South Carolina's Surface Water Quality Monitoring Design

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

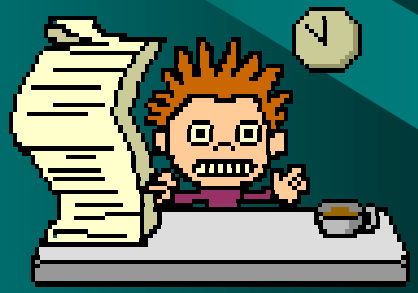
Presented by David Chestnut

Why Do We Collect Water Quality Data?

To satisfy a wide variety of different information needs

Reporting Requirements

- §305(b) Report
  - Comprehensive statewide summary report on water quality to Congress every two years
- §303(d) List
  - Listing of impaired waters
  - Submitted to EPA every two years



Other Reporting Activities

- State Government Accountability Report
  - Periodic comprehensive statewide summary report on progress to meeting established water quality goals
- Watershed Water Quality Assessments (WWQA)
  - One per year
- *Healthy People Living In Healthy Communities*

Specific Management Needs

- Targeted monitoring for:
  - Tracking water quality improvements after TMDL implementation
  - Tracking of implementation of other control strategies
  - Model & permit development
  - Responding to developing situations

Primary Purpose of Ambient Surface Water Monitoring is:

- <u>Big Picture:</u>
  - Make statements about representative WQ (§305(b), State Government Accountability Report)
- <u>Site Specific</u>
  - Examine long-term trends in WQ parameters
  - Identify sites not meeting classified uses (§303(d))
  - Track specific targeted activities

Components of the SC Monitoring Network Design

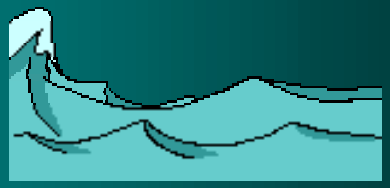
- Fixed Monitoring Network
  - Long-term trends
  - Consistent statewide coverage
- Rotating Basin Monitoring
  - More spatially dense
  - Watershed focus
- Probability Based Monitoring
  - Statistical survey of statewide resources
  - Sample new locations

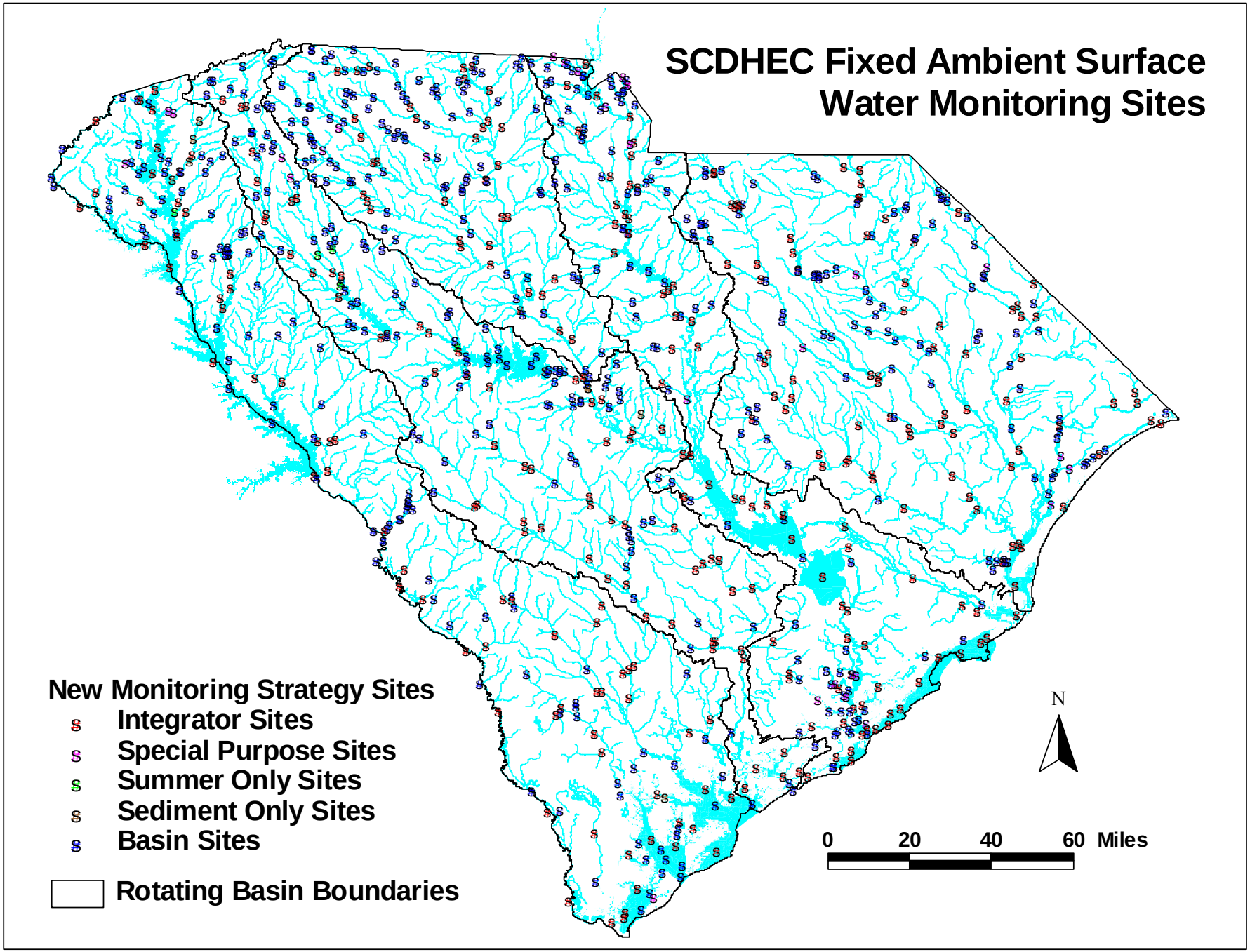
Types of Fixed Statewide Surface Water Chemistry Monitoring Sites

