# Water Quality Monitoring to Assess the Impact of Marcellus Gas Development on Surface Waters in Pennsylvania

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MARCELLUS SHALE INFORMATION CLEARINGHOUSE

# Presentation Outline

- What is Water Quality Monitoring
- Assess Marcellus Development Impacts?
- GIS Analysis of Historical and Ongoing WQM
- Silver Creek Watershed Example

# What is Water Quality?

- the physical, chemical and biological characteristics of water.
- a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose.
- used by reference to a set of standards against which compliance can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact and drinking water.

# Water Quality Monitoring

- Why?
- Where?
- When?
- What?
- How?
- What Do the Results Mean?

# Water Quality Monitoring
# Why?

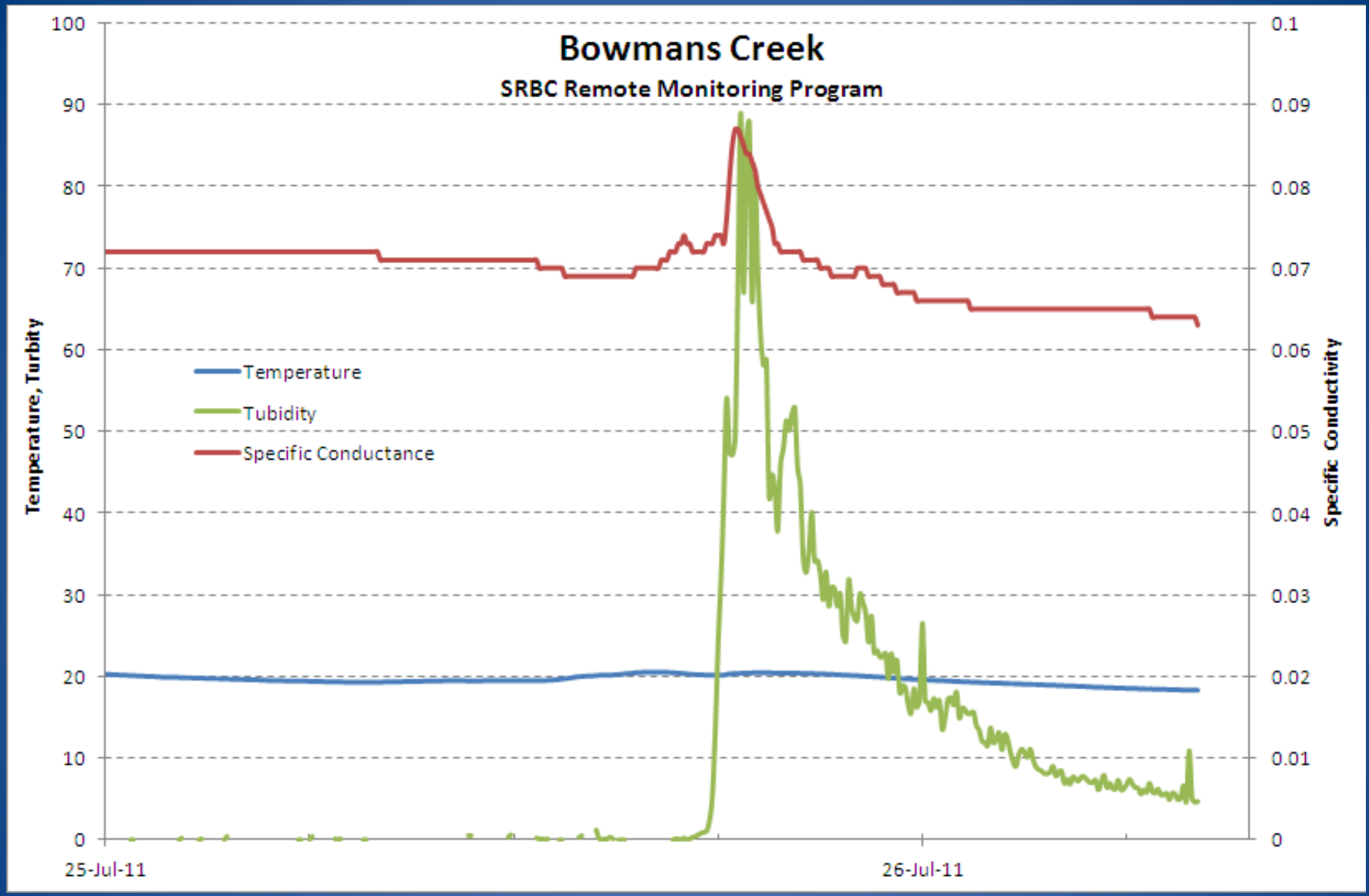
- Baseline or current conditions
- Impact assessment
- Compliance monitoring
  - Concentration limits
  - TMDLs

# Water Quality Monitoring Where?

- Streams
  - mid cross section, mid depth, highest flow
- Rivers
  - flow weighted sampler for x-section composite
- Lakes
  - outlet (for downstream impacts)
  - depth profiles

# Water Quality Monitoring When?

- Season variation
- Event responses
- Grab vs. time composite




## Stream Response to Storm Event

SRBC Bowman Creek Station 54 $mi^2$ , 73 mi, 3 gas permits 90% Forest, 0.5 % developed

# Water Quality Monitoring What?

- Physical
  - Temperature, conductivity
  - Flow, channel Geometry, substrate characteristics
- Chemical
  - Water mg/L, Solids mg/kg, biomass mg/kg
- Biological
  - Counts #/100 mL, presence per species
- Radiological
  - pCi/L

# Water Quality Monitoring How?

- In Stream Instrumentation
- Field Test Kits
- Grab Sampling – Laboratory Analysis
- Field collection with Preprocessing.

