



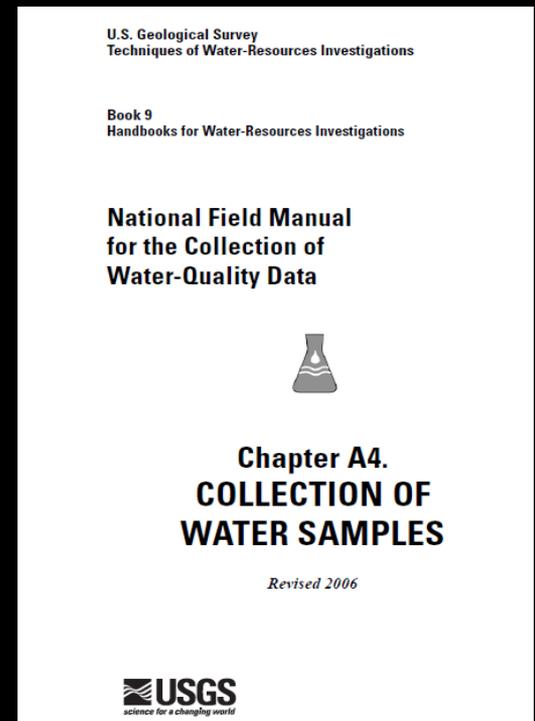
Water-Quality Sampling in Surface Water

USGS National Field Manual for the Collection of Water-Quality Data

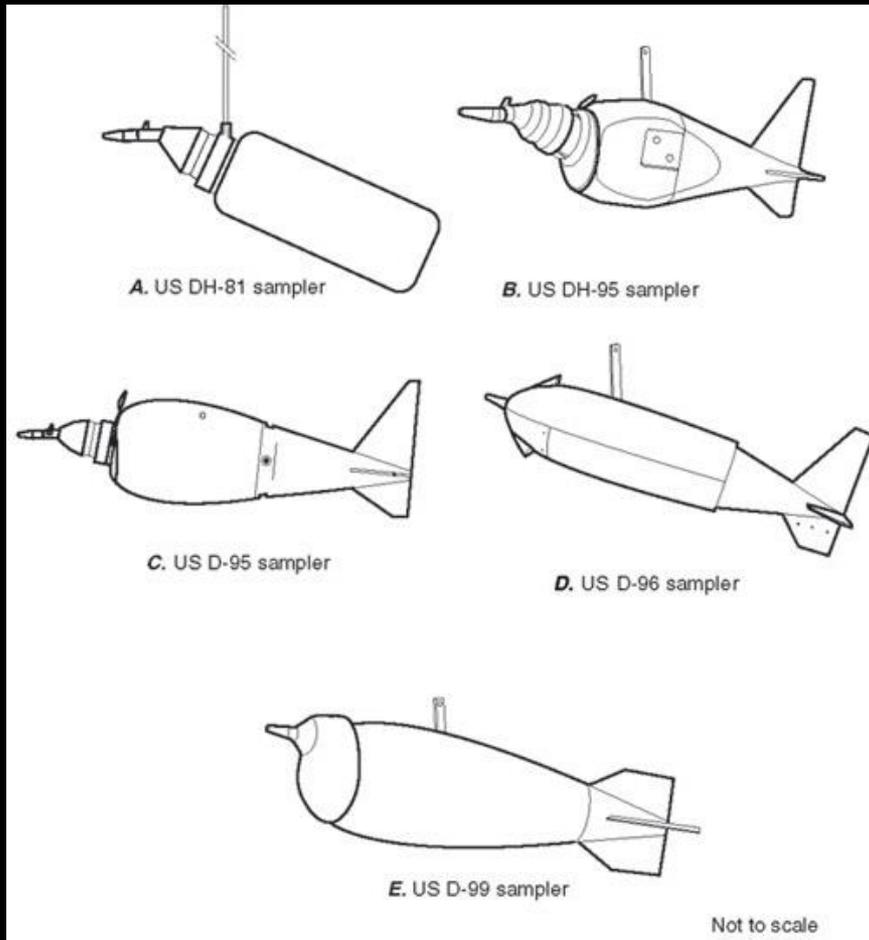
- Provides foundation for USGS water-quality training
 - Supports consistency in method implementation to produce comparable and transferable data
 - Minimizes data bias
 - Provides a scientifically defensible basis for collecting WQ samples.
- Primary reference for personnel



