Florida's Status Monitoring Network:

Overview of Seven Years of Lake Sampling

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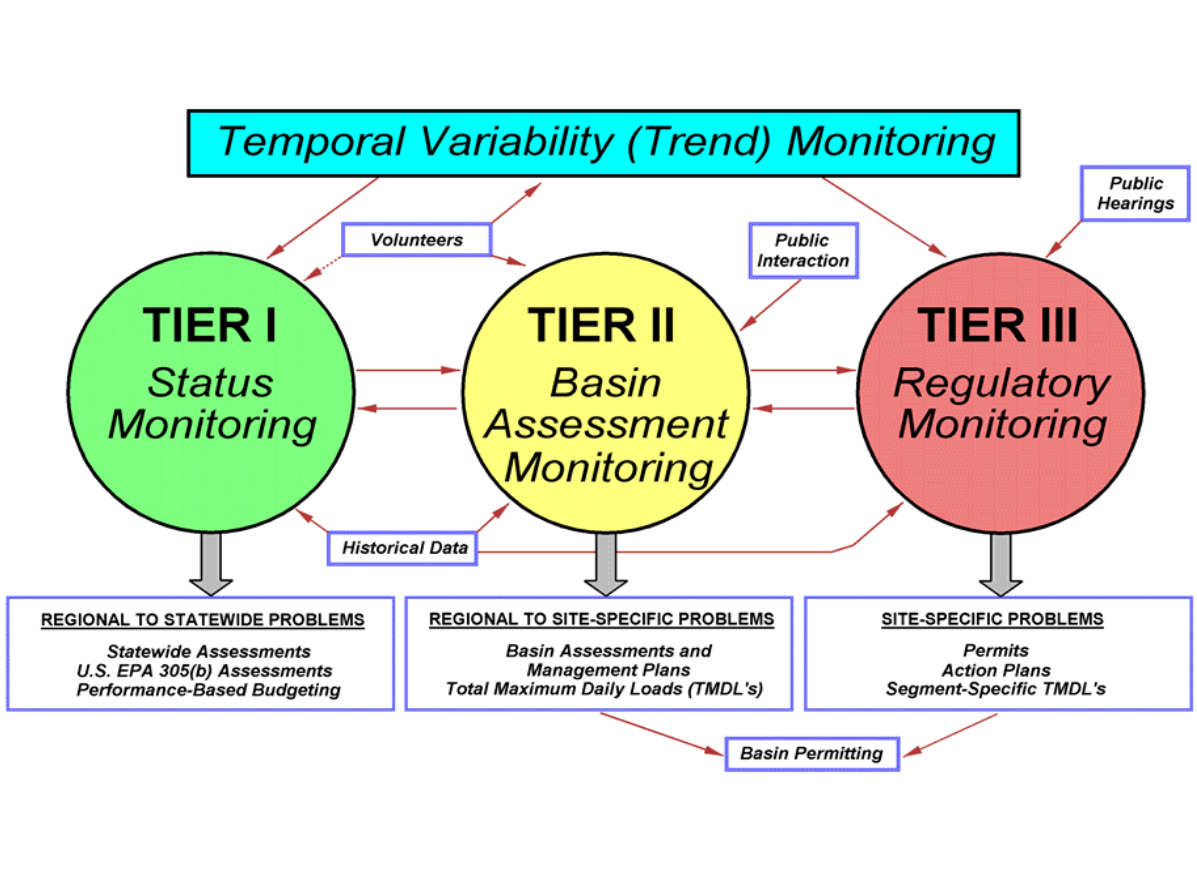
Florida DEP Monitoring History

- Prior to the mid 1990's only 20-25% of state waters assessed for EPA's 305(b) report. Section 305(b) of the Clean Water Act requires states to assess the quality of ***all*** waters in biennial reports to EPA, ergo litigation.
- DEP was tasked with establishing a statewide status and trend monitoring network for both surface and ground water.
- Steering group: EPA, state and other government agencies to establish design.

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

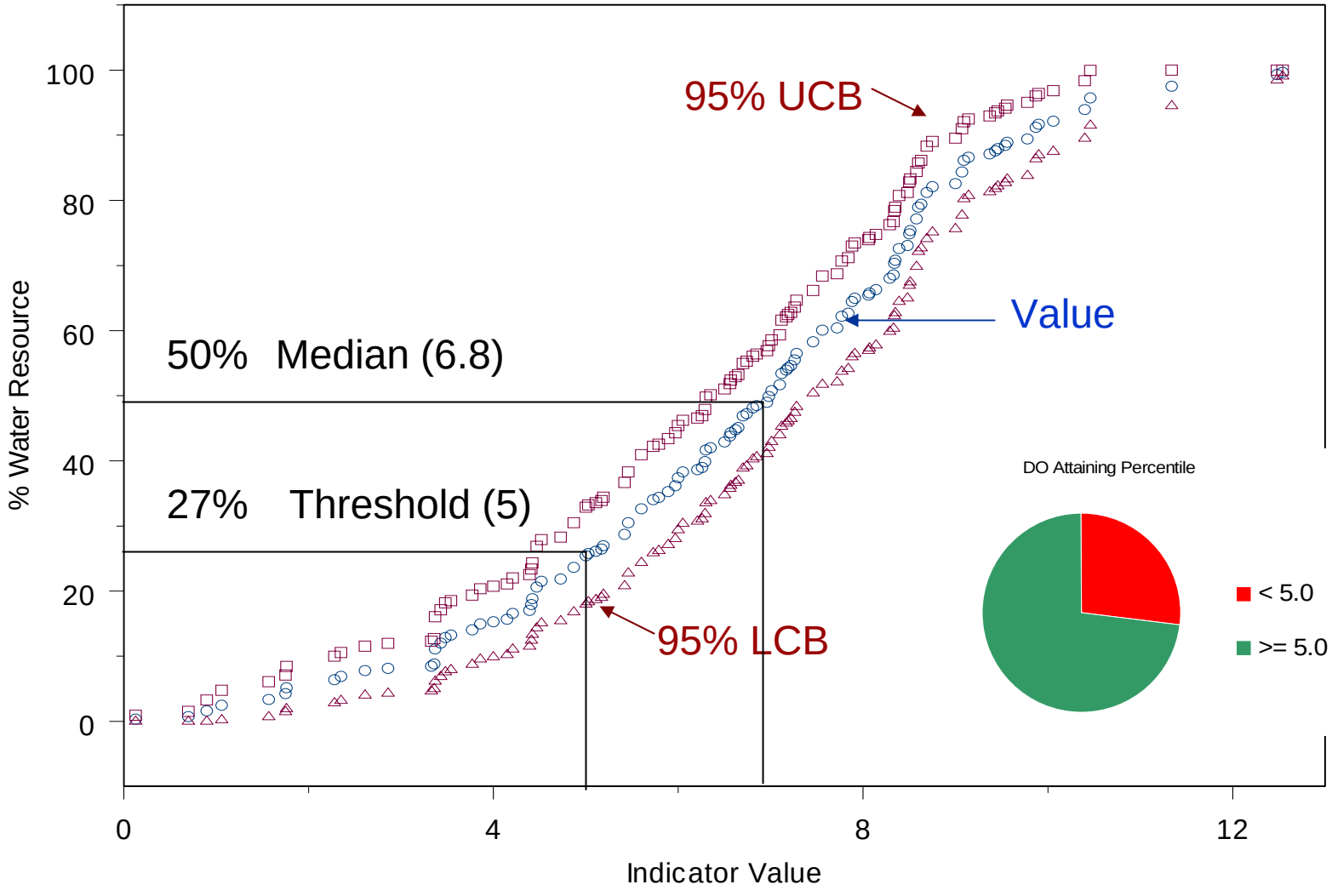
Integrated Water Resource Monitoring Design



STATUS NETWORK OBJECTIVES

- Characterize regional and statewide water resource conditions, using a rotating basin, multi-year probabilistic sampling approach.
- Determine percentage of each resource within each basin which meets standards or designated use (surface & ground water) with known confidence using core and supplemental indicators.