# Conceptual Model of Marcellus Gas Development on Water Quality

| Activity | Impact on Surface Waters |
|---|---|
| Access Roads, Site Preparation | Habitat disruption, Increased runoff, Erosion |
| Drilling | Consumptive Use of Water, Wastewater, Spoils |
| Hydrofacking | Release of chemicals to environment, Consumptive Use of Water, Wastewater, Spoils |
| Gas Production | Wastewater |
| Pipelines | Habitat disruption, Increased runoff, Erosion, spills at stream crossings |

# Data vs. Processes

Data

What we measure

- Physical characteristics
- Concentration
- Biological
  - Number of individuals
  - Identification of species
  - Presence/absence

Processes

What we want to know

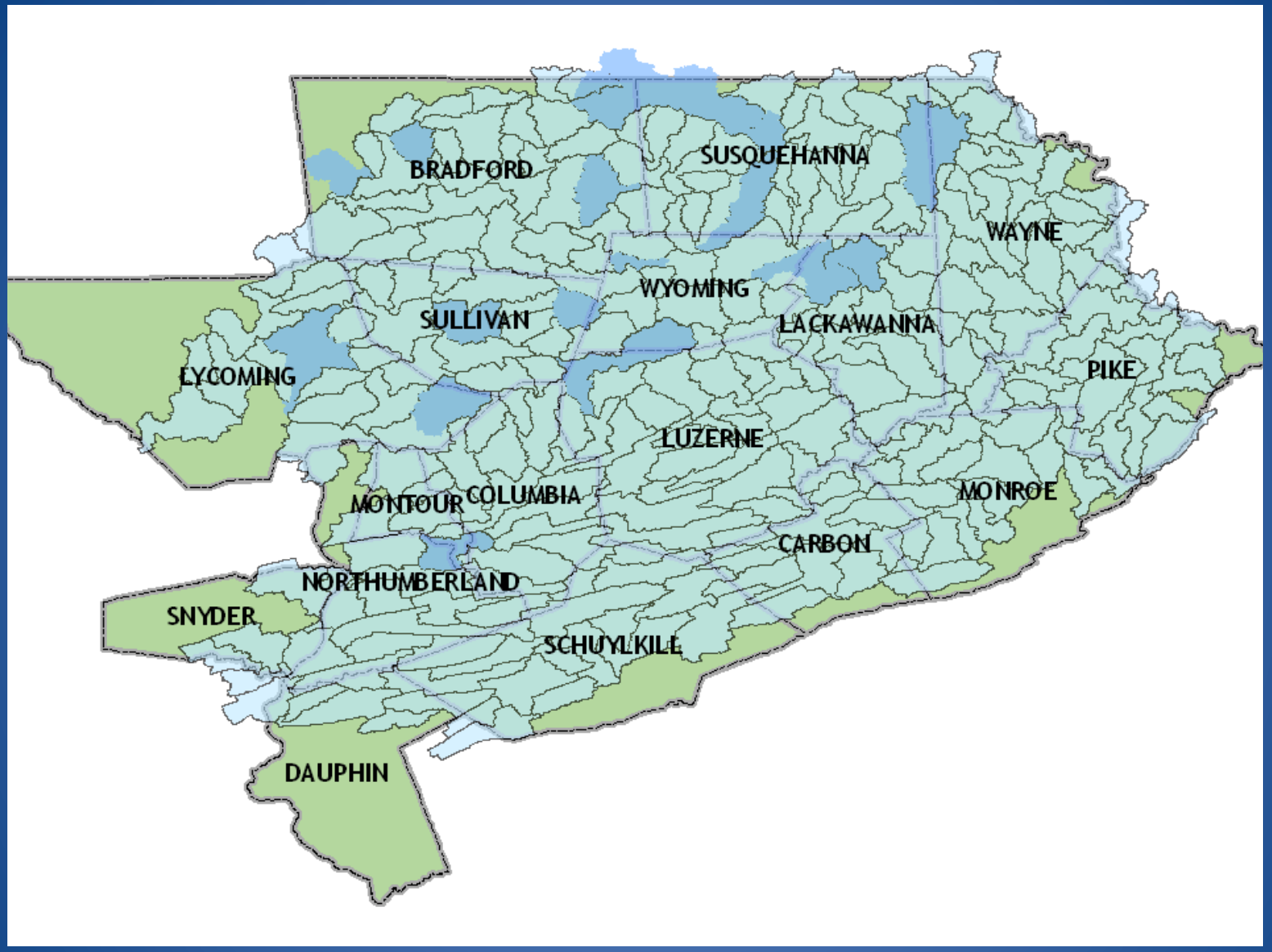
- Weathering
- Mass transport
- Production/respiration
- Bio-uptake/partitioning
- Bio diversification
- Eutrophication
- Dilution
- Climate Change

# Water Quality Monitoring
# What Do the Results Mean?

- Comparison to Standards (Criteria)
  - Drinking water
  - Aquatic life
- Comparison to Baseline
- Trends
  - Spatial
  - Temporal
- Environmental Processes?

