Establishing a Probabilistic Stream, Lake and Ground Water Monitoring Network in Florida: *Lessons Learned*

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WHY MONITOR WATER QUALITY ?

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[U.S. Congressional Statutes 1315(b) - 305(b)]

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[Florida Statutes, Chapters 376 and 403]

Authorizes Florida DEP to require permittees to monitor water quality.

WHY MONITOR WATER QUALITY ?

FLORIDA WATER POLICY, Chapter 62-40.540:

"The Department Shall Coordinate Department, District, State Agency, and Local Government Water Quality Monitoring Activities to Improve Data (Quality) and Reduce Costs..."

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- ***Networks combined and re-structured beginning in July, 1996***

Components of a Water-Quality Monitoring System

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- Information Goals

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INTEGRATED WATER RESOURCE MONITORING NETWORK (IWRM):

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"To provide scientifically defensible, statewide data and information on the important chemical, physical and pertinent biological characteristics of water, including sediments, from the major surface water bodies, the major aquifer systems, and the coastal waters of the state. The information generated by the integrated network is to be the basis for reporting and advising relevant Departmental and other governmental agencies on the status and trends of Florida's water quality"

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3) Document potential problem areas;

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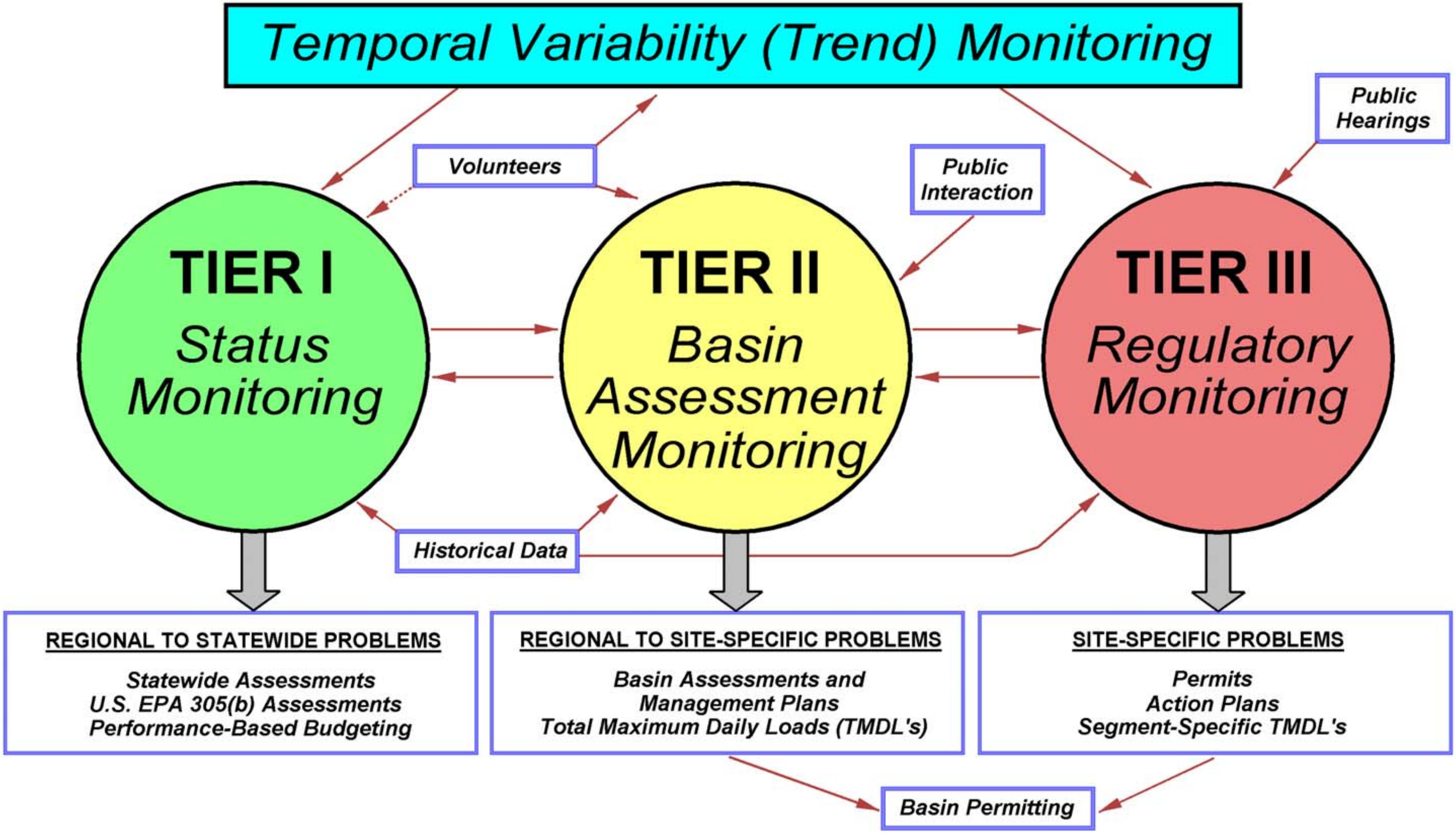
6) **Determine the proportion of the state’s water bodies that meet water quality criteria.**