- Integrator (314) & Special Purpose Sites (28)
  - Sampled monthly year-round
  - Target outflow of 11-digit WSU or specific data needs
- Special Summer-Only Sites (5)
  - Sampled monthly May-October
  - Target specific data needs
- Special Sediment-Only Sites (8)
  - Target specific data needs

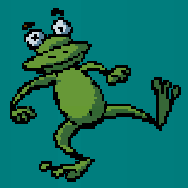
Other Types of Surface Water Chemistry Monitoring Sites

- Basin Sites (85-105 per year depending on basin)
  - More-or-less fixed, on a 5 year cycle
  - Sampled monthly for 1 year when active
- Probability Sites (90)
  - Sampled monthly for 1 year
  - Unbiased sample of resource



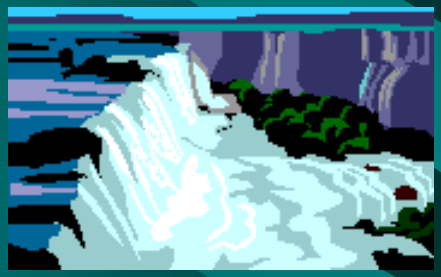

SCDHEC Fixed Ambient Surface Water Monitoring Sites
New Monitoring Strategy Sites
Integrator Sites
Special Purpose Sites
Summer Only Sites
Sediment Only Sites
Basin Sites
Rotating Basin Boundaries
N
0
20
40
60
Miles

What’s with Probability Based Monitoring?



Objectives of Probability Based Component

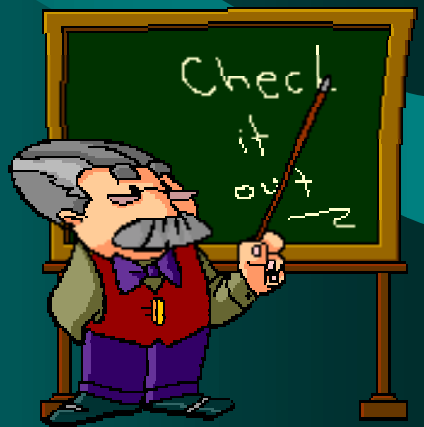
- Make comprehensive statements about statewide WQ conditions (§305(b) use support, State Gov. Accountability Report)
  - Unbiased random sample (poll)
  - Known confidence