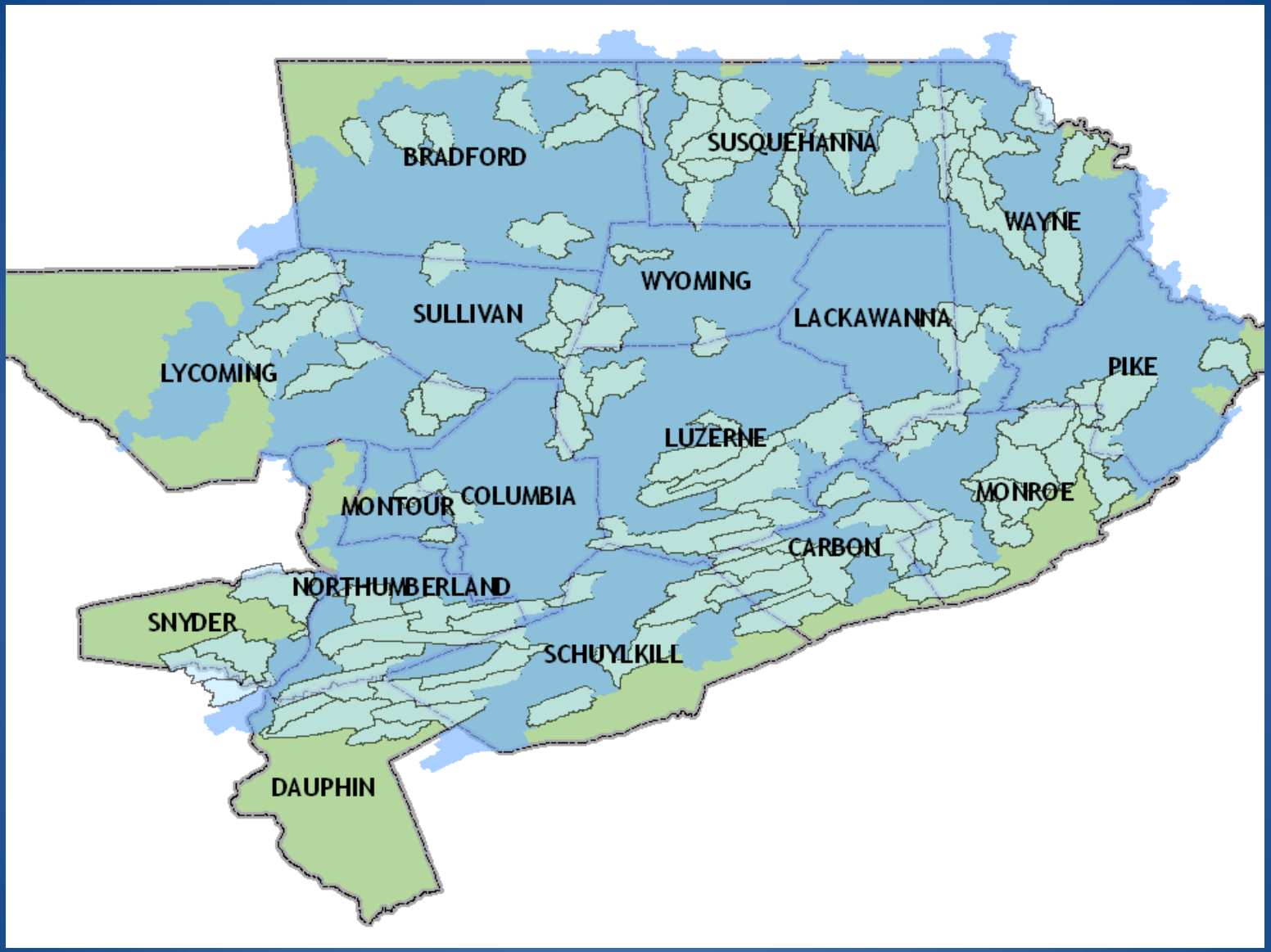
# GIS Analysis of WQM

- Environmental
  - Hydrography
  - Land Use/Land Cover
  - Topography
  - Withdrawals/discharges
  - BMPs
- Political/ Infrastructure
  - Boundaries
    - County
    - Municipal
    - Property
  - Transportation
- Water Quality Monitoring
  - Location
  - Dates
  - Parameters
  - Results
  - Watershed characteristics
- Marcellus Gas Activities
  - Access roads
  - Impoundments
  - Wells
  - Pipelines (gas & water)
  - Leases
  - Time!