Temporal Variability (Trend) Monitoring
Volunteers
Public Interaction
Public Hearings
TIER I
Status Monitoring
TIER II
Basin Assessment Monitoring
TIER III
Regulatory Monitoring
Historical Data
REGIONAL TO STATEWIDE PROBLEMS
Statewide Assessments
U.S. EPA 305(b) Assessments
Performance-Based Budgeting
REGIONAL TO SITE-SPECIFIC PROBLEMS
Basin Assessments and Management Plans
Total Maximum Daily Loads (TMDL's)
SITE-SPECIFIC PROBLEMS
Permits
Action Plans
Segment-Specific TMDL's
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3) Determine percentage of each resource within each basin which meets standards (ground water) or designated use (surface water).

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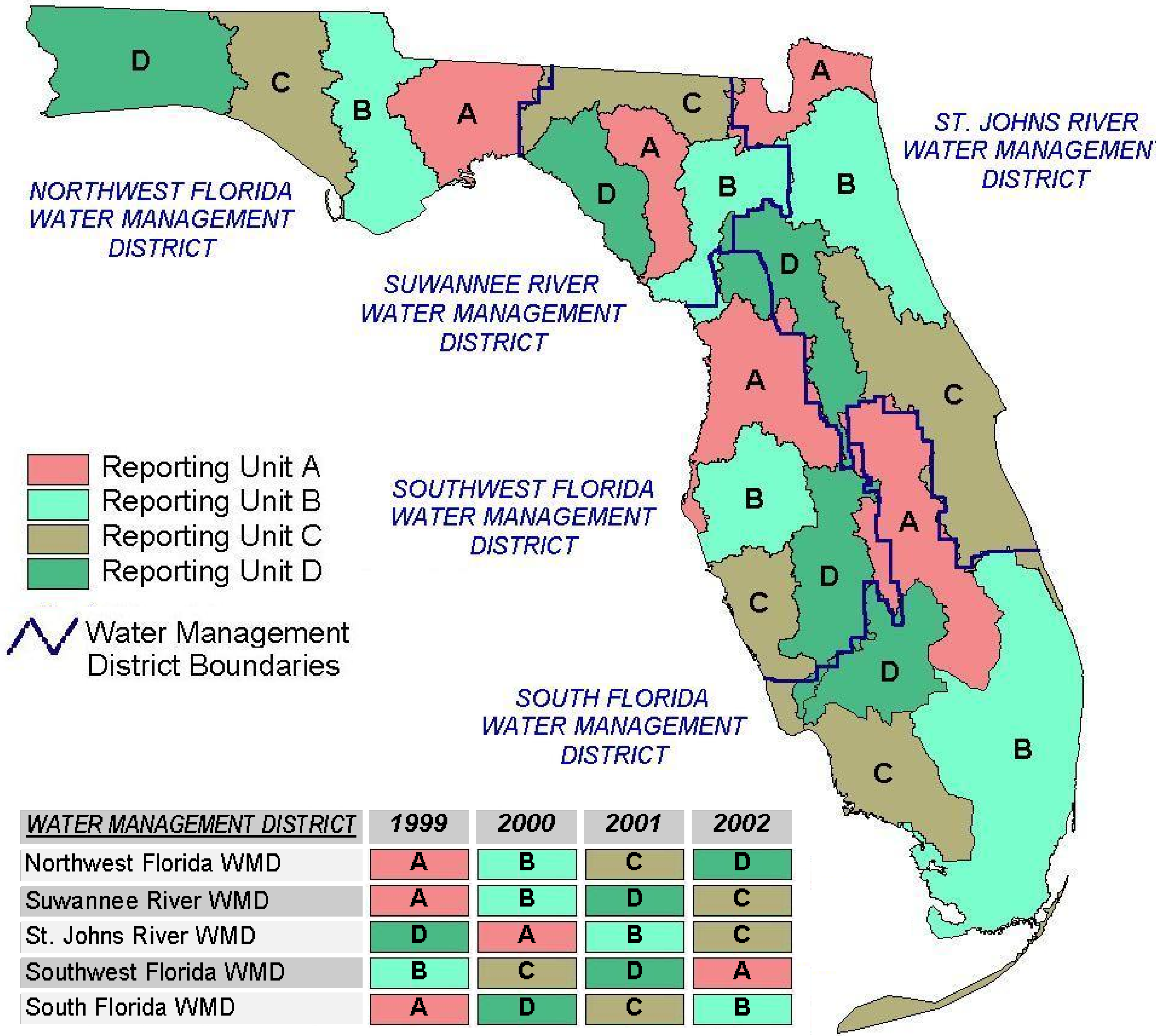

WATER MANAGEMENT DISTRICT	1999	2000	2001	2002
Northwest Florida WMD	A	B	C	D
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Year 1 - Randomly sample one RU - "C"
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(enables estimate of temporal variance)