- Sample previously unsampled locations
  - Identify new §303(d) candidates

Assistance in Development of Probability- Based Monitoring

- Ron Raschke – Region IV EPA (ret.)
- Kent Thornton – FTN Associates
- EPA ORD National Health & Environmental Effects Research Laboratories
- Tony Olsen – EPA ORD NHEERL Corvallis, OR
- Kevin Summers – EPA ORD NHEERL Gulf Breeze, FL
- Bob Van Dolah – SCDNR MRRI



Statewide Design

- New sites selected every year
- Statewide statements required for §305(b) use support, State Government Accountability Report
  - No requirement for basin-level statements

Resource Types to be Assessed Using Probability Based Approach

- Streams

- Lakes

- Estuaries

Targeted Categories for Probability Based Sites

- Streams (30 sites per year)
  - Sampled monthly
  - First order streams
  - Second order streams
  - Third order & greater streams
  - Unequal weights

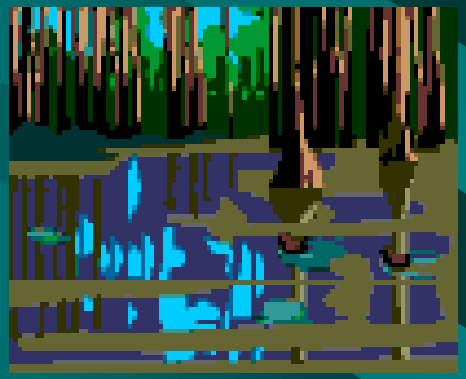
Why Weight by Stream Order?

- To ensure roughly equal representation of large and small streams

- Other concerns
  - Public perception – fixed sites at outflow of WSU are higher volume locations w/ good dilution, “you’re trying to hide problems”
  - Department of Natural Resources – headwaters are important breeding and nursery habitats that need to be targeted

Targeted Categories for Probability Based Sites

- Significant Lakes (Reservoirs) with Public Access (30 sites per year)
  - Sampled monthly
  - Major lakes (≥ 850 acres)
  - Minor lakes (40 to 850 acres)
  - Unequal weights

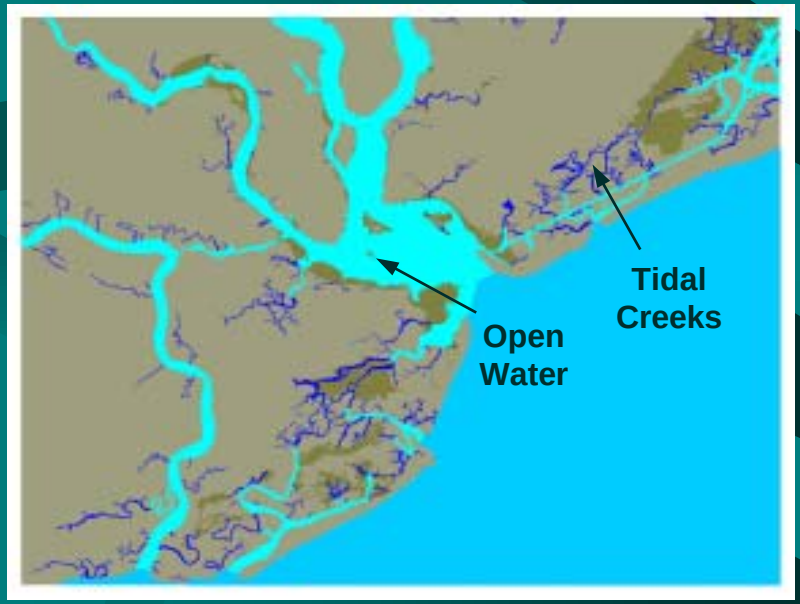


Why Weight by Reservoir Size?