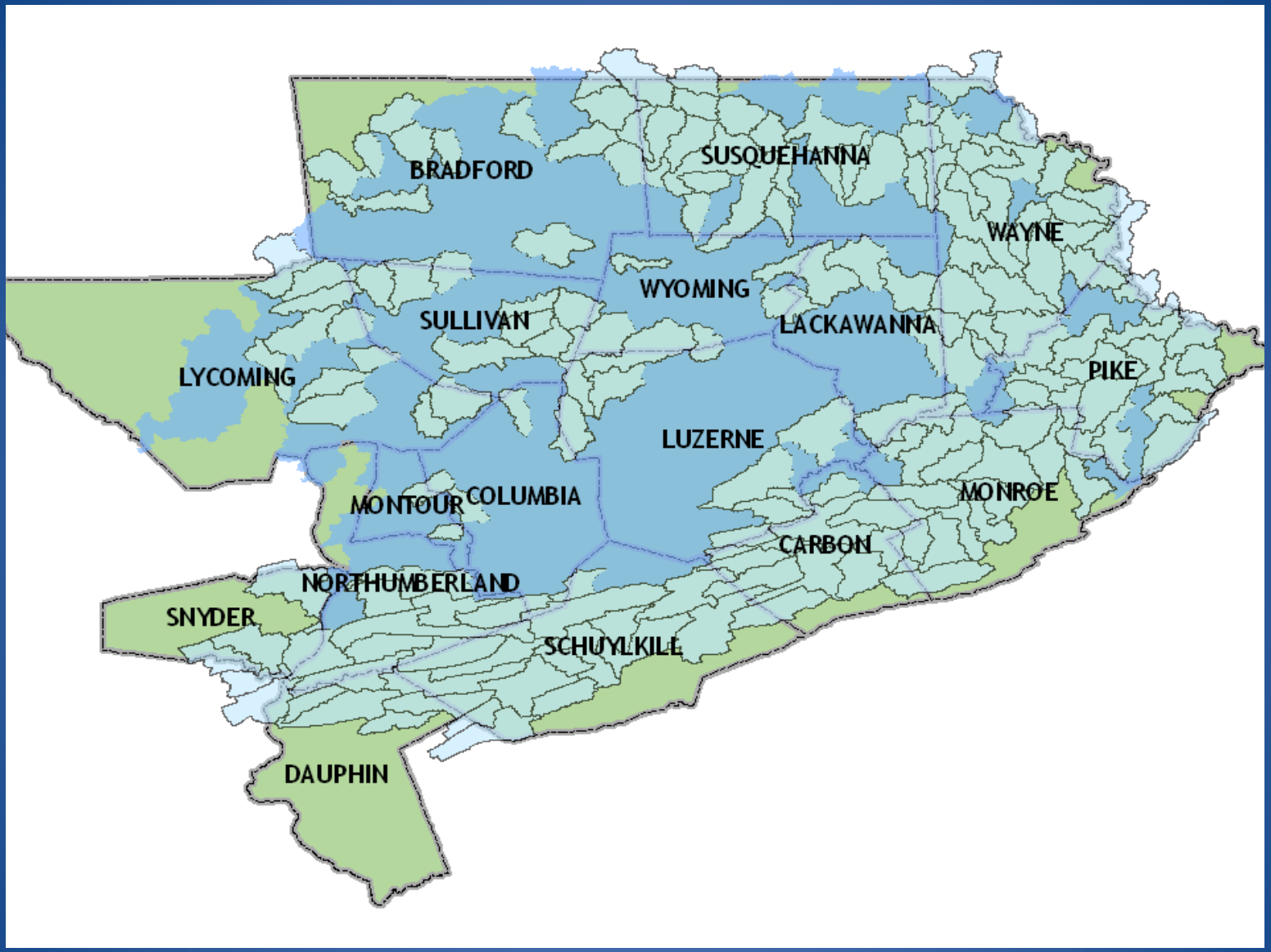

## Watersheds with Continuous Monitoring

SRBC Remote Water Quality Monitoring Network, USGS, HUC 12



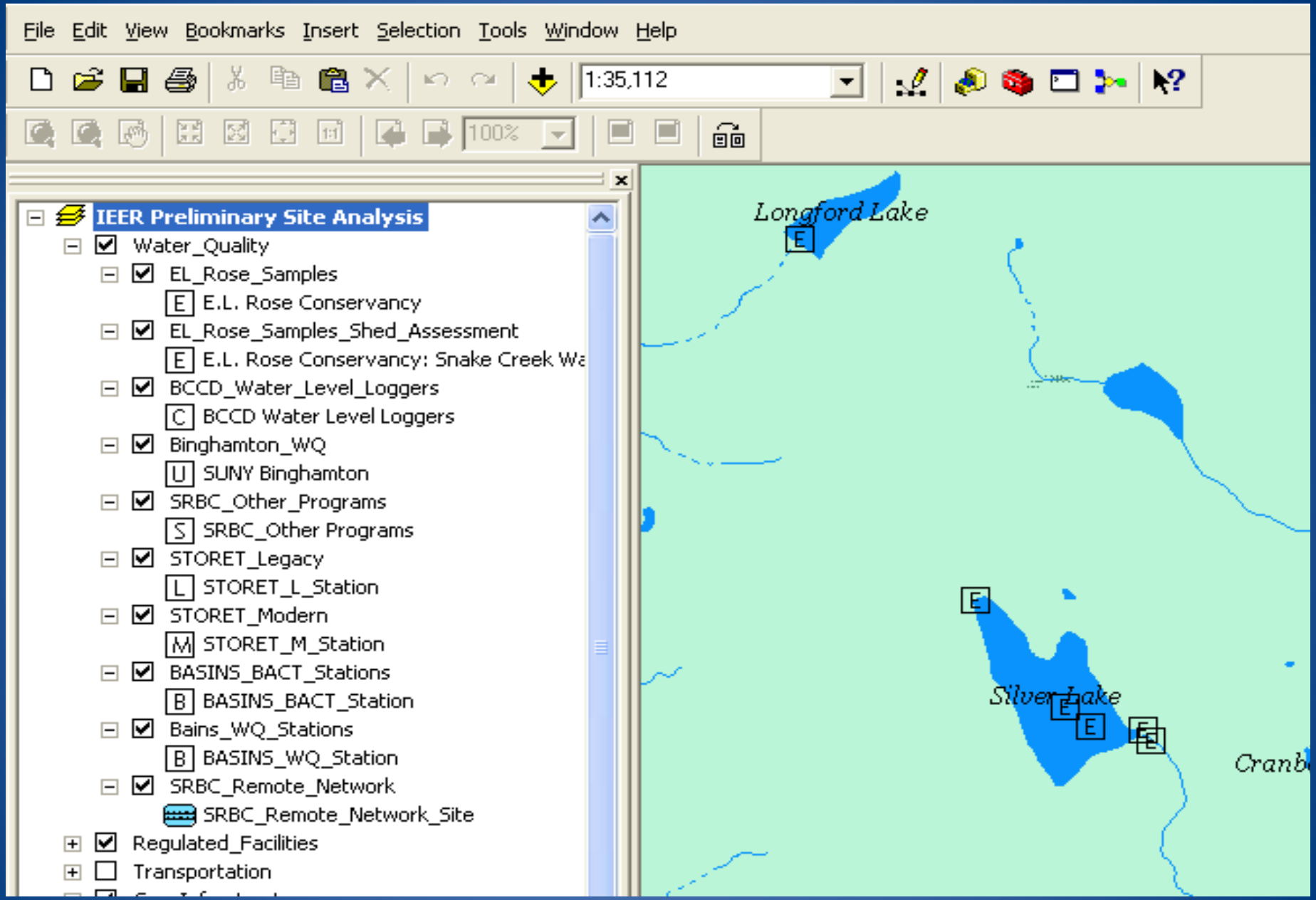

**2006 - Present**

SRBC, WQN, USGS

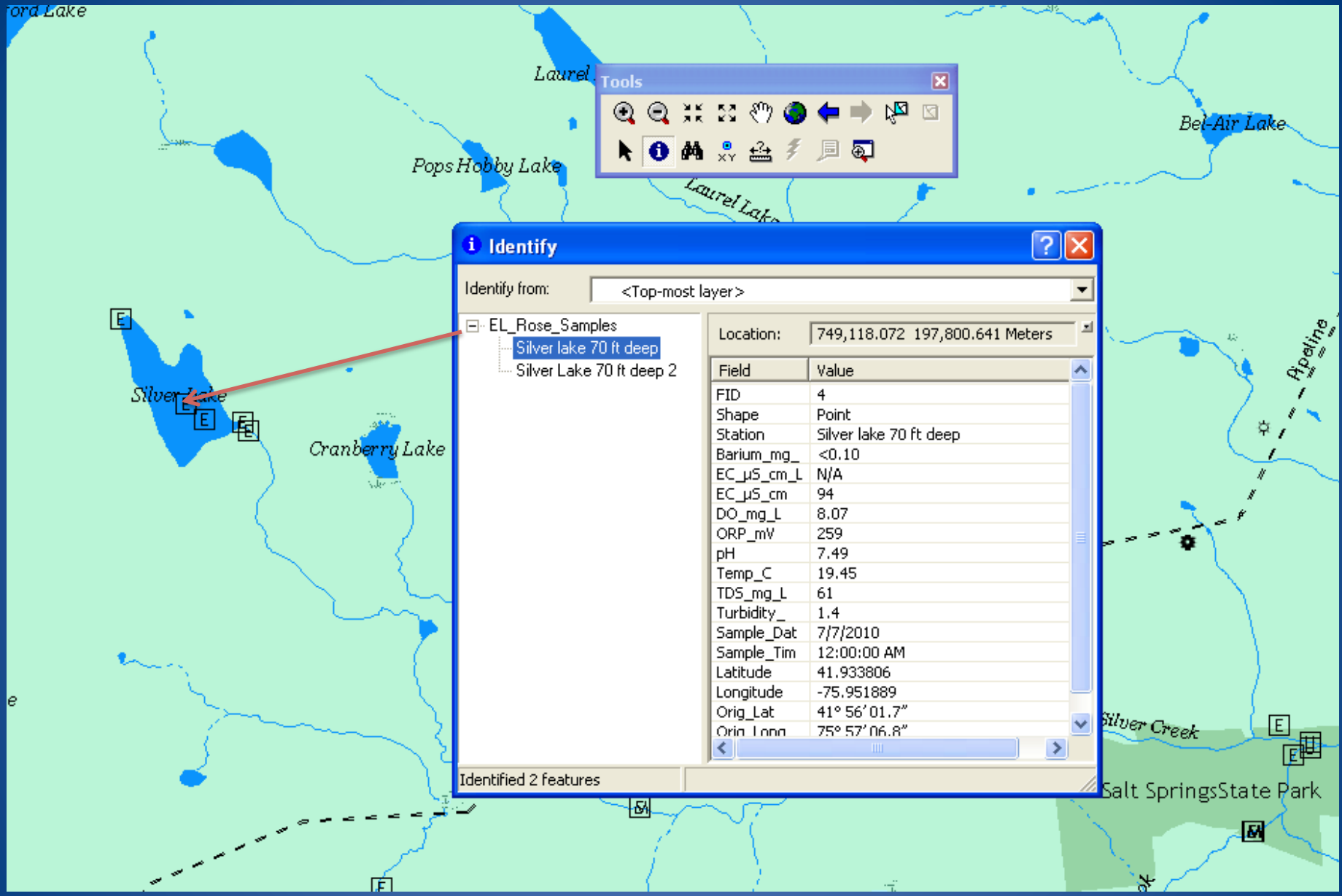