<http://water.usgs.gov/owq/FieldManual/>



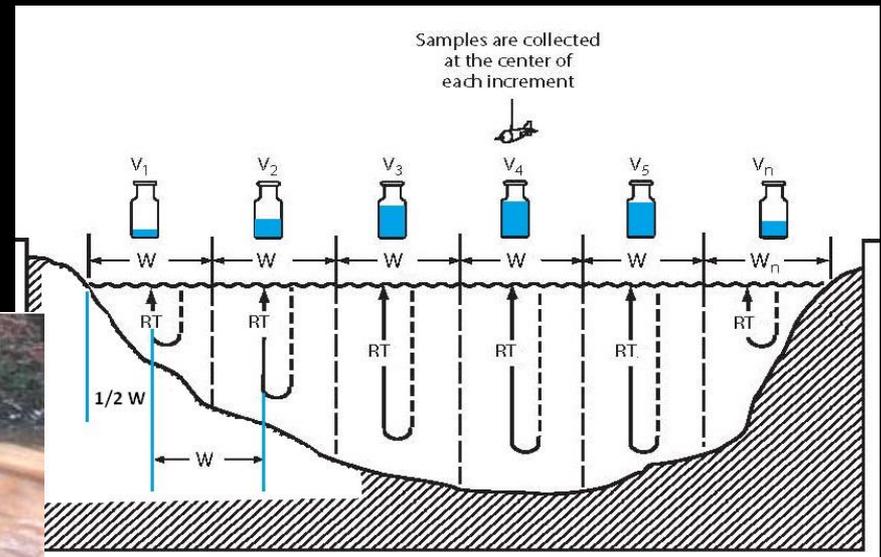
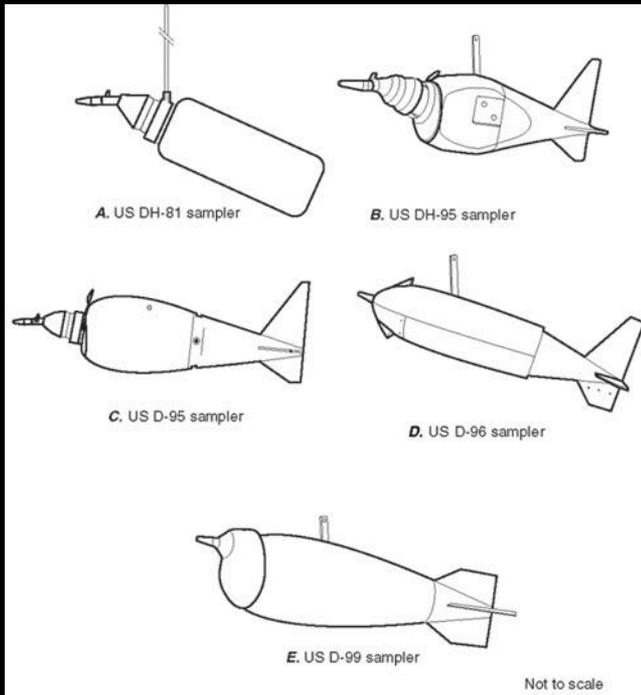
What water-quality sampling equipment is needed?



Types of Water-Quality Samplers

- Isokinetic samplers

- Depth-integrating methods designed to produce a representative discharge-weighted sample



Types of Water-Quality Samplers-- cont.

- **Nonisokinetic Samplers**

- **Devices where sample enters at velocity different than ambient stream velocity**

- **Dip (weighted-bottle)**
- **Discrete (point)**
- **Pump**

- **Use when...**

- **Velocity too high that isokinetic sampler cannot be lowered safely through water column**
- **Extreme-low flow (depth <1ft; velocity <1.5 ft/s)**
- **Study objectives dictate**



Processing Water-Quality Samples

- Processing occurs on site using mobile laboratory, unless a field office is close
- Chamber used to prevent contamination



Data-Quality Management

Quality Assurance/Quality Control---Integral component of all USGS water-quality studies

- Field QA/QC activities
 - Data-quality plans (blanks, replicates, spikes)
 - Good field practices
 - Clean hands/dirty hands techniques
 - National Field-Quality Assurance Program
- Laboratory QA/QC activities
 - Standard Reference Water Sample Project
 - Laboratory Evaluation Program



Laboratory Evaluation Program

- USGS Policy:** ALL analytical laboratories providing physical, chemical, radiochemical, and biological analyses to the USGS will be evaluated, approved, and regularly reviewed.