For example, sample "C" in Year 5

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- Do not sample same basin two consecutive years

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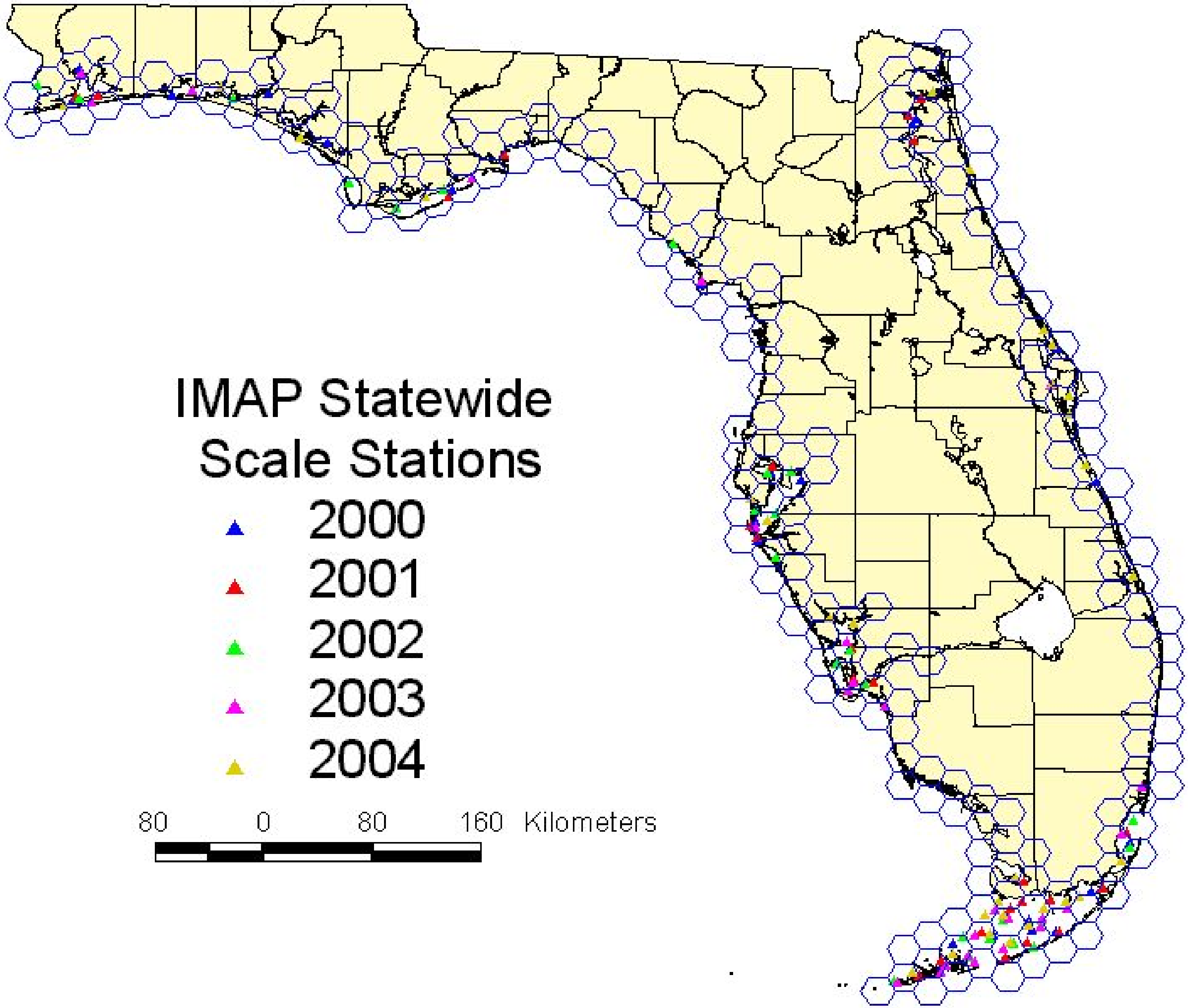
IMAP Statewide
Scale Stations
2000
2001
2002
2003
2004
80 0 80 160 Kilometers

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9) **Sediments – no sampling at this time**

Current Status Network Analyte List

INDICATOR	LAKES	STREAMS	AQUIFERS
Calcium	T	T	D
Magnesium	T	T	D
Sodium	T	T	D
Potassium	T	T	D
Chloride	T	T	D
Sulfate	T	T	D
Fluoride	T	T	D
Alkalinity	T	T	D
Nitrate + Nitrite	T	T	D
Ammonia	T	T	D
Kjeldahl Nitrogen	T	T	D
Phosphorous	T	T	D
ortho-Phosphate	D	D	D
Organic Carbon	T	T	T
Dissolved Solids	T	T	T
Suspended Solids	T	T	T
Turbidity	T	T	T
Color	T	T	T
Total Coliform	T	T	T
Fecal Coliform	T	T	T
E. coli	T	T	T
Enterococci	T	T	T
Chlorophyll-A	T	T	
Algal Growth Potential	T		
Phytoplankton	T		
Water Temperature	X	X	X
pH	X	X	X
Specific Conductance/Salinity	X	X	X
Dissolved Oxygen	X	X	X
Secchi Depth	X	X	
Total Depth	X	X	
Sample Depth	X	X	
Depth to Water (from LSE)			X
Land Surface Elevation (LSE)			X
Microlanduse			X

