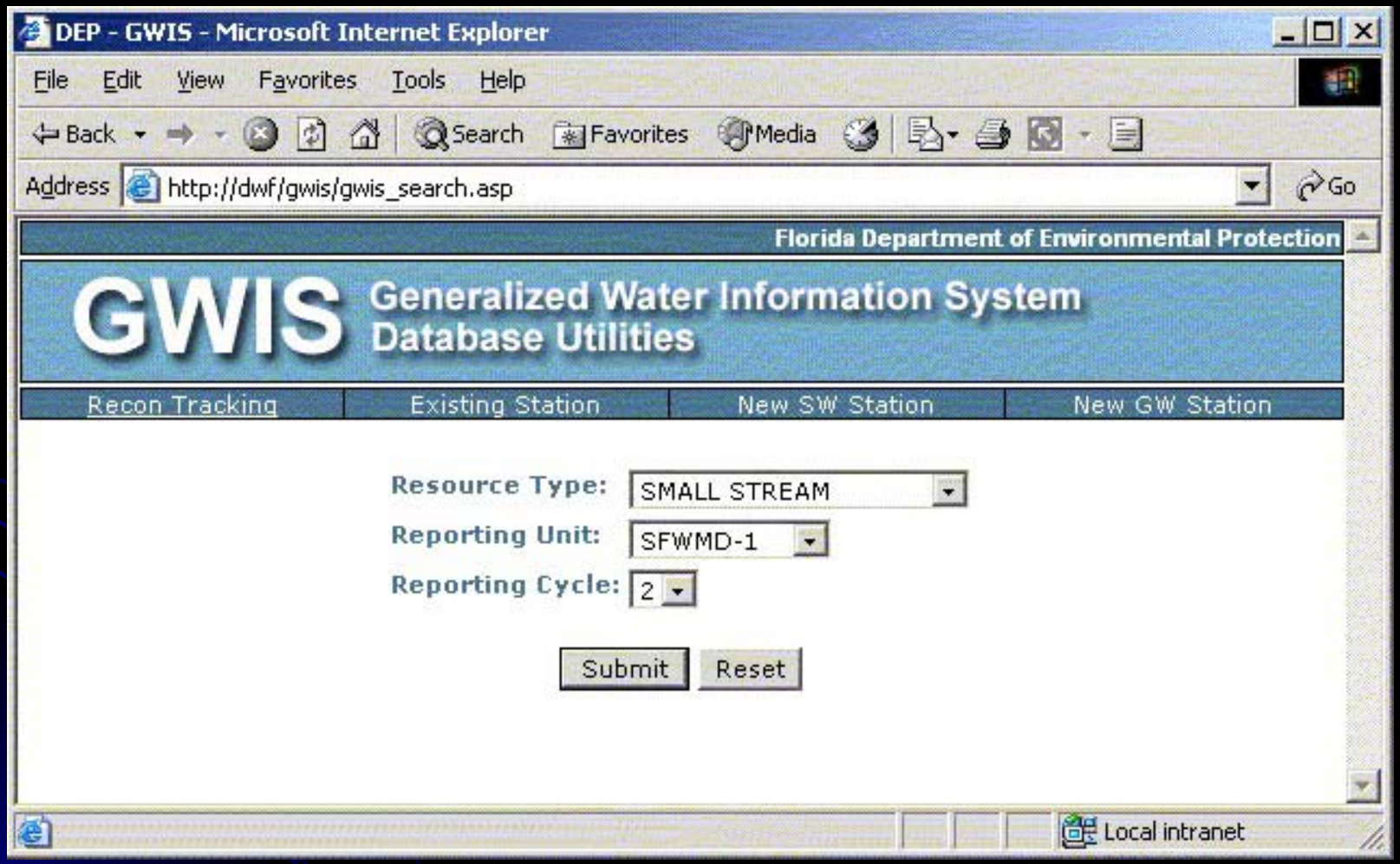
• Trophic state index

• Macrophyte community

Are Alligators an Exclusion?

Characterizing and tracking excluded sites has been the most challenging part of data analysis. We developed an in-house reconnaissance tracking tool to alleviate the problems of tracking paper field sheets.

Data Tracking: Database Utility



Recon Tracking- Database Utility

DEP - GWIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites History

Address http://thdwfd/GWIS/gwis_search_results.asp Go

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GWIS Generalized Water Information System
Database Utilities

Recon Tracking | Existing Station | New SW Station | New GW Station

RESOURCE TYPE = SMALL STREAM; REPORTING UNIT = SFWMD-1; REPORTING CYCLE = 2;

Show Map(Random Sample Location) | Generate Export File | Show Map(Station ID)