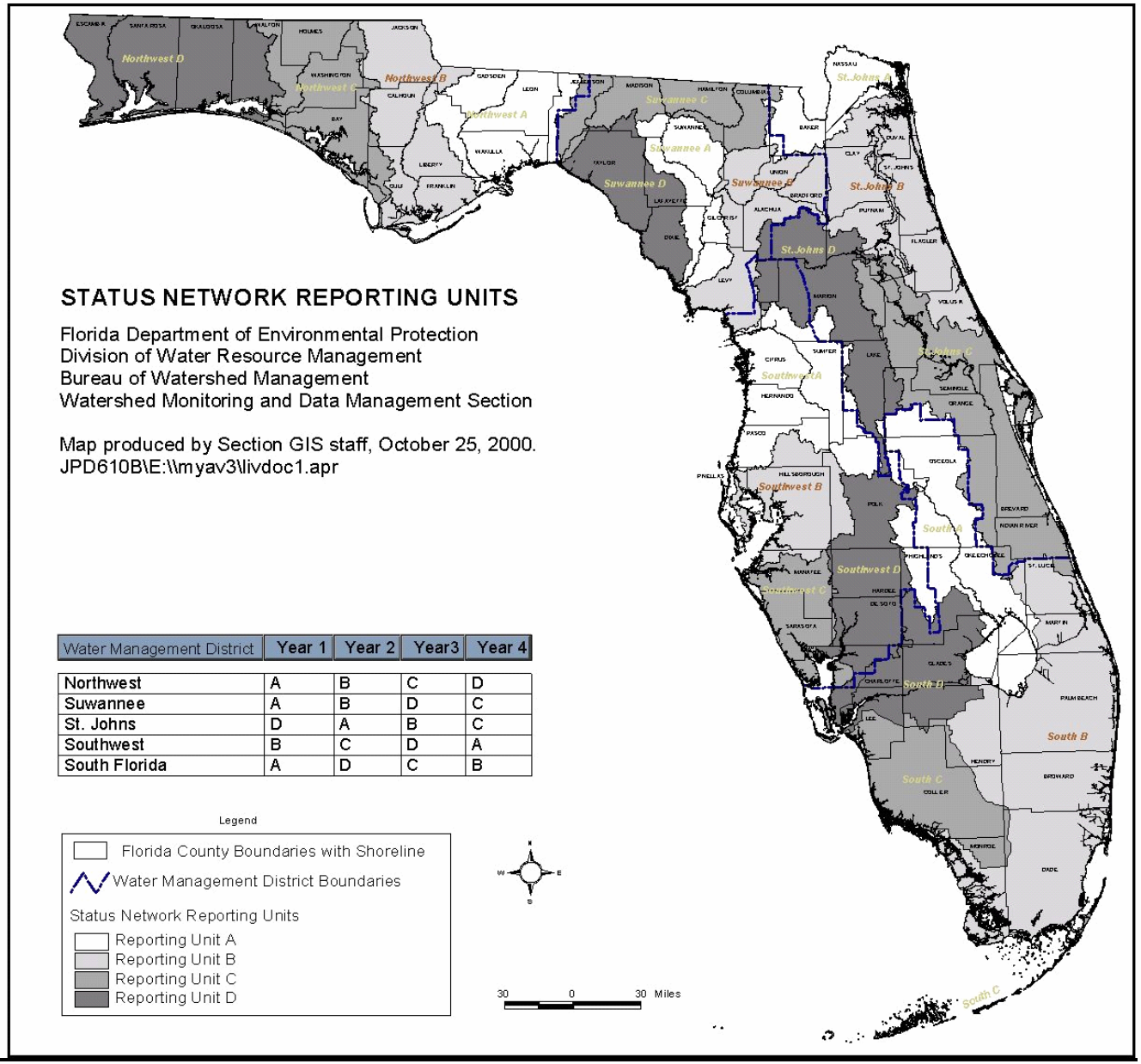
Cumulative Distribution Function



Cycle 1 design:

Stratified Random

- Five Water Management District basins
- Four reporting units per basin with randomly assigned rotation.
- 5 Water Resources



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

Stochastic Processes!

- Internal reorganization resulting in higher priority of TMDL sampling.
- Loss of Water Management District participation in the program.
- Peculiarities of Florida's GIS coverages forced collapsing of high and low-order streams together, since they could not be accurately segregated.
- Natural disasters including severe drought and major hurricanes.