Laboratory Evaluation for the NWQL

Date: February 20, 2013

Project Information
 Project Name: A Multiple-Source Tracking Approach for Identifying Pollution Sources in the Little River Basin, Kentucky
 Project Number: GC13NG00F100020
 Cooperator: Little River Consortium through Hopkinsville Surface and Stormwater Utility
 Laboratory Name: National Water Quality Laboratory, Denver, CO
 WSC: Kentucky
 Project Chief: Aigis S. Crain
 LEP Reviewer: Timothy Willoughby
 WSC Director: William Guertel

Email: ascrain@hwsu.edu
willoughby@usgs.gov
wguertel@usgs.gov

PH: 502-493-1943
 317-600-2166
 502-493-1910

Project Description
 The current project is scheduled to occur through FY14 (2 years). In cooperation with the Little River Consortium through the Hopkinsville Surface and Stormwater Utility, water quality samples will be collected at 19 sites within the Little River Basin. Samples will be collected monthly as well as three to four storm events each year at all sites with a total of about 600 samples being collected. All laboratory data will be examined for gross error and any laboratory analytical variability for the selected nutrients.

The project is requesting the analysis of nutrients using Schedule 878 which follows the USGS Methods listed in Table 1. The expected concentrations for ammonia as N, ammonia + organic nitrogen as N, nitrite + nitrate as N, phosphorus, phosphate, ortho, and phosphorus (total) are presented in Table 1. Agricultural land use represents 60% of the study area, with forests representing 30%, and urban areas representing 10%. Approximately 15 percent of the collected water-quality samples will consist of equipment blanks, field blanks, and replicate samples for quality assurance of laboratory analyses.

Laboratory Information
 National Water Quality Laboratory, Lakewood, CO
 Lab Help (LabHelp@usgs.gov) (866) 275-6975
 Inorganic Parameters: Harold Ardourel 303-236-3151

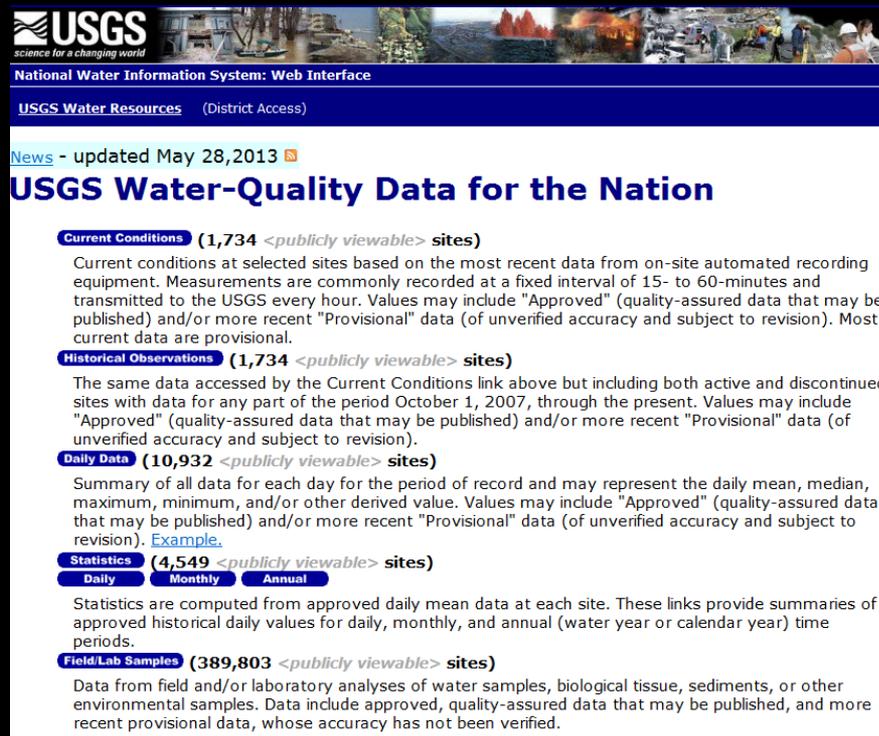
List of Analytes, Methodology, and Reporting Levels

Analyte	USGS Parameter Code	Project Expected range (mg/L)	RL (mg/L)	Unit	Method
Nitrogen, ammonia as N	00608	0.02-0.7	0.02	mg/L	3005, 491, 1, 2022, 40
Nitrogen, ammonia + organic	00625	0.14-4.0	0.14	mg/L	3005, Schedule 878 1-491 (S-2) NWQL, Schedule 878



National Water Information System (NWIS)

- Principal repository of water-resources data



USGS
science for a changing world

National Water Information System: Web Interface

[USGS Water Resources](#) (District Access)

News - updated May 28, 2013

USGS Water-Quality Data for the Nation

Current Conditions (1,734 <publicly viewable> sites)
Current conditions at selected sites based on the most recent data from on-site automated recording equipment. Measurements are commonly recorded at a fixed interval of 15- to 60-minutes and transmitted to the USGS every hour. Values may include "Approved" (quality-assured data that may be published) and/or more recent "Provisional" data (of unverified accuracy and subject to revision). Most current data are provisional.