T = total sample
D = dissolved sample
X = other sample or measurement

Month	Confined Aquifer		Unconfined Aquifer		Low Order Streams		High Order Streams		Small Lakes		Large Lakes		Total Number of Samples *
	N	P	N	P	N	P	N	P	N	P	N	P	
January	20	30											50
February	20	30											50
March	20	30							30				80
April				45	30				30				105
May				45	30			45					120
June			30					45			30		105
July			30				30			45	30		135
August						45	30			45			120
September						45							45
October												45	45
November												45	45
December													0

N = North Florida (NWFWMD, SRWMD); **P** = Peninsular Florida (SJRWMD, SWFWMD, SFWMD)

Primary Index Period

Overflow Index Period

* Total does not include QA samples

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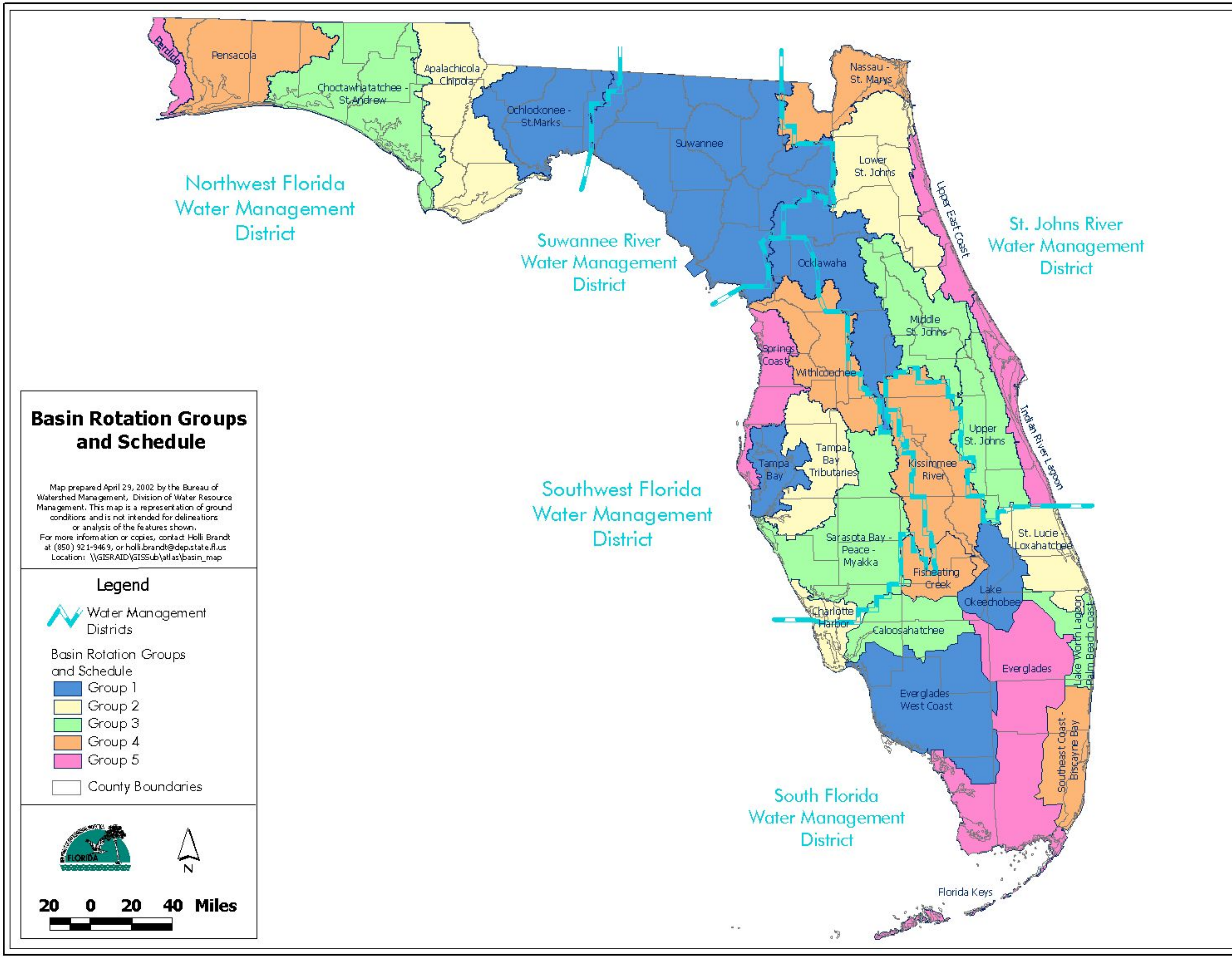
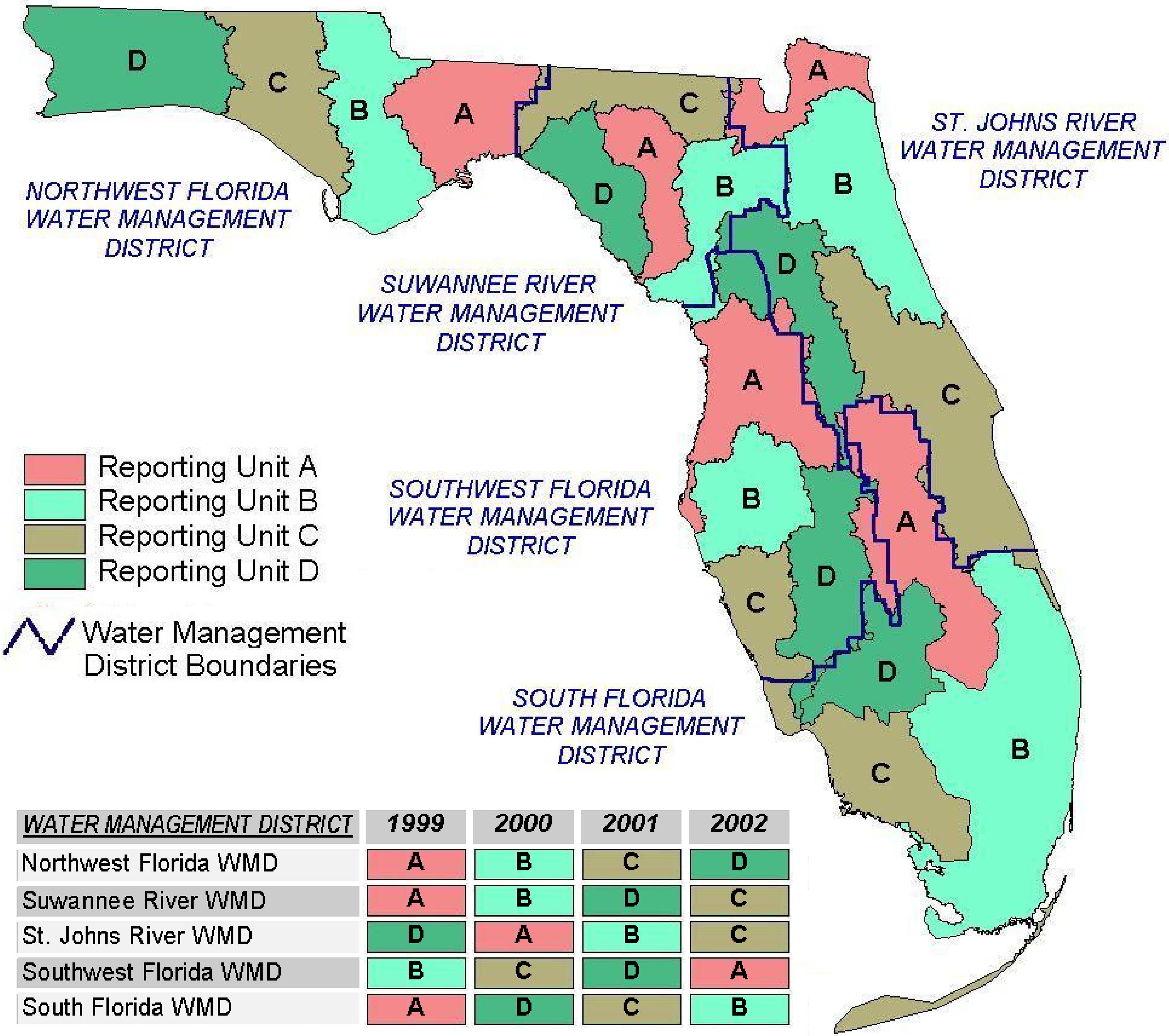

Basin Rotation Groups and Schedule
Map prepared April 29, 2002 by the Bureau of Watershed Management, Division of Water Resource Management. This map is a representation of ground conditions and is not intended for delineations or analysis of the features shown.