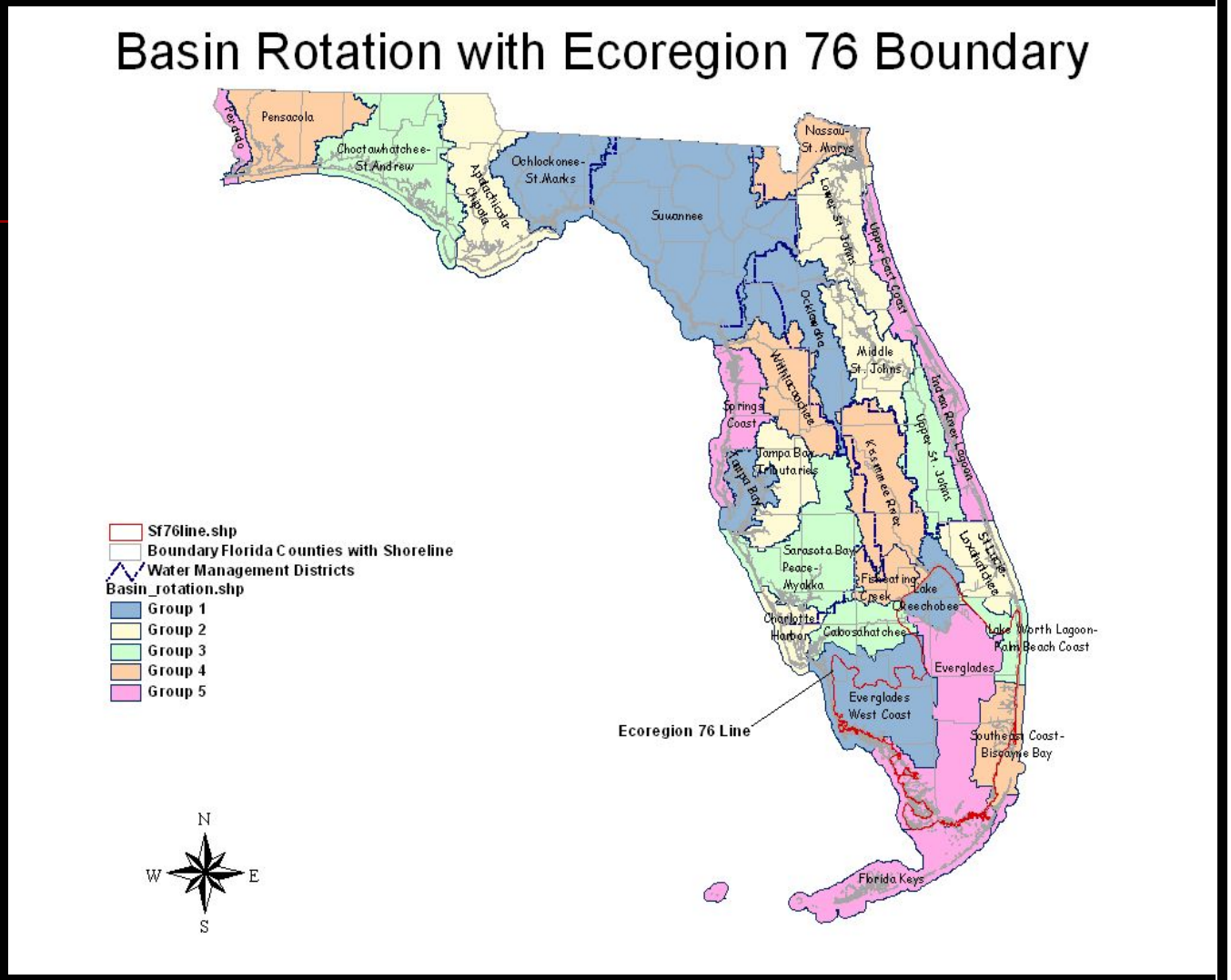
Transition from Cycle 1 to Cycle 2

- Kept program goals and objectives
- Geography strata change
- Kept some indicators, added more integrators such as biology and sediment metrics.
- Added an extra month to our Index periods.
- Updated data tracking and reconnaissance procedures

Cycle 2 Design:

Generalized Random Tessellation Stratified

- 29 TMDL Basins
- 5 basin groups, one sampled each year
- 6 water resources



Cycle 2 Water Resources (Target Populations)

- Confined Aquifers – Point
- Unconfined Aquifers – Point
- Small Streams – Linear
- Large Rivers – Linear
- Small Lakes – Point
- Large Lakes - 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												
Feb												
Mar												
Apr												
May												
Jun												
Jul												
Aug												
Sep												
Oct **												
Nov												
Dec												

Primary Index Period

Overflow Index Period

Dashed line indicates proposed Contract Period Start/Finish

Status Lakes

- Small lakes (1 to <10 hectares).
- Large lakes(10 hectares and above). Natural lakes and large impoundments.
- Limit population to systems where water quality standards apply (waters of the state).
- Develop well defined exclusion criteria.

Lakes Indicators

- Large and Small Lakes:
  - Field measurements, basic water quality, trophic state index, and sediment analyses.
- Small Lakes:
  - Phytoplankton community, Macrophyte community (Lake Vegetative Index in development).

Types of Florida Lakes

http://aquat1.ifas.ufl.edu/guide/lakes.html

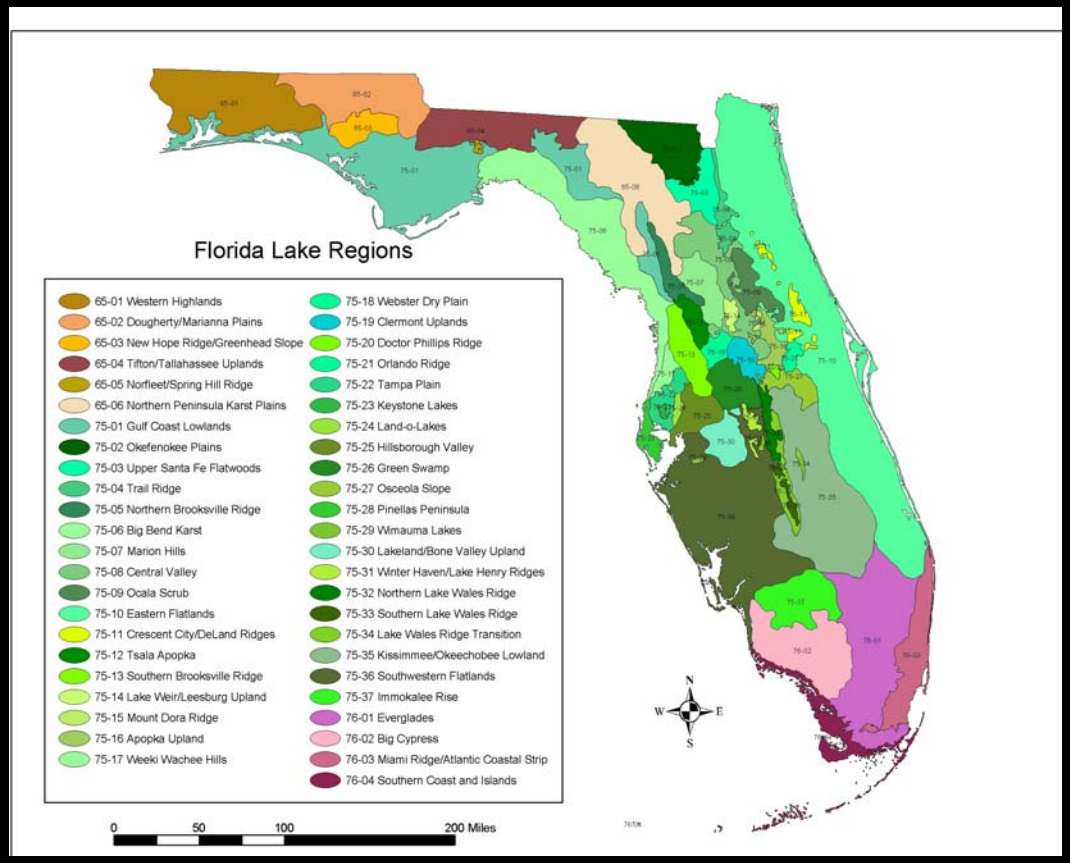
- Solution (sinkhole) lakes
- Depressions in ancient seabed
- River lakes
- Coastal dune lakes
- Artificial lakes

Lake Hydrology

- Seepage lakes:
  - 70% of Florida's lakes (originally)
  - Closed basins, no surface water outflow
  - Lose and gain water through groundwater exchange

- Drainage lakes:
  - Open basins
  - Affected by rainfall and runoff
  - Lose water to rivers and wetlands

Florida Lake Regions
(Griffith, Canfield, Omernik 1994)



Lake Site Selection Process

- Identify small and large lakes in a GIS Coverage (1:100,000 rNHD), as well as the lat/long for each small lake's epicenter.
- Associate all lakes within a reporting unit.
- Hand over coverage to Tony Olsen. He selects 30 random locations for each basin, and then repeats process 5 more times to yield 180 random locations per basin via GRTS methodology.