Historical Observations (1,734 <publicly viewable> sites)
The same data accessed by the Current Conditions link above but including both active and discontinued sites with data for any part of the period October 1, 2007, through the present. Values may include "Approved" (quality-assured data that may be published) and/or more recent "Provisional" data (of unverified accuracy and subject to revision).

Daily Data (10,932 <publicly viewable> sites)
Summary of all data for each day for the period of record and may represent the daily mean, median, maximum, minimum, and/or other derived value. Values may include "Approved" (quality-assured data that may be published) and/or more recent "Provisional" data (of unverified accuracy and subject to revision). [Example](#).

Statistics (4,549 <publicly viewable> sites)
[Daily](#) [Monthly](#) [Annual](#)
Statistics are computed from approved daily mean data at each site. These links provide summaries of approved historical daily values for daily, monthly, and annual (water year or calendar year) time periods.

Field/Lab Samples (389,803 <publicly viewable> sites)
Data from field and/or laboratory analyses of water samples, biological tissue, sediments, or other environmental samples. Data include approved, quality-assured data that may be published, and more recent provisional data, whose accuracy has not been verified.

Water-Quality Projects in the Kentucky Water Science Center

National Projects

Cooperative Projects

USGS National Programs

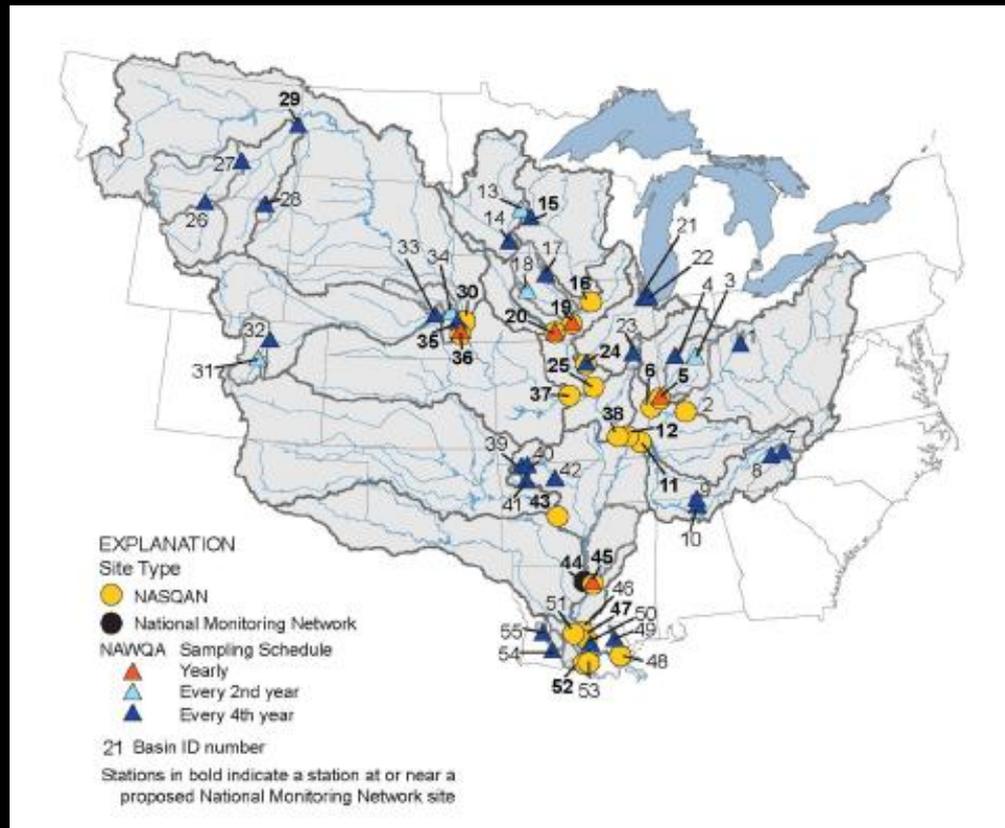
- **National Stream Quality Assessment Network (NASQAN)—Large Rivers**