For more information or copies, contact Holli Brandt at (850) 921-9469, or holli.brandt@dep.state.fl.us
Location: \\GISRAID\GISSub\atlas\basin_map
Legend
Water Management Districts
Basin Rotation Groups and Schedule
Group 1
Group 2
Group 3
Group 4
Group 5
County Boundaries
FLORIDA
N
20 0 20 40 Miles
Northwest Florida Water Management District
Suwannee River Water Management District
St. Johns River Water Management District
Southwest Florida Water Management District
South Florida Water Management District
Perdido
Pensacola
Choctawhatatchee - St.Andrew
Apalachicola - Chipola
Ochlockonee - St.Marks
Suwannee
Nassau - St. Marys
Lower St. Johns
Upper East Coast
Ocklawaha
Middle St. Johns
Springs Coast
Withlacoochee
Upper St. Johns
Indian River Lagoon
Tampa Bay
Tampa Bay Tributaries
Kissimmee River
Sarasota Bay - Peace - Myakka
Fisheating Creek
St. Lucie - Loxahatchee
Lake Okeechobee
Charlotte Harbor
Caloosahatchee
Lake Worth Lagoon - Palm Beach Coast
Everglades
Everglades West Coast
Southeast Coast - Biscayne Bay
Florida Keys



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  20 statewide "Reporting Units" do not match up aerially or temporally with Florida's TMDL Basins.