- Site selection based on entire surface area, not individual lakes, to ensure all habitats represented
  - So if not weighted by size the few really big reservoirs would get most of the sites and the small ones might never get sampled
- Why?
  - Public perception – fixed sites typically mid-lake, deep water, nobody swims or fishes there

Targeted Categories for Probability Based Sites

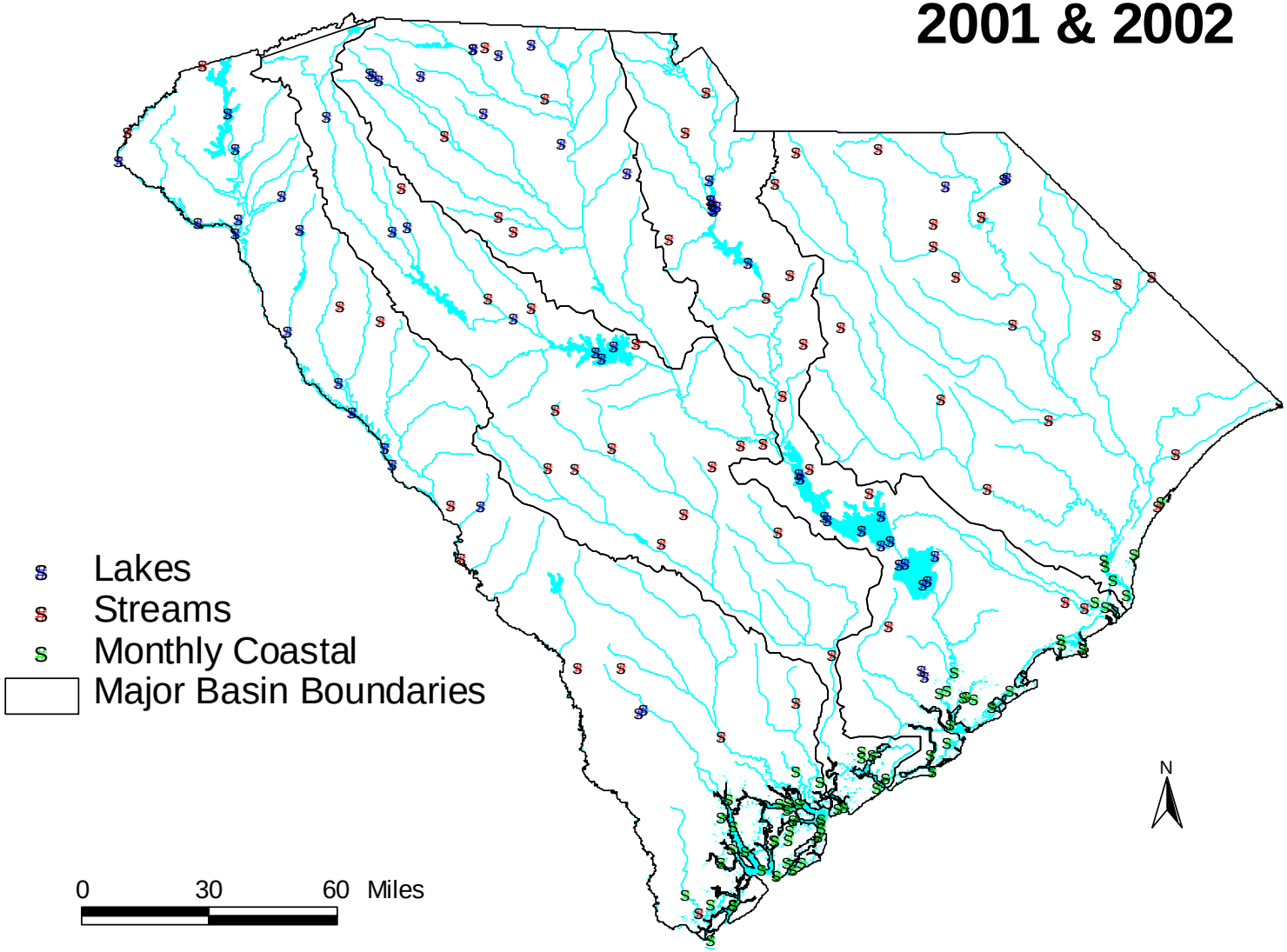
- Estuaries (30 sites per year + 30 more with cooperators)
  - 30 visited monthly
  - Two distinct strata
  - Open water (> 100 m wide)
  - Creeks (< 100 m wide)



Why Two Strata?