RANDOM SAMPLE LOCATION	RANDOM LATITUDE	RANDOM LONGITUDE	SAMPLEABLE	STATION ID
SF1-SS-2001	26° 11m 14.2553s	81° 30m 11.7139s	N/A	
SF1-SS-2002	26° 33m 30.5244s	81° 00m 52.2622s	N/A	
SF1-SS-2003	25° 45m 38.8907s	80° 55m 12.7591s	N/A	
SF1-SS-2004	26° 18m 58.8497s	81° 16m 44.9895s	N/A	
SF1-SS-2005	26° 22m 15.0093s	81° 44m 44.5177s	N/A	
SF1-SS-2006	26° 28m 37.5368s	80° 58m 16.0814s	N/A	
SF1-SS-2007	26° 22m 59.9801s	81° 26m 40.2147s	N/A	
SF1-SS-2008	26° 21m 38.3061s	80° 54m 31.9978s	N/A	
SF1-SS-2009	26° 40m 27.792s	81° 04m 30.4416s	N/A	
SF1-SS-2010	26° 25m 39.8031s	81° 37m 34.9681s	N/A	
SF1-SS-2011	26° 04m 12.4935s	81° 36m 45.3079s	N/A	
SF1-SS-2012	26° 28m 41.8531s	81° 33m 50.3107s	N/A	
SF1-SS-2013	26° 24m 56.4282s	81° 01m 23.0564s	N/A	
SF1-SS-2014	26° 27m 13.1062s	81° 07m 26.3344s	N/A	

Done Local intranet

Recon Tracking Database Utility

DEP - GWIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://dwf/gwis/sw_sampleable_update.asp?pk_random_sample_location=SF1-SS-2001&resource_type=SMALL+STREAM&re Go

Florida Department of Environmental Protection

GWIS Generalized Water Information System
Database Utilities

Recon Tracking | Existing Station | New SW Station | New GW Station

PK RANDOM SAMPLE LOCATION = SF1-SS-2001

County	HENDRY
WMD	SOUTH FLORIDA WMD
Quarter Quad	q2109ne
HUC	SOUTHEAST FLORIDA COAST
Random Latitude	26° 35m 50.4895s
Random Longitude	81° 02m 42.4571s

Is SF1-SS-2001 sampleable? ○ Yes ○ No ◉ N/A

Exclusion Category:

Exclusion Criteria:(definitions):

Was SF1-SS-2001 sampled? ○ Yes ◉ No Month 11 Day 7 Year 2003

Comments:

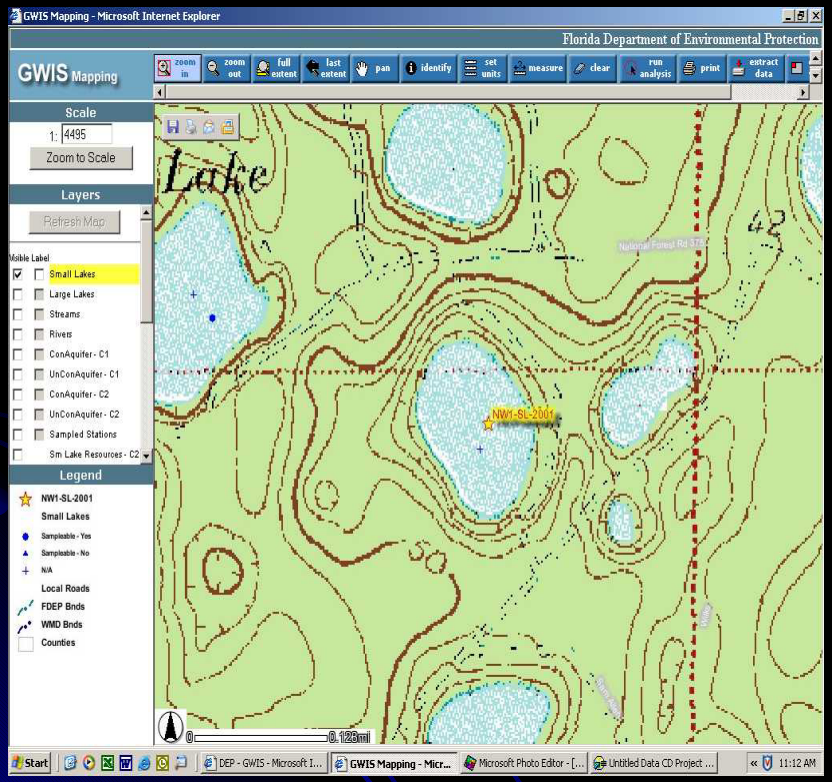
Save Reset

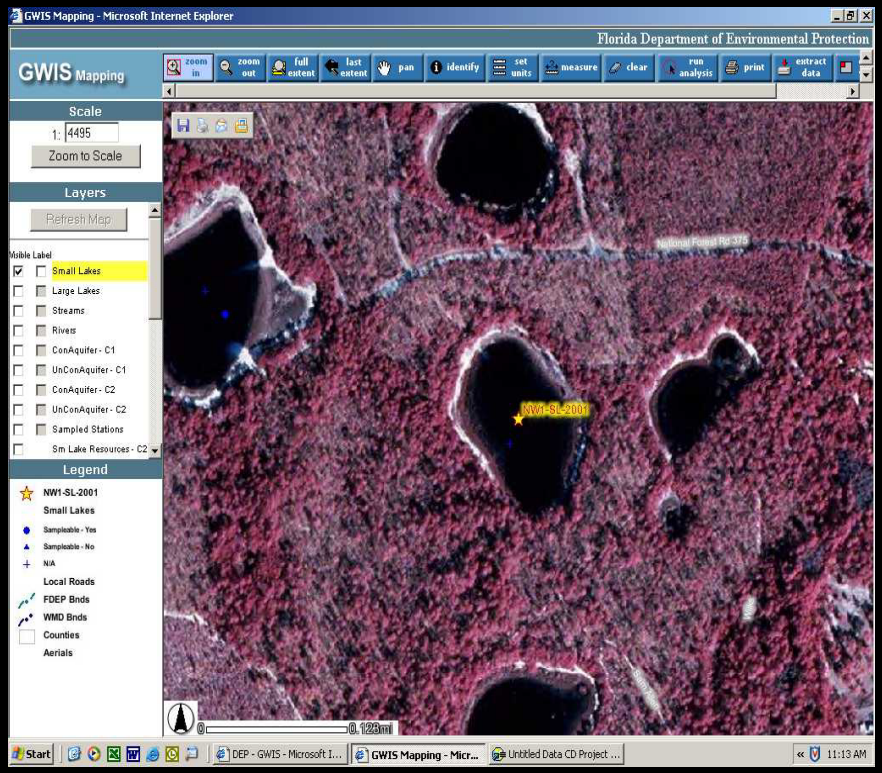
◉ Aerial Photo ○ Quad Map ○ No Image

Show Map

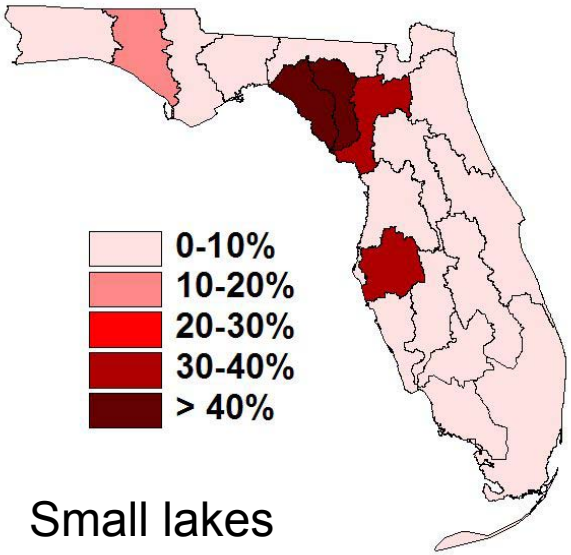
Local intranet

Database Utility: ArcIMS tools

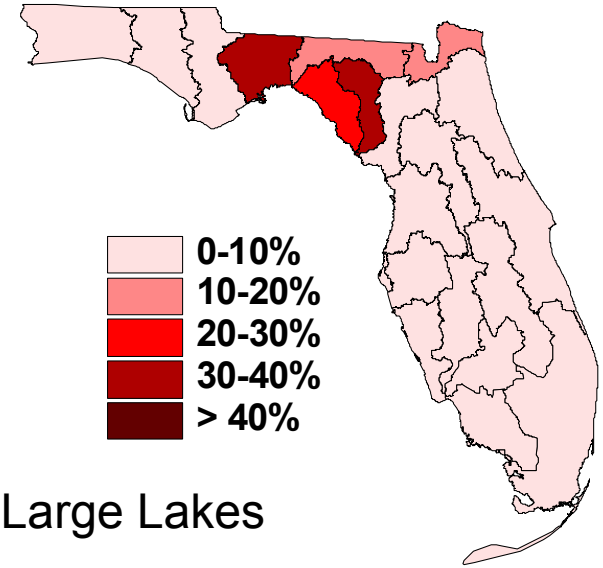




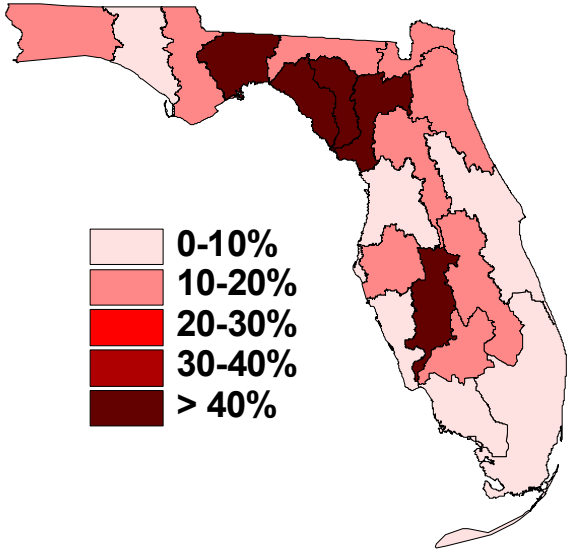
Dry Sites