Sampling Process

- Reconnoiter first site. If site falls into one of the ‘exclusion categories’, exclude site and move on to next site in the site list.
- Continue procedure until 30 sites are sampled or the random selections of the resource are exhausted.

Site Exclusion Categories

- Wrong resource/not part of target population
- Dry
- Unable to access
- No permission from owner
- Otherwise unsampleable

SW EXCLUSION CATEGORY	SW EXCLUSION CRITERIA
DENIED ACCESS	ACCESS DENIED BY PROPERTY OWNER
DRY	DRY DURING INDEX PERIOD
DRY	NO FLOWING WATER AT STREAM/RIVER RANDOM LOCATION FOR TWO MONTHS
OTHERWISE UNSAMPLEABLE	FLOOD CONDITIONS DURING INDEX PERIOD AT STREAM/RIVER RANDOM LOCATION, FOR SCI ONLY
OTHERWISE UNSAMPLEABLE	UNSAFE SAMPLING CONDITIONS
OTHERWISE UNSAMPLEABLE	STREAM/RIVER RANDOM LOCATION LESS THAN 10 CM DEEP
UNABLE TO OBTAIN ACCESS	UNABLE TO REACH RANDOM LOCATION WITHIN THREE HOURS FROM ACCESS POINT
UNABLE TO OBTAIN ACCESS	UNABLE TO OBTAIN PERMISSION FROM OWNER
UNABLE TO OBTAIN ACCESS	UNABLE TO GET EQUIPMENT TO RANDOM LOCATION
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ARTIFICIALLY CREATED LAKE OTHER THAN ESTABLISHED IMPOUNDMENTS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	PERMITTED STORMWATER TREATMENT AREAS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WETLANDS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ROADSIDE BARROW PIT
WRONG RESOURCE/NOT PART OF TARGET POPULATION	CURRENT OR HISTORIC MINING OPERATION
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ARTIFICIAL LAKE, LAGOON, OR POND USED FOR AGRICULTIURAL OPERATIONS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ARTIFICIAL LAKE, LAGOON, OR POND USED FOR AQUACULTURE OPERATIONS
WRONG RESOURCE/NOT PART OF TARGET POPULATION	LAKE DOES NOT MEET EMAP LAKE DEFINITION (SMALL LAKE LESS THAN ONE HECTARE IN AREA)
WRONG RESOURCE/NOT PART OF TARGET POPULATION	LAKE DOES NOT MEET EMAP LAKE DEFINITION (SMALL OR LARGE LAKE LESS THAN ONE METER DEEP)
WRONG RESOURCE/NOT PART OF TARGET POPULATION	LAKE DOES NOT MEET EMAP LAKE DEFINITION (SMALL OR LARGE LAKE LESS THAN .1 HECTARE OPEN WATER)
WRONG RESOURCE/NOT PART OF TARGET POPULATION	GIS COVERAGE INCORRECT, WATERBODY NOT PRESENT AT RANDOM LOCATION
WRONG RESOURCE/NOT PART OF TARGET POPULATION	WATERBODY WITHIN FDEP PREMITTED FACILITY BOUNDARY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	RANDOM LOCATION LIES AT OUTFALL OF FDEP PERMITTED FACILITY (SITE LIES AT THE OUTFALL POINT OF EFFLUENT ENTERING STATE WATERS (IN MIXING ZONE OK).
WRONG RESOURCE/NOT PART OF TARGET POPULATION	RANDOM LOCATION FALLS OUTSIDE BASIN BOUNDARY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	ESTUARY
WRONG RESOURCE/NOT PART OF TARGET POPULATION	CHANGING RESOURCE TYPE (INCLUDING RESTORATION AREAS) (RESOURCE TYPE WILL DEFINITELY CHANGE PRIOR TO SCHEDULED SAMPLING. EXAMPLE: IMPOUNDMENT OF A FORMER RIVER TO FORM A LAKE.)

Wrong Resource

Otherwise unsampleable!

Dry

Data Management

- Oracle Database which is interfaced with a web application.
- Web application interacts with an ArcIMS server allowing sites to be reconnoitered in-house via Digital Ortho Quad Maps.

DEP - GWIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://dwf/GWIS/gwis_search_results.asp Go Links

Florida Department of Environmental Protection

GWIS Generalized Water Information System Database Utilities

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

RESOURCE TYPE = SMALL LAKE; REPORTING UNIT = SRWMD-A; REPORTING CYCLE = 1;

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

RANDOM SAMPLE LOCATION	RANDOM LATITUDE	RANDOM LONGITUDE	SAMPLEABLE	STATION ID
SRA-SL-1001	29° 45m 56s	83° 00m 36s	NO	
SRA-SL-1002	29° 59m 13s	83° 02m 27s	YES	6921
SRA-SL-1003	29° 34m 27s	83° 00m 44s	NO	
SRA-SL-1004	29° 26m 58s	82° 48m 12s	NO	
SRA-SL-1005	29° 46m 22s	83° 00m 20s	NO	
SRA-SL-1006	30° 07m 53s	82° 49m 35s	YES	7416
SRA-SL-1007	29° 50m 38s	82° 54m 55s	NO	
SRA-SL-1008	29° 45m 44s	82° 56m 10s	NO	
SRA-SL-1009	30° 12m 39s	82° 50m 04s	YES	7123
SRA-SL-1010	29° 35m 19s	82° 56m 34s	NO	
SRA-SL-1011	29° 44m 47s	83° 00m 30s	NO	
SRA-SL-1012	29° 44m 57s	82° 50m 00s	NO	
SRA-SL-1013	29° 32m 18s	83° 00m 26s	NO	
SRA-SL-1014	30° 21m 30s	82° 59m 54s	YES	7417
SRA-SL-1015	30° 06m 44s	82° 51m 18s	NO	
SRA-SL-1016	29° 42m 57s	82° 58m 51s	NO	
SRA-SL-1017	30° 12m 24s	83° 20m 26s	NO	
SRA-SL-1018	30° 20m 11s	83° 20m 53s	NO	
SRA-SL-1019	30° 21m 52s	83° 21m 52s	NO	
SRA-SL-1020	30° 22m 27s	83° 04m 30s	NO	
SRA-SL-1021	29° 49m 31s	82° 59m 46s	NO	
SRA-SL-1022	29° 41m 00s	83° 01m 49s	NO	
SRA-SL-1023	29° 32m 40s	83° 01m 06s	NO	
SRA-SL-1024	29° 39m 44s	83° 04m 04s	NO	

Done Local intranet

DEP - GWIS - Microsoft Internet Explorer

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Back Search Favorites

Address http://dwf/GWIS/sw_sampleable_update.asp?pk_random_sample_location=SRA-SL-1003&resource_type=SMALL+LAKE&reporting_unit=SRWMD%2DA&reporting_cycle=1&sfilter=RESOURCE+TYP Go Links