- **SOLUTION:**

  1) Adopt TMDL's 30 basins. This will result in an increase (4500 vs. 3600) in number of samples collected during the second basin rotation cycle;
  2) Sample basins 18 – 24 months prior to initiation of TMDL basin assessments (second cycle).

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  2) Develop in-house capabilities for making random site selections;
  3) Re-define high-order and low-order streams by designating certain specific "major rivers" as a separate stream resource.

PROBLEMS ENCOUNTERED IN FIRST BASIN ROTATION CYCLE:

- **PROBLEM #3:**
  Chemistry-based sampling alone does not allow for accurate determination of percentage of streams meeting "designated uses" (potable water supplies, shellfish propagation or harvesting, recreational use, agricultural water supplies, and navigation / utility / industrial use).

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- **SOLUTION:**

  Move to bio-reconnaissance as the major stream assessment tool. BioRecons include habitat assessment, dip-net sweeps and some chemistry (field analytes, nutrients).

PROBLEMS ENCOUNTERED IN FIRST BASIN ROTATION CYCLE:

- **PROBLEM #4:**

  “Designated Use” of Florida’s potable aquifer systems is defined by statute as *drinking water.* Analyte list for ground water sites does not sufficiently address Primary and Secondary drinking water standards, or indicators of concern.

PROBLEMS ENCOUNTERED IN FIRST BASIN ROTATION CYCLE:

- **PROBLEM #4:**

  "Designated Use" of Florida's potable aquifer systems is defined by statute as *drinking water.* Analyte list for ground water sites does not sufficiently address Primary and Secondary drinking water standards, or indicators of concern.

- **SOLUTION:**

  Adjust analyte list to include all Primary and Secondary standards. Add analytes of concern in Florida's potable aquifer systems (Sr, Ra or gross alpha, fecal coliform in unconfined aquifer systems, Fe, Mn, Al).

PROBLEMS ENCOUNTERED IN FIRST BASIN ROTATION CYCLE:

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  2) Add additional wells / springs to the candidate "list frame".

PROBLEMS ENCOUNTERED IN FIRST BASIN ROTATION CYCLE:

- **PROBLEM #6:**
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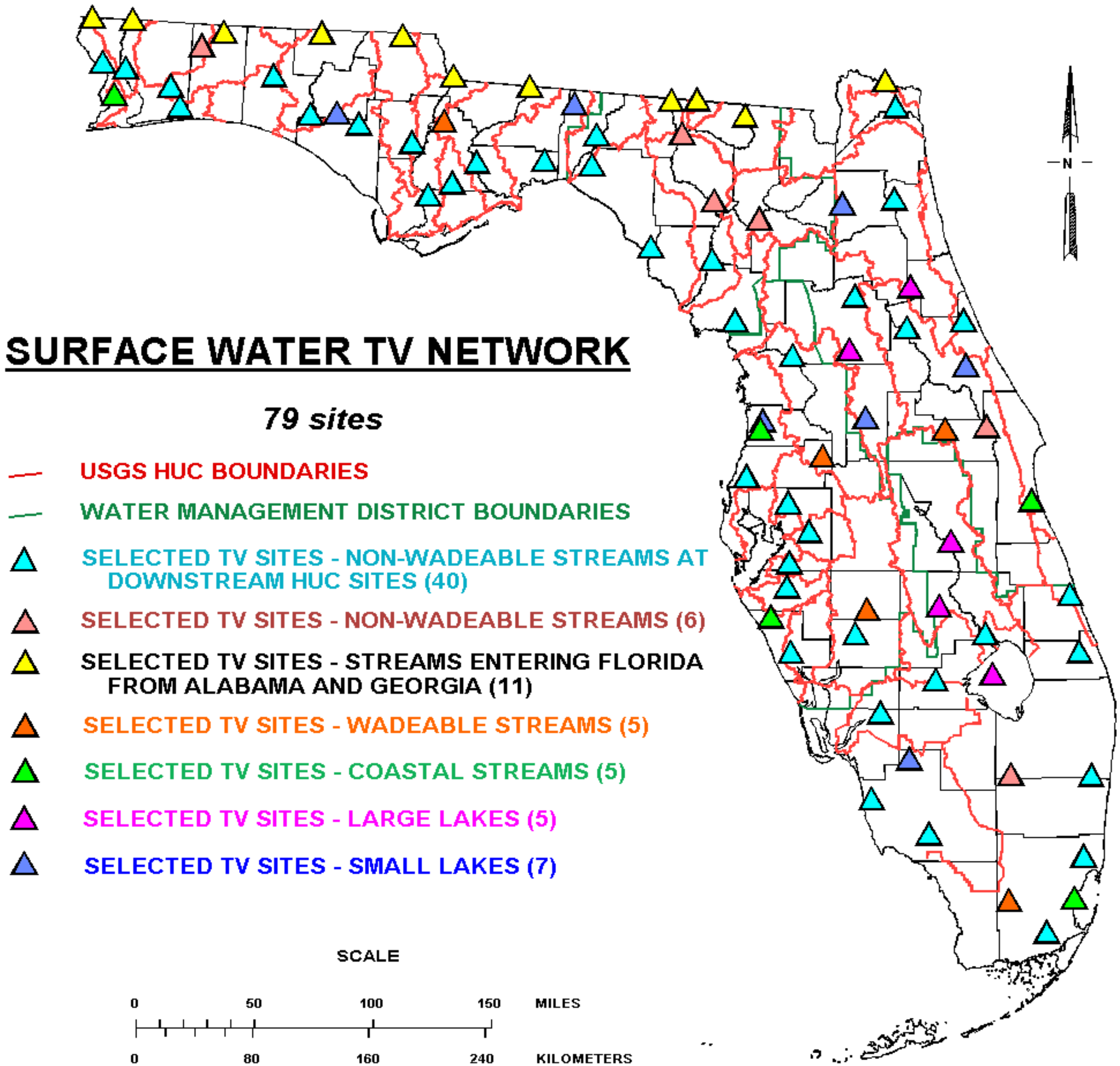
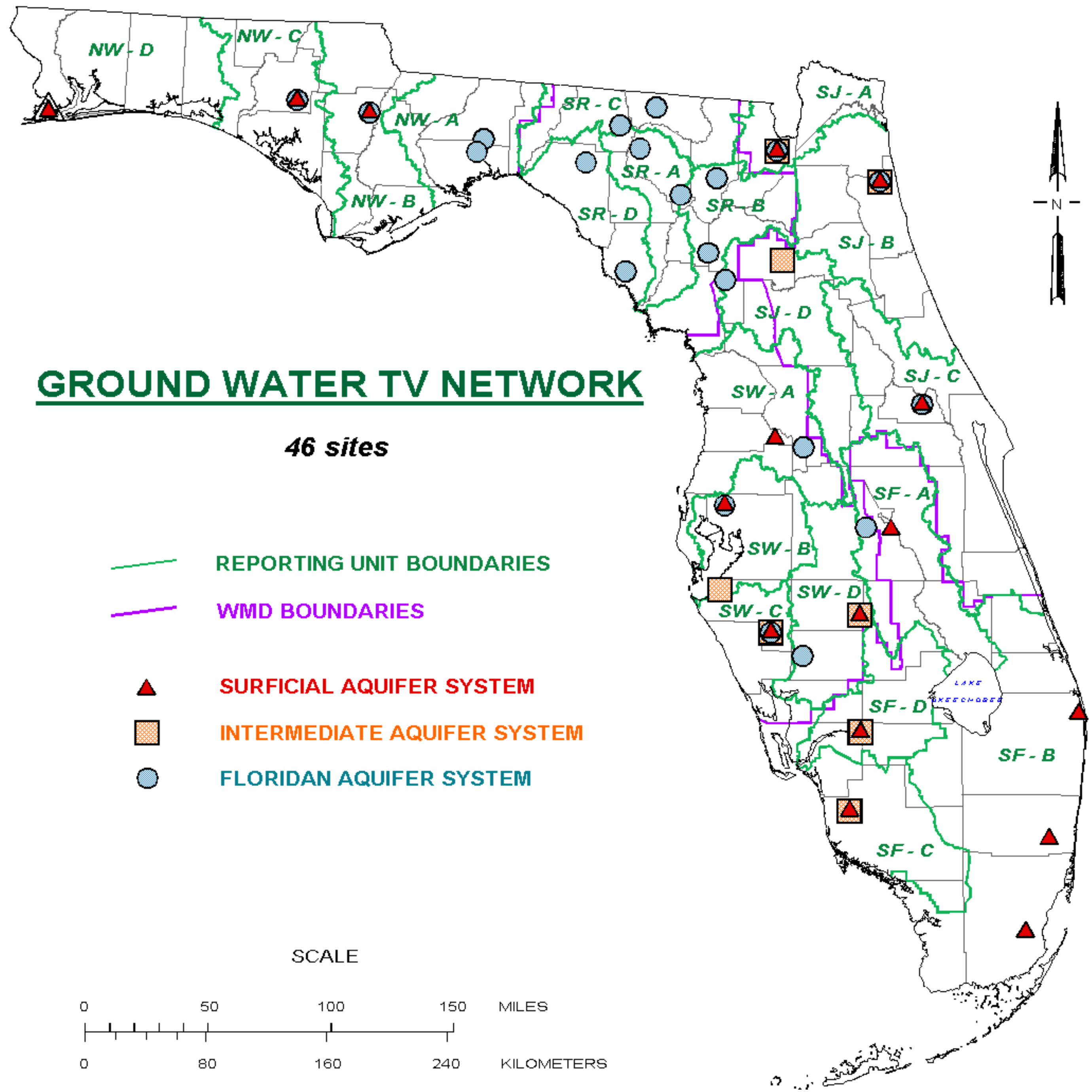
- **PROBLEM #6:**