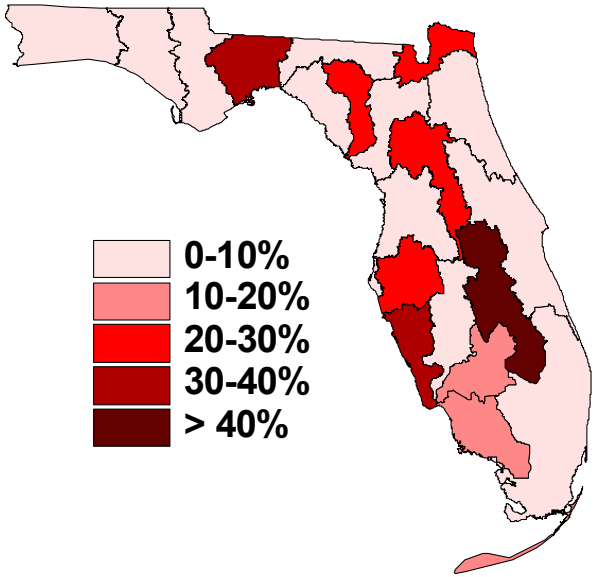
Small lakes



Large Lakes

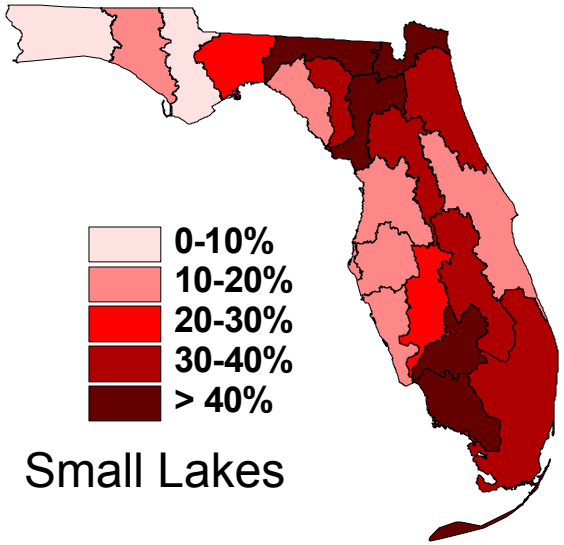


Streams

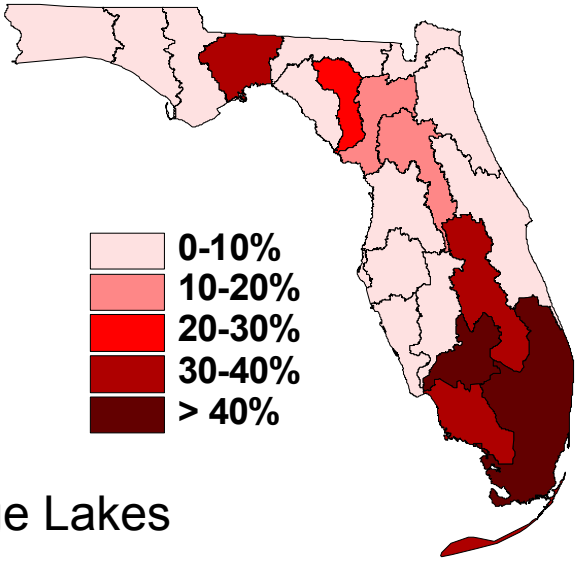


Rivers

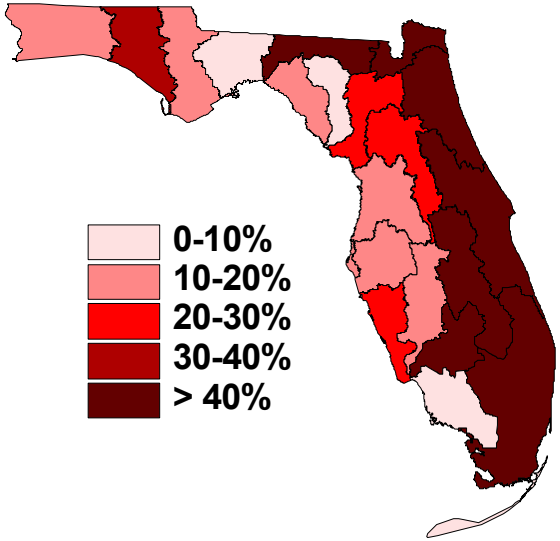
Inaccessible Sites



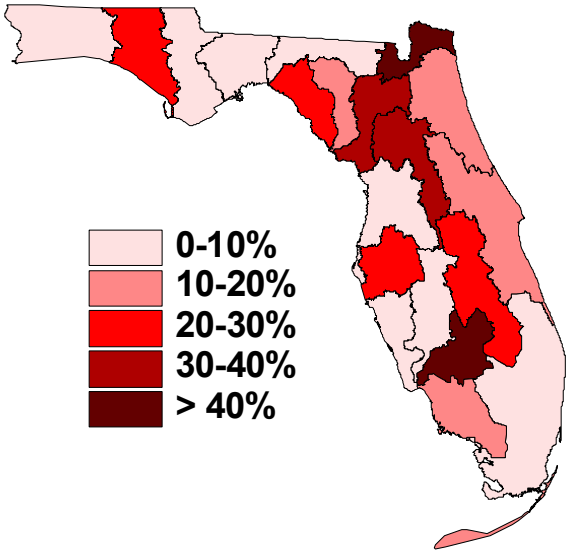
Small Lakes



Large Lakes