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 = SRA-SL-1003

County	DIXIE	Quarter Quad	EUGENE (NE)
WMD	SUWANNEE RIVER WMD	HUC	LOWER SUWANNEE RIVER
Random Latitude	29° 34m 27s	Random Longitude	83° 00m 44s

Is SRA-SL-1003 sampleable? ○ Yes ◉ No ○ N/A

Exclusion Criteria: LAKE DRY

Was SRA-SL-1003 sampled? ○ Yes *Month* 4 *Day* 8 *Year* 2006

Comments:

Save Reset

◉ Aerial Photo ○ Quad Map ○ No Image

Show Map

Done Local intranet

GWIS Mapping - Microsoft Internet Explorer

Florida Department of Environmental Protection

GWIS Mapping

zoom in | zoom out | full extent | last extent | pan | identify | set units | measure | clear | run analysis | print | extract data | over view | help

Scale

1: 4057

Zoom to Scale

Layers

Refresh Map

Visible Label

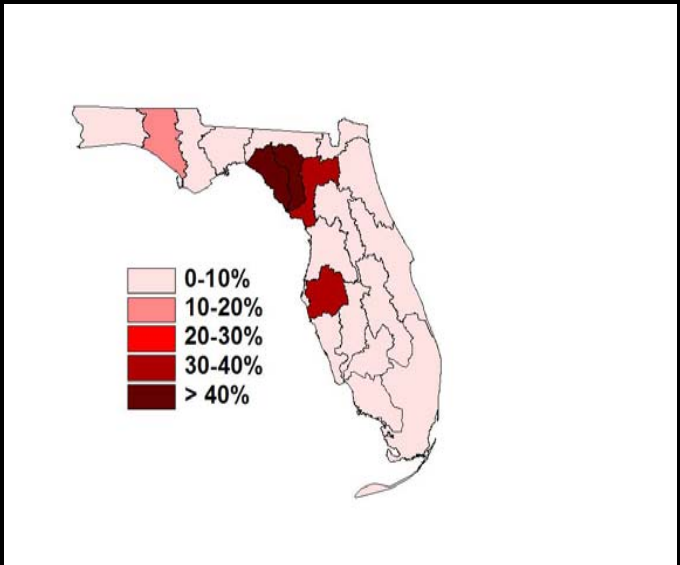
- [x] Small Lakes
- [ ] Large Lakes
- [ ] Streams
- [ ] Rivers
- [ ] ConAquifer - C1
- [ ] UnConAquifer - C1
- [ ] ConAquifer - C2
- [ ] UnConAquifer - C2
- [ ] Sampled Stations
- [ ] Sm Lake Resources - C2
- [ ] Lg Lake Resources - C2
- [ ] Stream Resources - C2

Legend

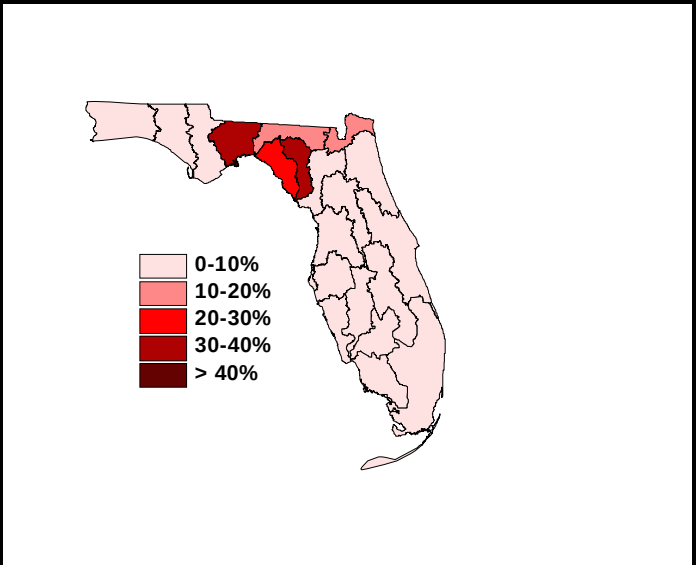
- SRA-SL-1003
- Small Lakes
- Sampleable - Yes
- Sampleable - No
- N/A
- Local Roads
- FDEP Bnds
- WMD Bnds
- Counties
- 2004 Aerials