  Proposed new five-year, 30 rotating basin sampling regimen does not allow for re-sampling of randomly-selected basins in order to determine temporal variance.

- **SOLUTION:**

  Use data from Florida DEP’s fixed station Surface Water and Ground Water Temporal Variability Networks to estimate variance.


SURFACE WATER TV NETWORK
79 sites
USGS HUC BOUNDARIES
WATER MANAGEMENT DISTRICT BOUNDARIES
SELECTED TV SITES - NON-WADEABLE STREAMS AT DOWNSTREAM HUC SITES (40)
SELECTED TV SITES - NON-WADEABLE STREAMS (6)
SELECTED TV SITES - STREAMS ENTERING FLORIDA FROM ALABAMA AND GEORGIA (11)
SELECTED TV SITES - WADEABLE STREAMS (5)
SELECTED TV SITES - COASTAL STREAMS (5)
SELECTED TV SITES - LARGE LAKES (5)
SELECTED TV SITES - SMALL LAKES (7)
SCALE
0
50
100
150
MILES
0
80
160
240
KILOMETERS
N


GROUND WATER TV NETWORK
46 sites
NW - D
NW - C
NW - A
NW - B
SR - C
SR - A
SR - B
SR - D
SJ - A
SJ - B
SJ - D
SJ - C
SW - A
SW - B
SW - C
SW - D
SF - A
SF - D
SF - B
SF - C
N
REPORTING UNIT BOUNDARIES
WMD BOUNDARIES
SURFICIAL AQUIFER SYSTEM
INTERMEDIATE AQUIFER SYSTEM
FLORIDAN AQUIFER SYSTEM
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- **SOLUTION:**

  Dispense with the "fifth year" in the first cycle, and move directly to the second cycle, with implementation of all remaining problem fixes beginning in January, 2004.

Surface Water Temporal Variability (SWTV) Monitoring Network

SURFACE WATER TEMPORAL VARIABILITY NETWORK:

- **GOALS:**

  - *Correlate Status Network monitoring results ("Tier I Basin Characterization") with hydrographic period;*

  - *Estimate general basin-wide loading;*

  - *Make best temporal estimates of variances of parameters for HUC's.*

SURFACE WATER TEMPORAL VARIABILITY NETWORK:

- SITE SELECTION & MONITORING CRITERIA:
  - *Primarily monitor only one resource: non-tidal, non-wadeable rivers;*
  - *Select sampling sites at lower end of HUC basins;*
  - *Collect flow data at or proximal to sampling sites (recorder station or staff gage);*
  - *Preference for TREND sites with existing long-term historic water quality and/or flow records;*
  - *Reasonable site access;*

SURFACE WATER TEMPORAL VARIABILITY NETWORK:

- SITE SELECTION & MONITORING CRITERIA:
  - *At least one SWTV site per HUC;*
  - *Sampling stations should be located near the state line on major rivers entering Florida from Georgia and Alabama;*
  - *SWTV stations should be nested within Status Network sites;*

SURFACE WATER TEMPORAL VARIABILITY NETWORK:

- ADDITIONAL NOTES:
  - *Revised SWTV Network not designed to monitor point pollution sources;*
  - *SWTV sites should be initially sampled at least monthly;*
  - *Analyte list same as for Status Network sampling sites.*

Ground Water Temporal Variability (GWTV) Monitoring Network

Ground Water Temporal Variability Network

PURPOSE:

- Correlate ***"Status Basin Characterization"*** with seasonal hydroperiod;

- Estimate temporal variance of sampled analytes within each Reporting Unit.

Ground Water Temporal Variability Network

<u>SITE SELECTION</u>:

- Resources to be monitored:
    * *unconfined aquifers;*
    * *confined aquifers;*
- Number of monitoring sites:
    * *at least one <u>unconfined aquifer</u> monitoring well per reporting unit;*
    * *at least one <u>confined aquifer</u> monitoring well per reporting unit.*

Ground Water Temporal Variability Network

<u>MONITORING CRITERIA</u>:

- Sampling frequency:
    * *unconfined aquifers: **monthly**;*
    * *confined aquifers: **quarterly**;*
- Analytes to be measured:
    * *Status Network analyte list (field + lab) in 5 reporting units sampled as part of the Status Network during each year;*
    * *Field analytes only in 15 reporting units <u>not</u> sampled as part of the Status Network during each year.*