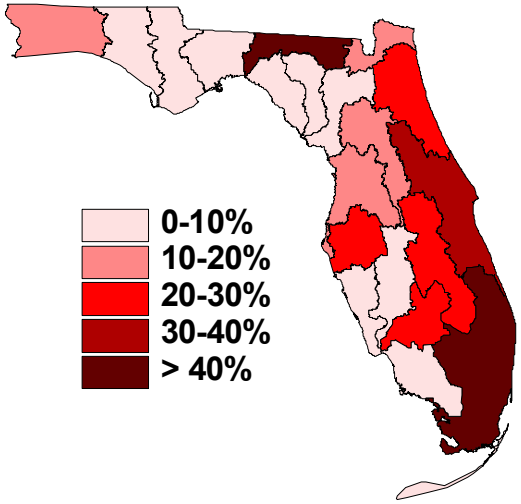


Small Streams

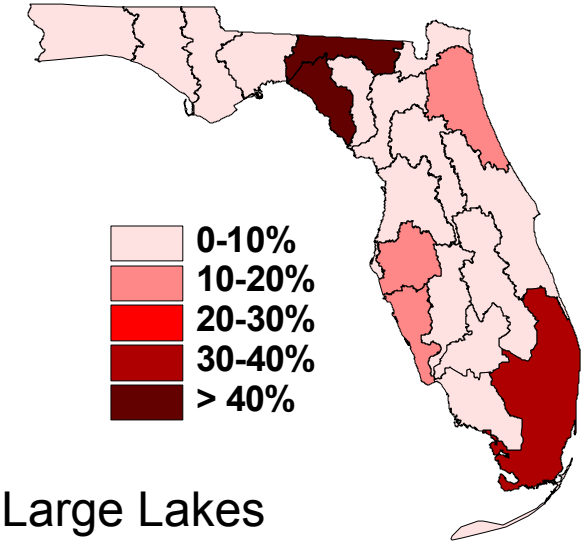


Large Rivers

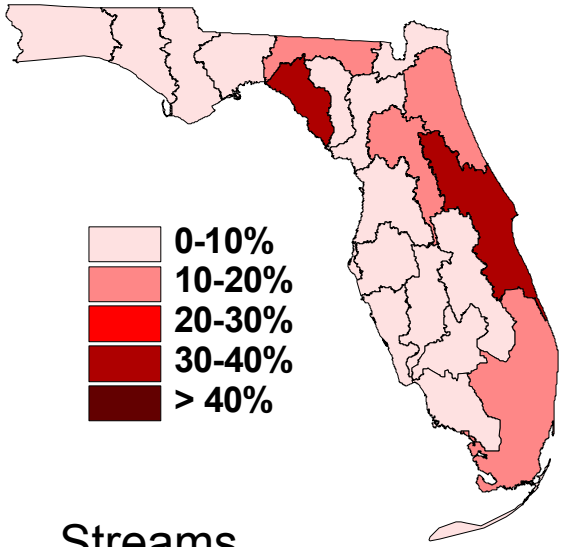
Incorrect Resource



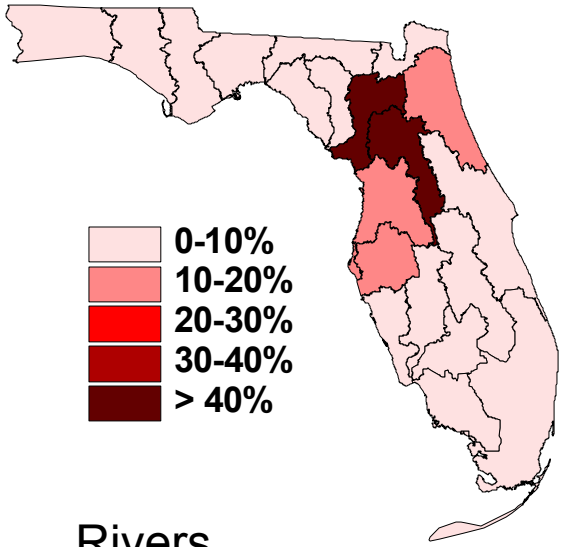
Small Lakes



Large Lakes

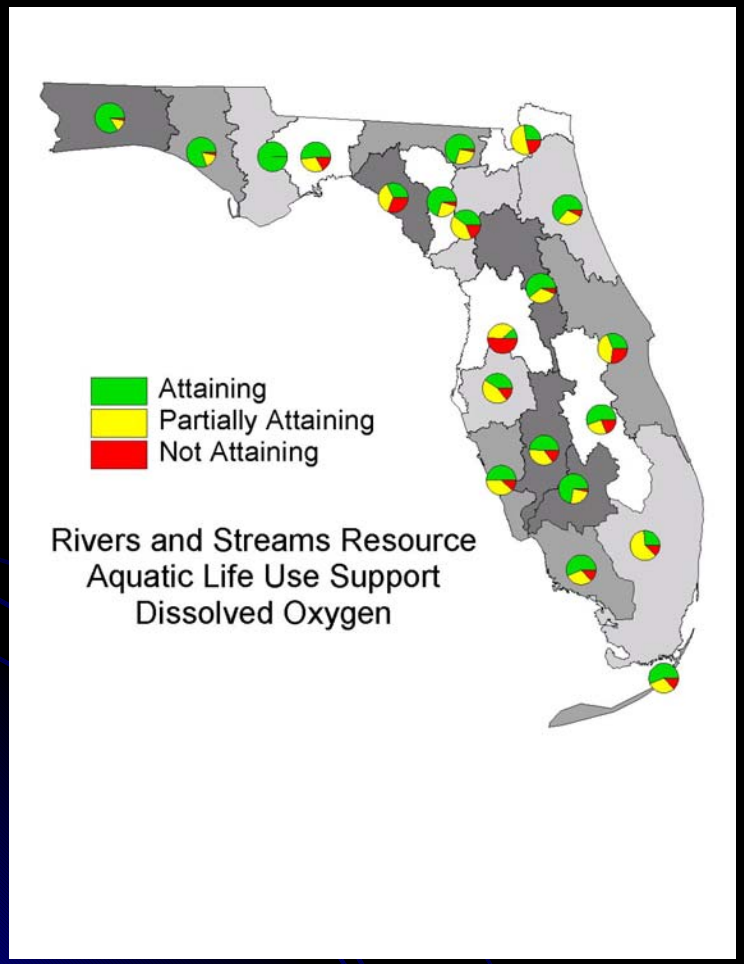


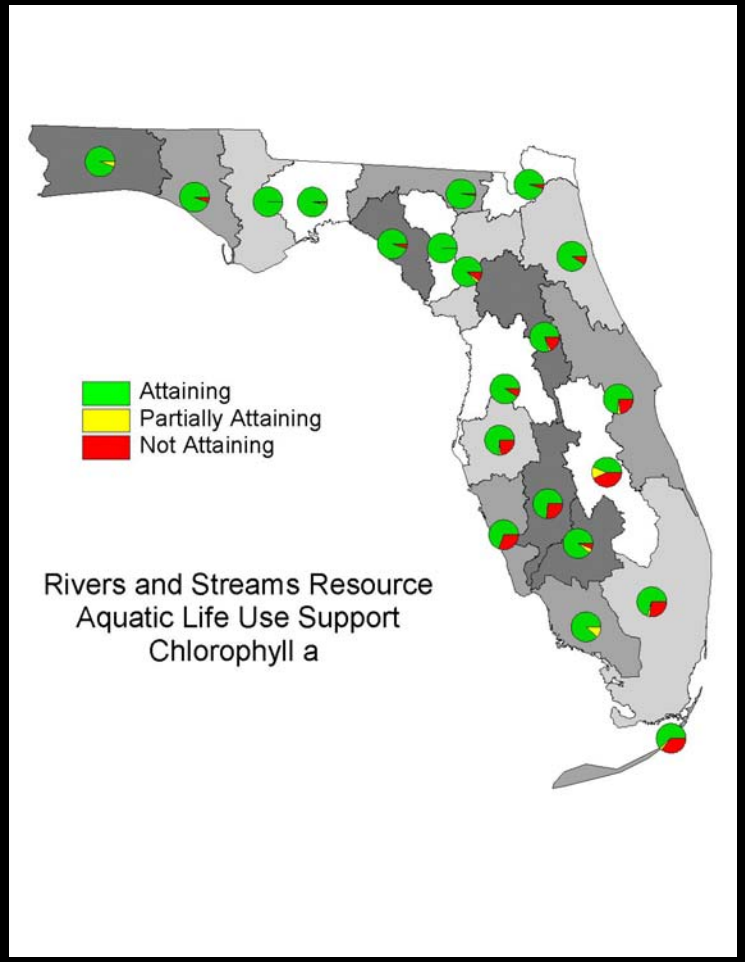
Streams