Cycle 1 Lake Exclusion Results

Dry Lakes



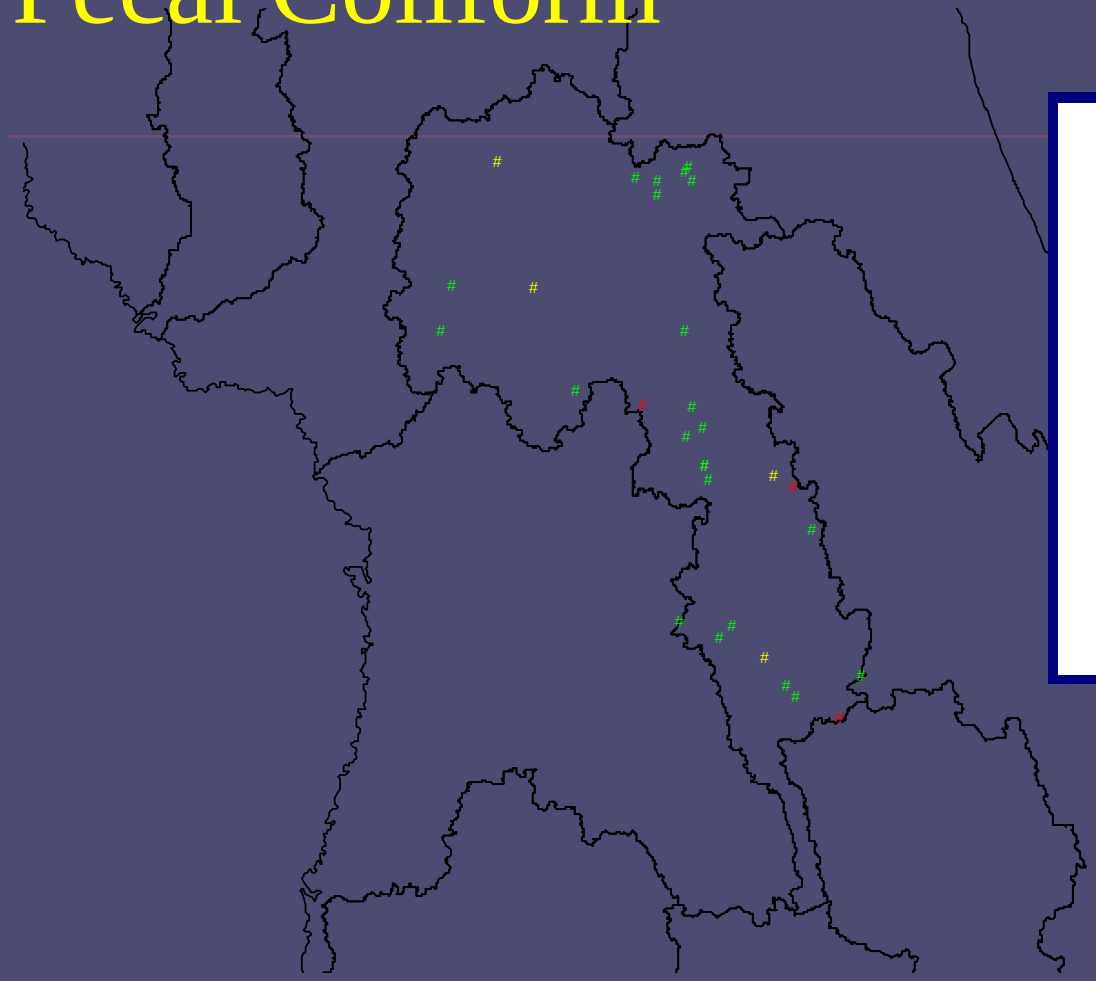
Small Lakes

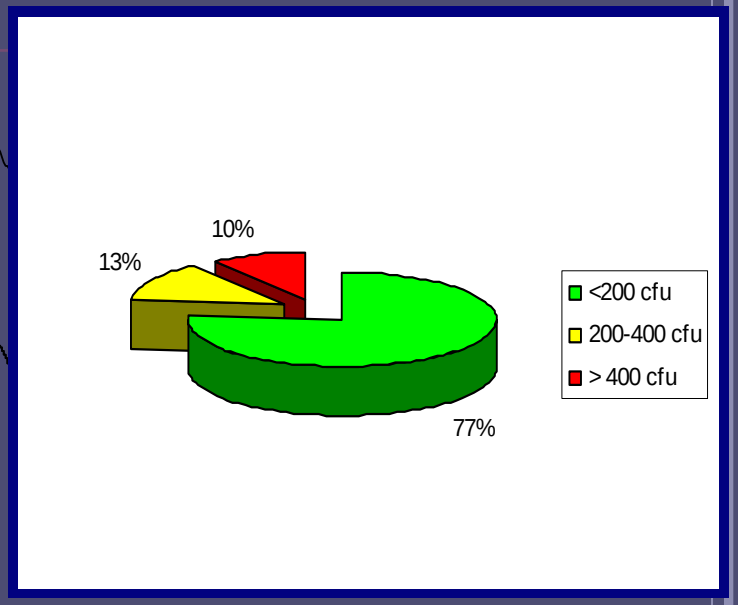


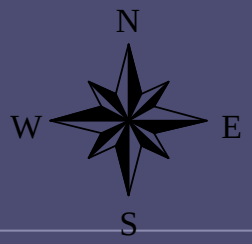
Large Lakes

Contrary to what you may be thinking, we actually did sample some lakes!

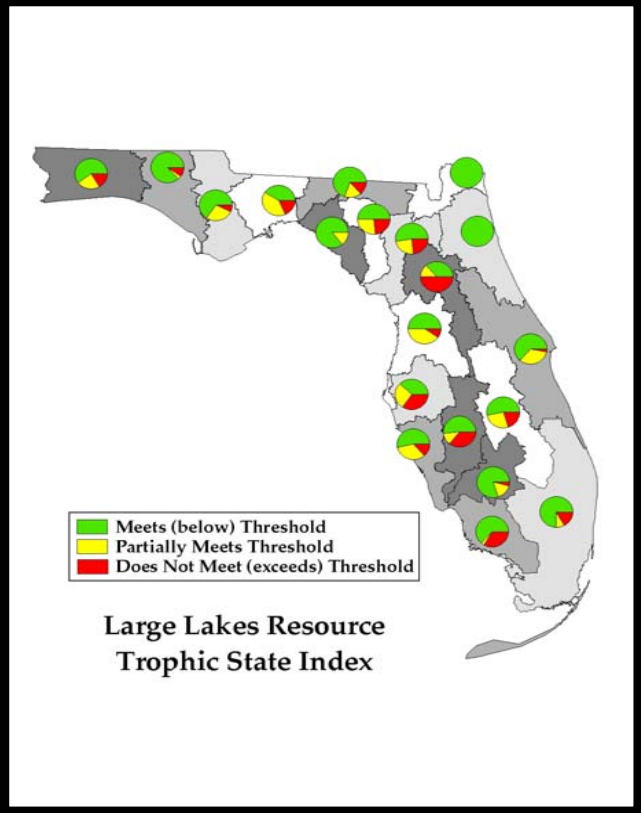
Ocklawaha Basin Small Lakes (2000) Fecal Coliform