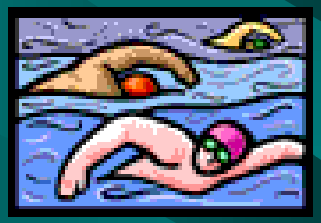
- Smaller smaller tide creeks are generally in closer association with upland disturbances and development than open water sites
  - Previous studies in SC show generally higher pollutant loads and more stressful environments in tide creek habitats

South Carolina Probability Based Network
2001 & 2002



Primary Uses to be Assessed with Probability Data

- Statewide
  - Aquatic Life Use Support
  - Recreational Use Support

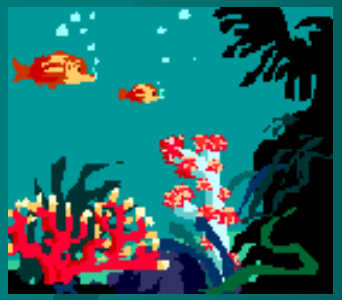


In order to do that, <u>sufficient data</u> must be collected at <u>each</u> Probability Site to assess attainment of each use

- This is a different design to answer a different basic question than the EMAP Program

Probability Based Sites

- All sites get annual sediment contaminant monitoring
- All stream and estuary sites get annual macroinvertebrate community monitoring
- All stream sites get annual habitat assessment
  - Estuaries?



Basic Physical & Chemical Parameter Coverage

<u>Monthly</u>

Air & Water Temp

Dissolved Oxygen

pH

BOD_5

Fecal Coliform Bacteria

Total Phosphorus

Nitrate

<u>Bi-Monthly</u>

Alkalinity

Ammonia

Kjeldahl Nitrogen

Basic Physical & Chemical Parameter Coverage

<u>Quarterly</u>

Total Organic Carbon

Cadmium

Chromium

Copper

Iron

Lead

Manganese

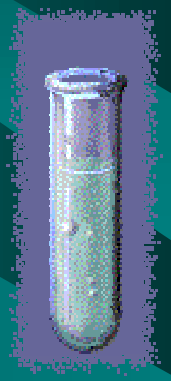
Mercury

Nickel

Zinc

<u>Annually</u>

Hardness*



*Freshwater sites only

Additional Water Analyses at Selected Monitoring Sites

<u>Monthly</u>

- Salinity } Saltwater sites only
- Conductivity
- Chlorophyll *a* (May-Oct. all lake and estuarine sites)
- Transparency (Secchi depth, all lakes)

Sediment Sampling

Annually

- All 30 streams and 30 lakes sampled and analyzed by SCDHEC
- All 60 estuarine sites collected by SCDNR and analyzed by NOAA – NOS

Expected Benefits of Probability Component

- Consistent & comparable data statewide
- Known confidence in §305(b) statements
  - At least under old guidance, who knows with Integrated Lists
- Sample previously unsampled locations
- Identify new §303(d) candidates

Don’t Put All of Your Eggs in One Basket!

You Need to Have a Little of Everything

- Probability based for big picture statements
  - Used to be the intent of 305(b), not clear what it means under new Integrated List
- Fixed sites to examine long-term trends in individual parameters
- Capability for targeted monitoring for specific needs

Implementation Difficulties

<u>Issue</u>

- What do the first & second order streams really represent?
  - Many (most) are really intermittent, channelized drainage ditches, or non-flowing & stagnant
  - With limited resources, most critics would probably prefer to see more recreationally important waters sampled

Implementation Difficulties

<u>Issue</u>

- What do the first & second order streams really represent (cont.)?
  - Is NHD any better than RF3 in this regard e.g. classification of intermittent vs. perennial, stream order, etc. ?
  - What are some design alternatives that still include smaller, “headwater” areas that are meaningful?

Implementation Difficulties

Problem

- Logistics of access and acceptability of sites
  - Need to visit monthly, so access must be easy

Solution

- Move sampling location to the nearest public access where:
  - Not beyond confluence with significant tributary
  - Still in similar land use area

Visit our Web Site!
www.scdhec.net/water/

- Monitoring Strategy
- Laws and regulations
- Reports and publications
- Program contacts
- Outreach information

That’s All Folks!

Any Questions?

Discussion?