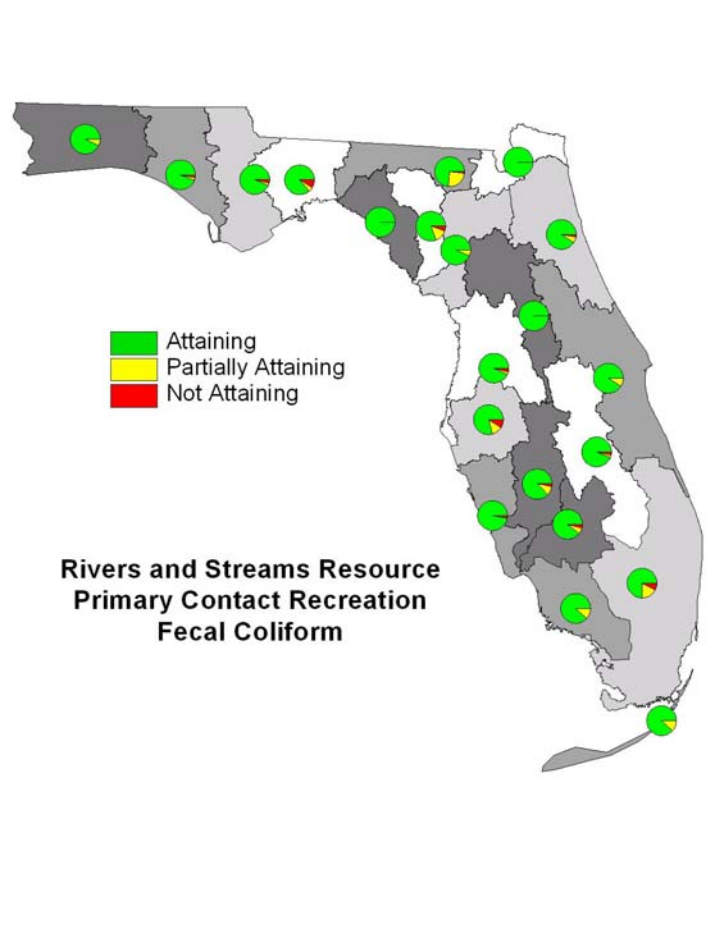
Rivers

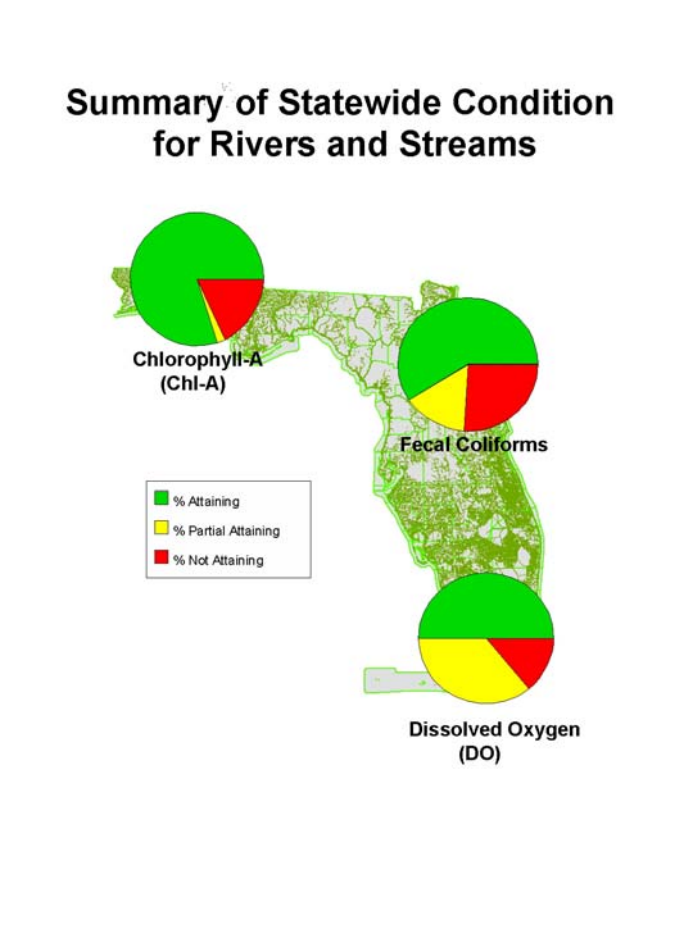
River and Streams Results Cycle 1





River and Streams Results Cycle 1

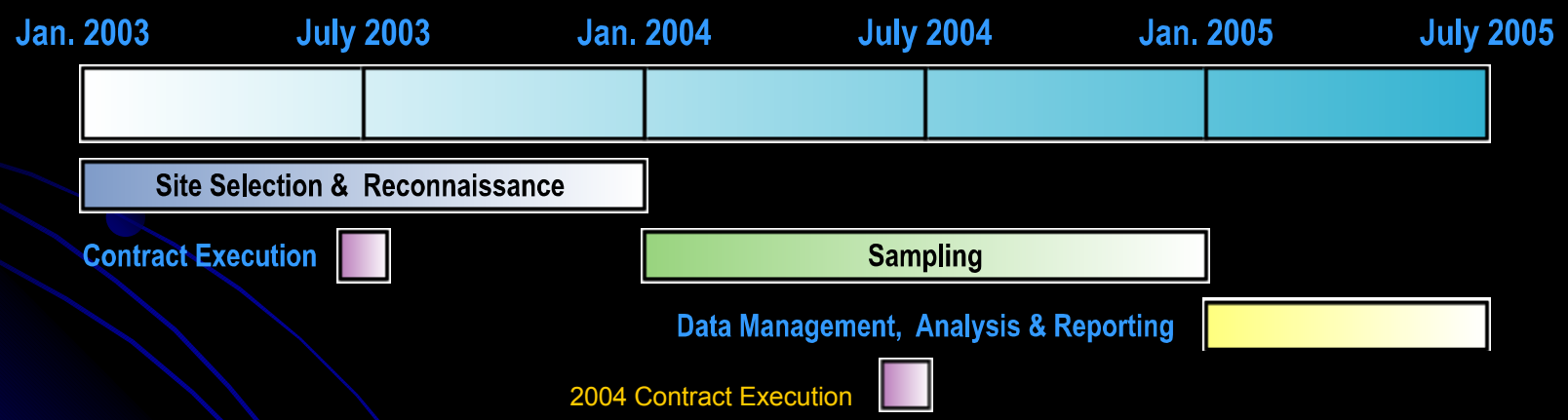




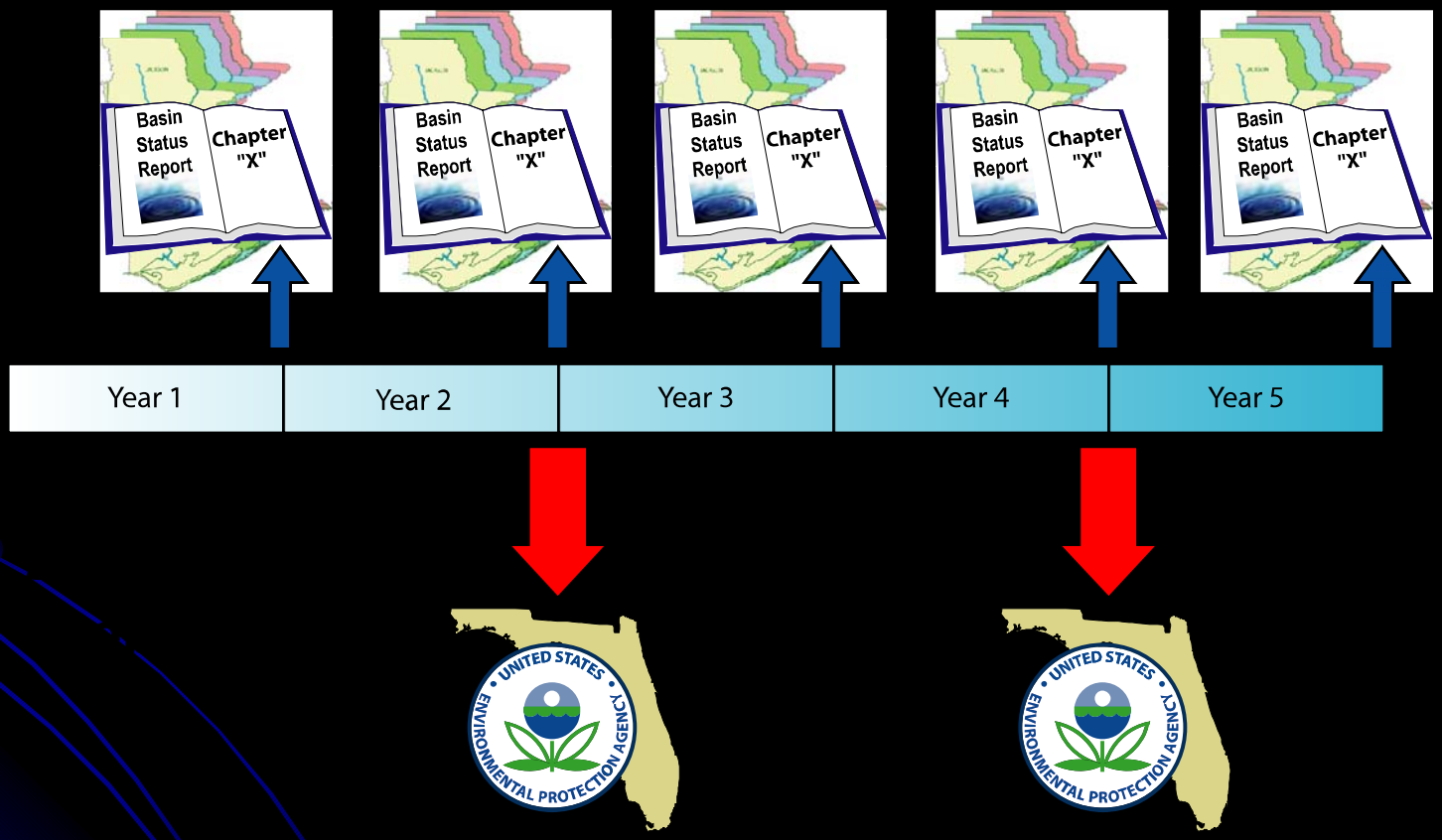
Status Monitoring Activities for a Basin Group

Cycle 2 basin rotation begins for Status Network

Cycle 2 Basin Rotation Program: Phase1 Group 1 Begins



Reports from Status Monitoring For a Rotating Basin Cycle



Status Monitoring Ongoing Projects

- Cycle one data being evaluated for state Nutrient criteria development.
- Initiating an index period comparison for surface waters
- Provide secondary evaluation: erosion of stream banks, areas where streams and rivers have habitat impairment, areas of state with high background levels of iron when considered a TMDL problem.
- Focus areas where there are overreaching issues, look for consensus using different resource types.

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