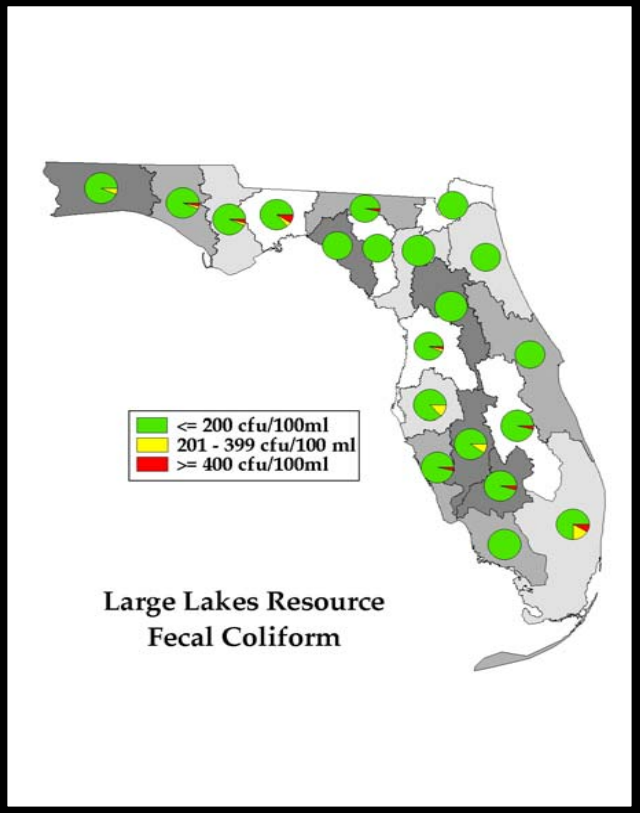






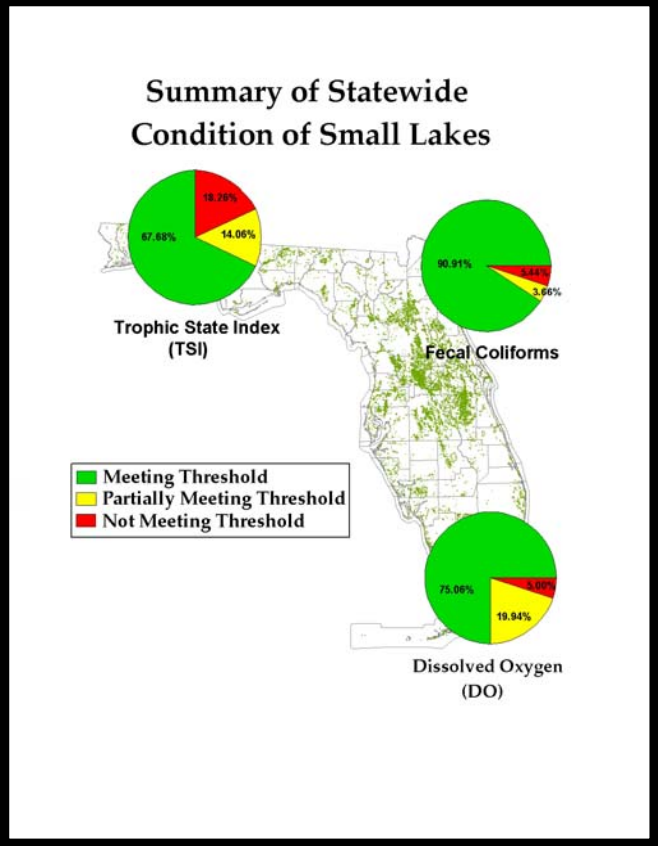
Selected Cycle 1 Sample Results

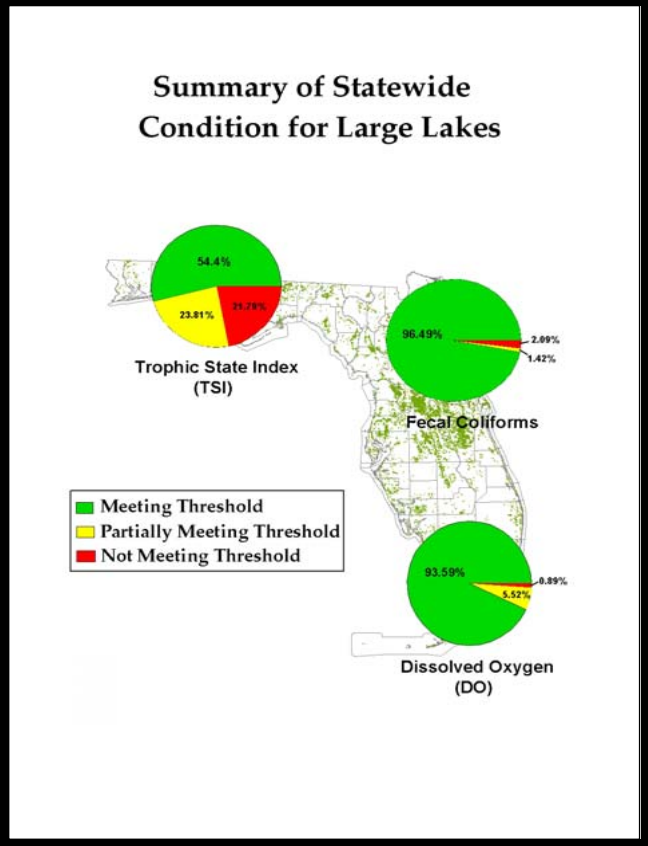




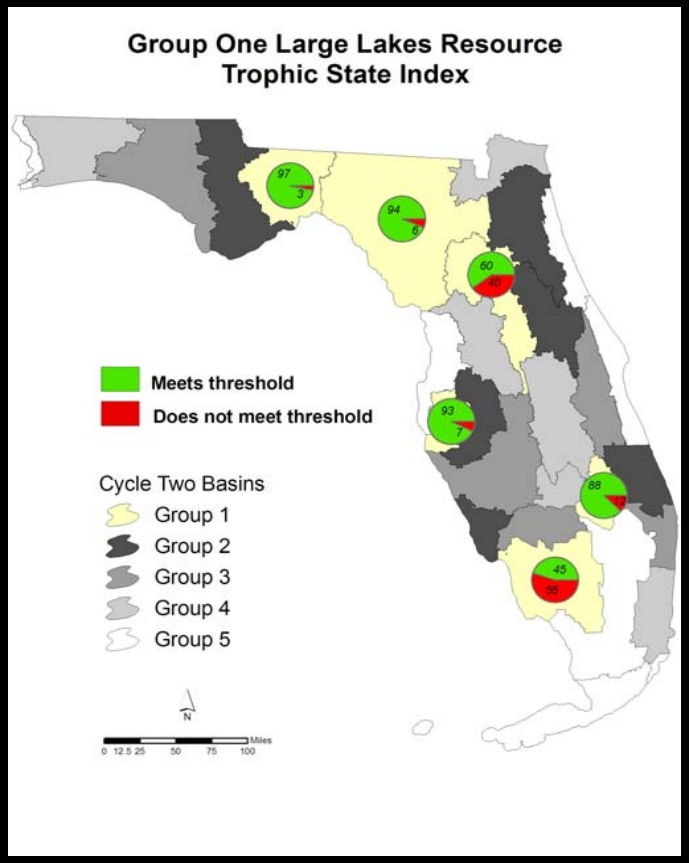
Selected Cycle 1 Sample Results

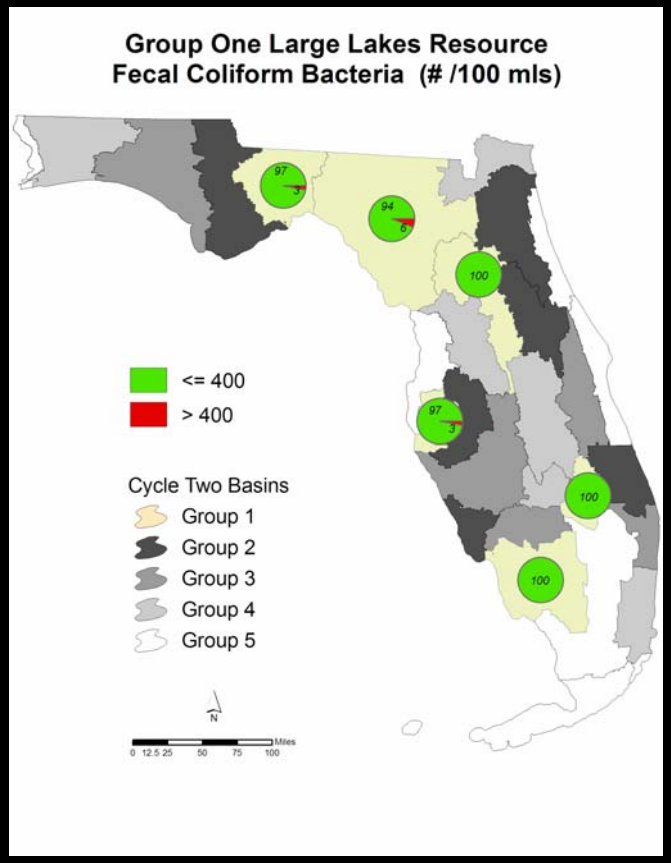
(full results at http://www.dep.state.fl.us/water/docs/2004_Integrated_Report.pdf)