## Recurring Water Quality Monitoring

SRBC, WQN, USGS

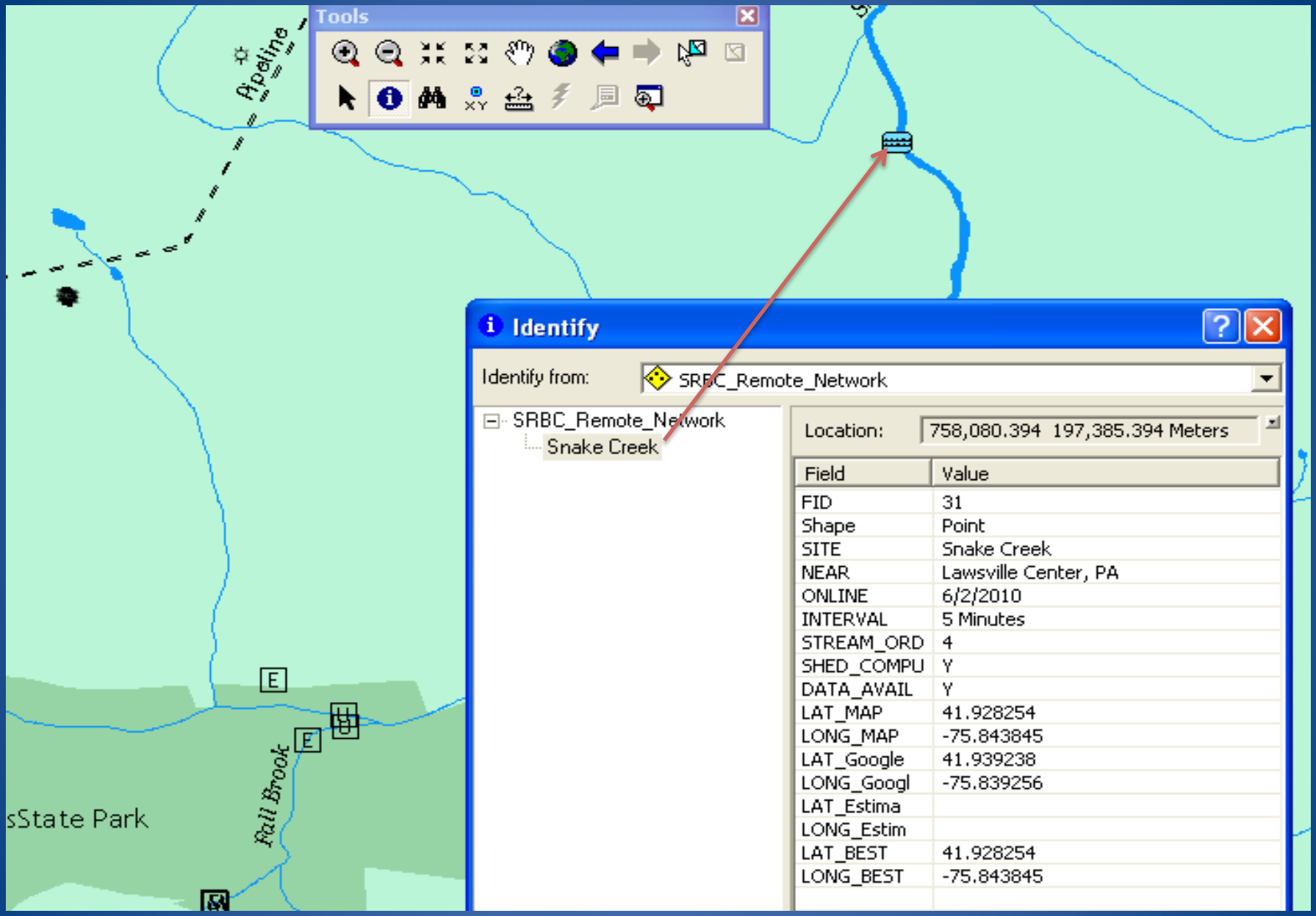



**Monitoring Programs – Silver Creek Watershed**

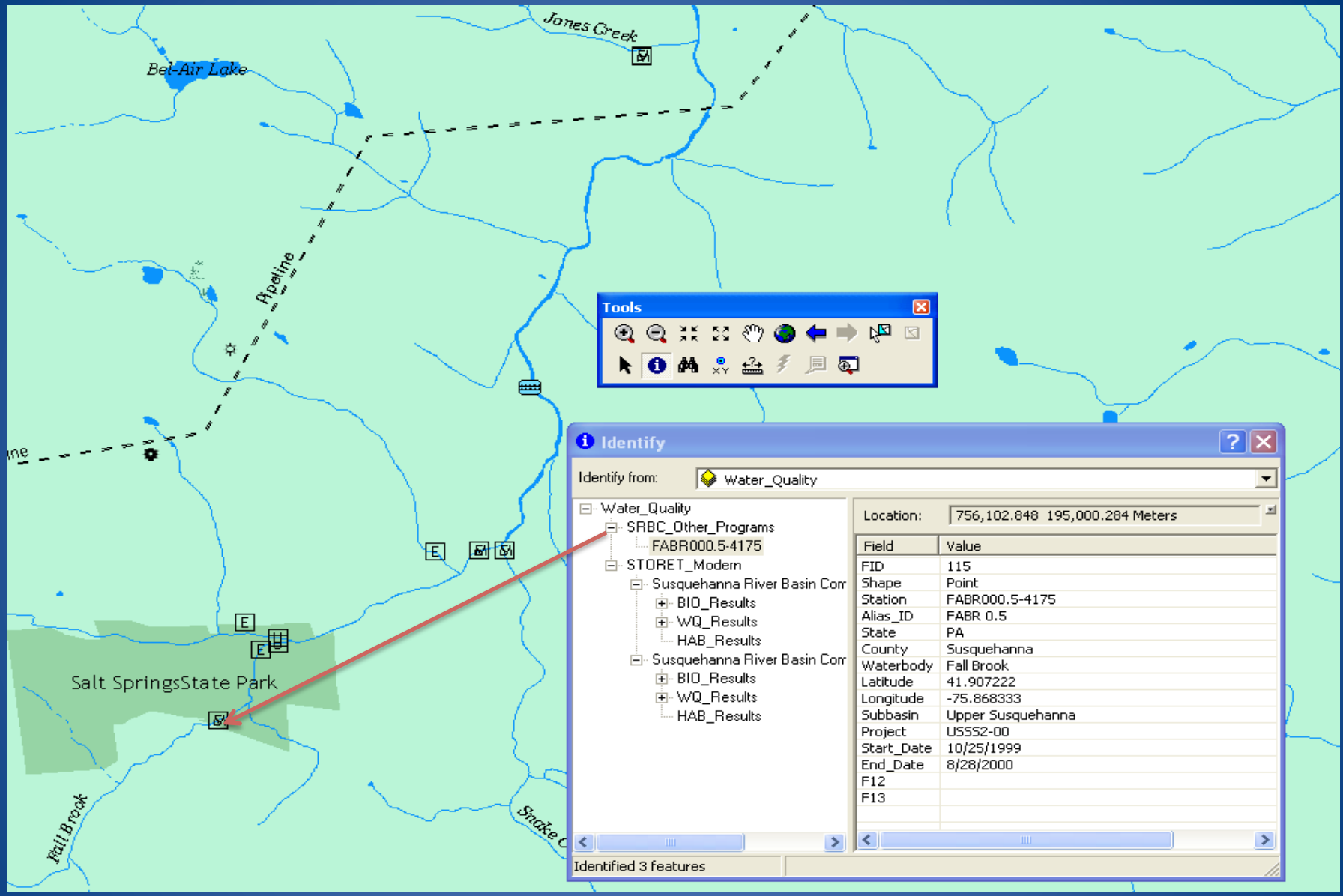



## Silver Lake Monitoring Results

2 sample results

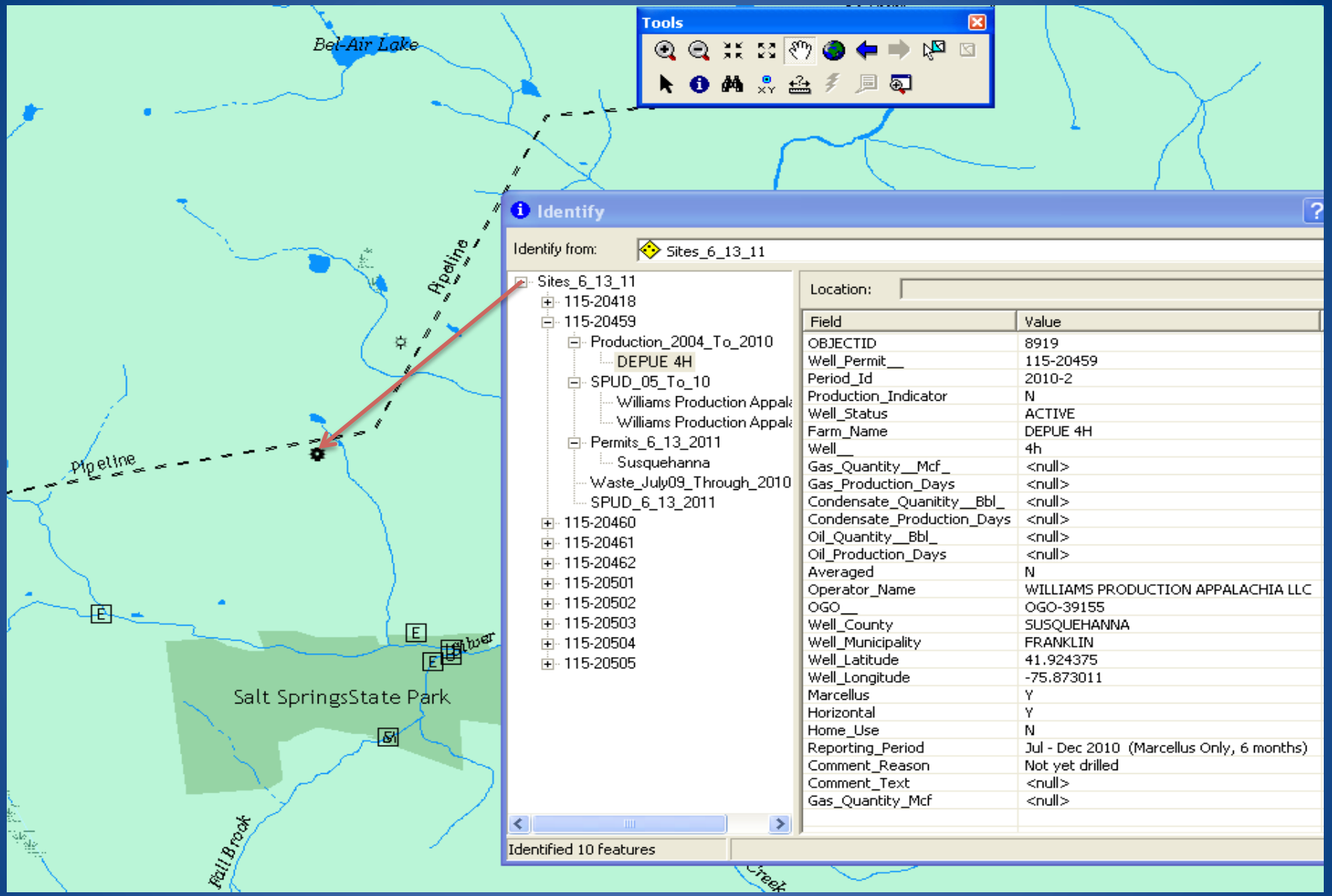