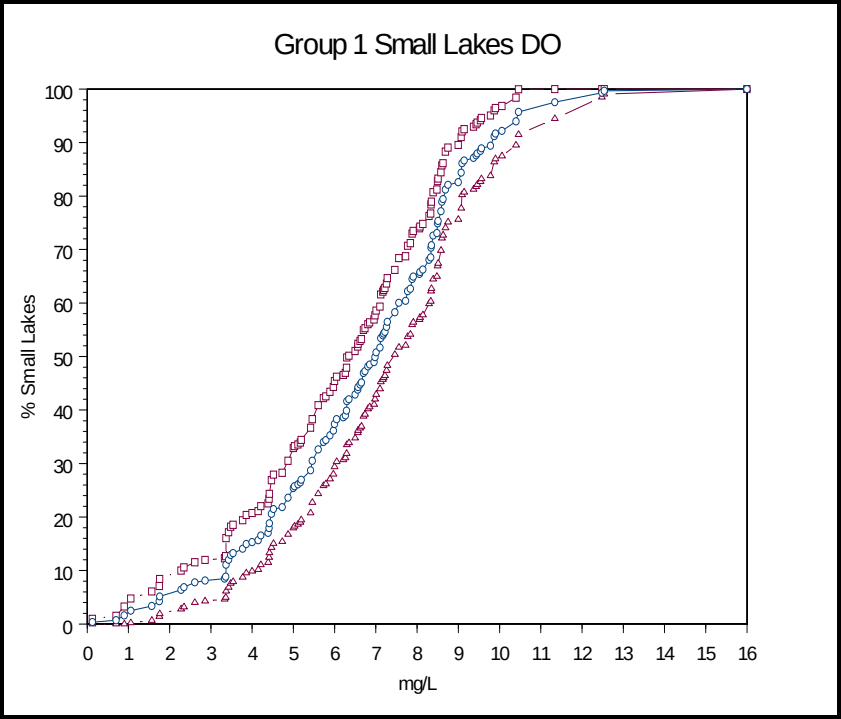


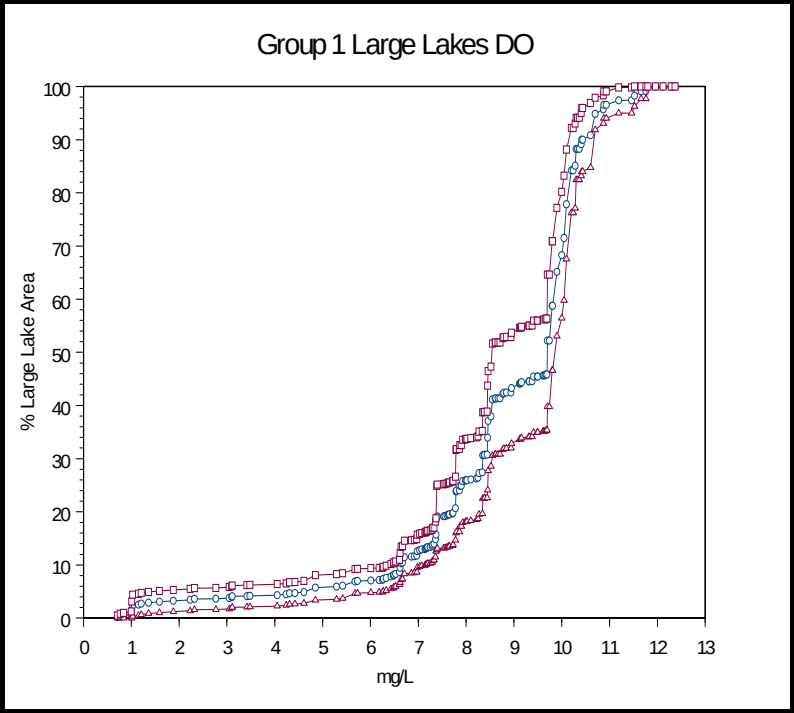
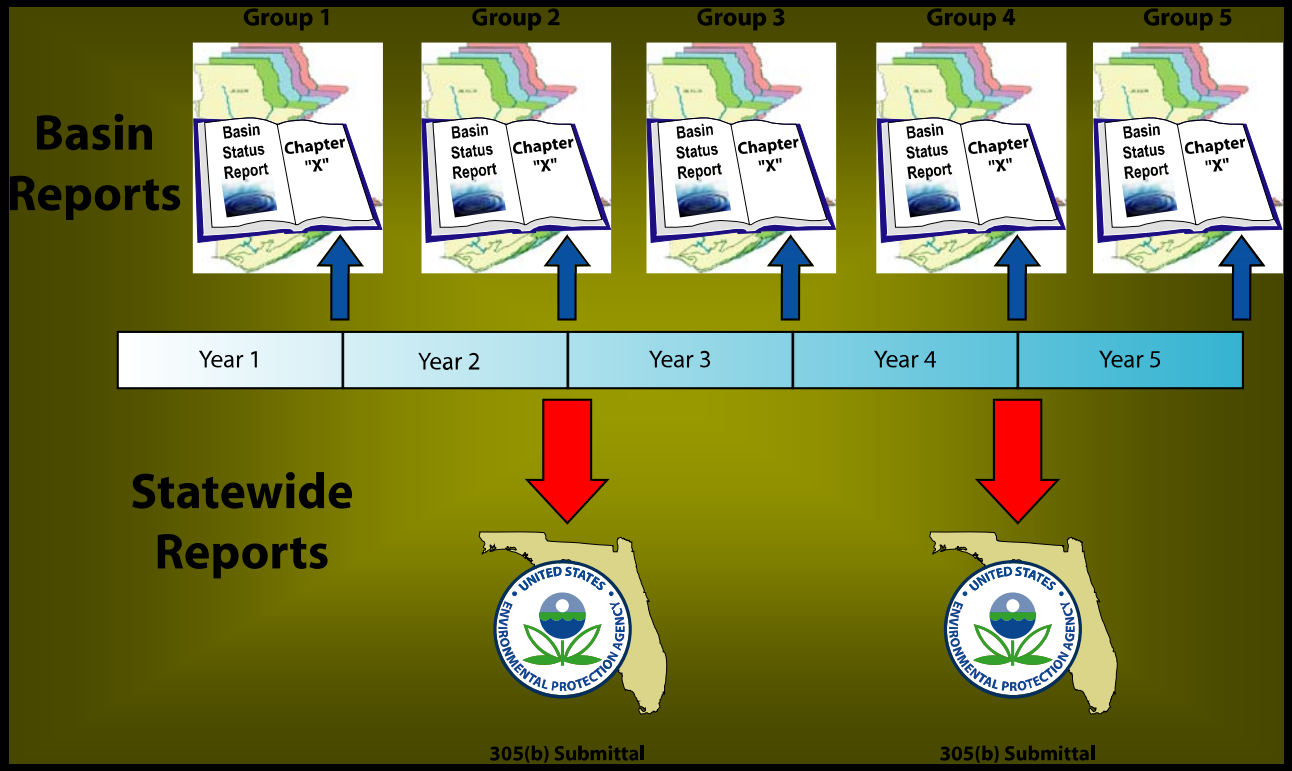
Selected 2004 Lake Results





Dissolved Oxygen Group 1 Lakes 2004





Reports from Status Monitoring For a Rotating Basin Cycle