**SRBC Remote Water Quality Monitoring Program**



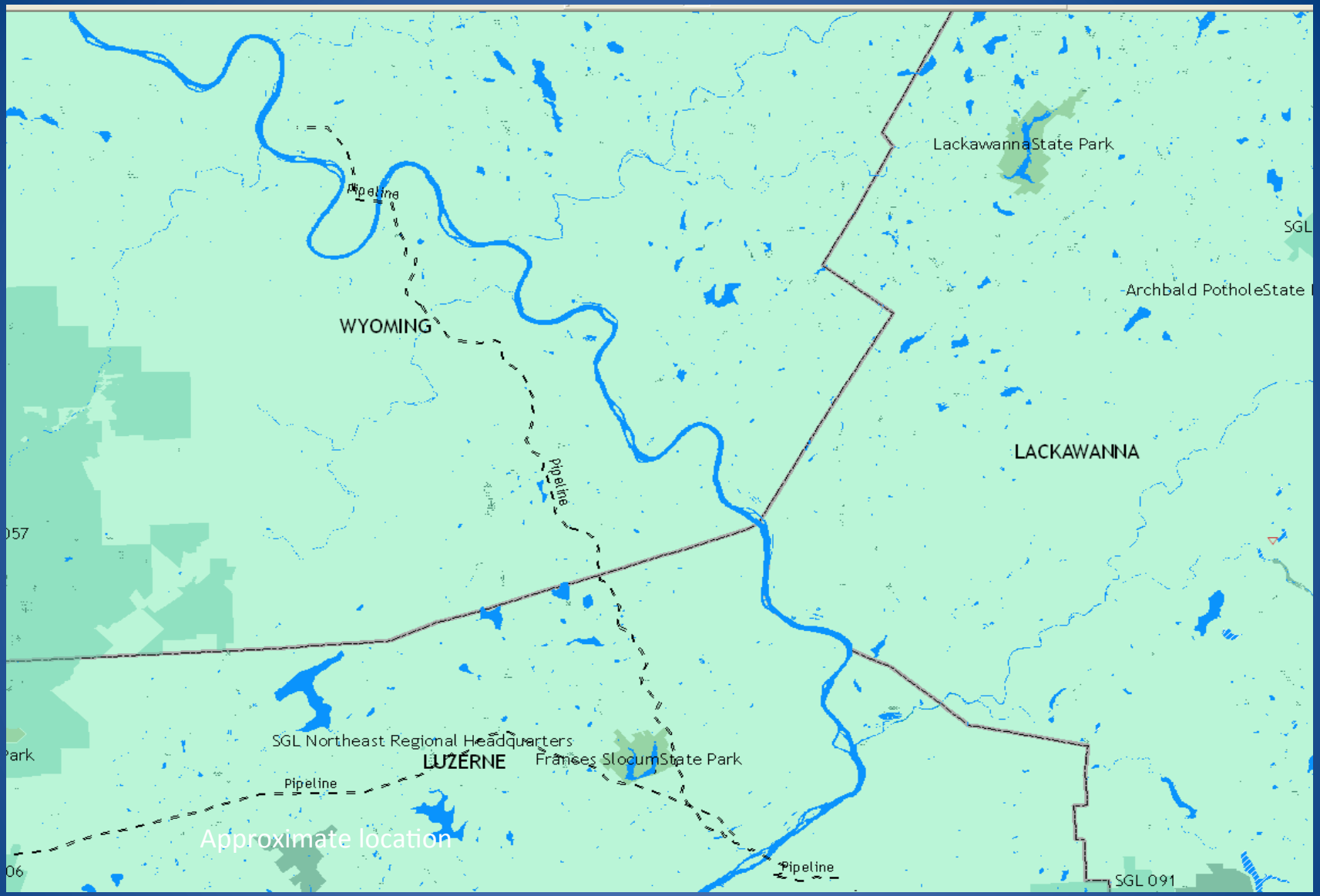

# Fall Brook Water Quality Monitoring

SRBC , Bio Monitoring




## Gas Well Data

Laser Gathering - approximate




# Proposed Auburn Line Extension Project

# Future Plans

- Continued Collection & Processing of Data
  - Recommendations re: Publication
  - Development of tools for data export
- Assessment of Existing Programs to Identify and Quantify Impacts of Marcellus Activities
- Water Quality Monitoring
  - Integration of historical & ongoing monitoring
  - Collaboration with WAs and monitoring groups
  - Collection of continuous WQ monitoring

# Summary

- Lots of Data Exist – Not Fully Utilized Due to
  - Lack of knowledge
  - Data management issues
- Are WQM Programs Adequate to Assess Marcellus Impacts?
- Can Citizens Contribute Scientific Knowledge Base?