- **Midwest Stream Quality Assessment (MSQA)**



National Stream Quality Accounting Network (NASQAN) in the Mississippi River Basin



What is NASQAN? (Mississippi River Basin)

- Network of 17 large river surface-water-quality stations that are sampled 14 times/year
 - KY WSC samples 4 stations
 - Ohio River at Cannelton, IN
 - Ohio River at LD53 near Grand Chain, IL
 - Wabash River at New Harmony, IN
 - Tennessee River near Paducah, KY



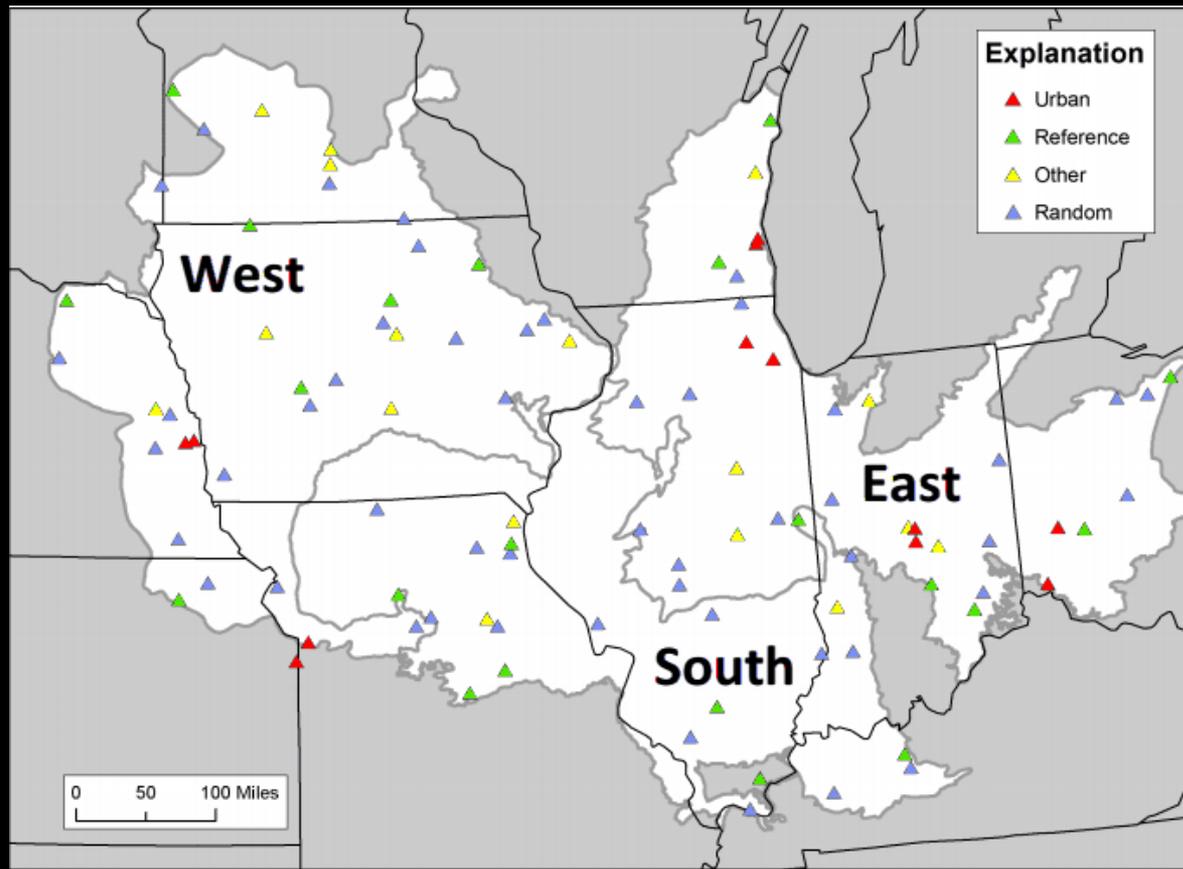
NASQAN objectives

- Determine annual and seasonal loads of nutrients
- Determine changes in loads and concentrations of nutrients, carbon, and select pesticides through time
- Determine concentrations and loads of these constituents in major subbasins (e.g. Ohio River)

NASQAN Sample Collection

- **Field parameters: Temp., SC, turbidity, DO, pH, alkalinity**
- **Discharge**
- **Suspended sediment and percent <63 um**
- **Nutrients**
- **Major ions**
- **Pesticides – water soluble**

Midwest Stream Assessment (MSQA)



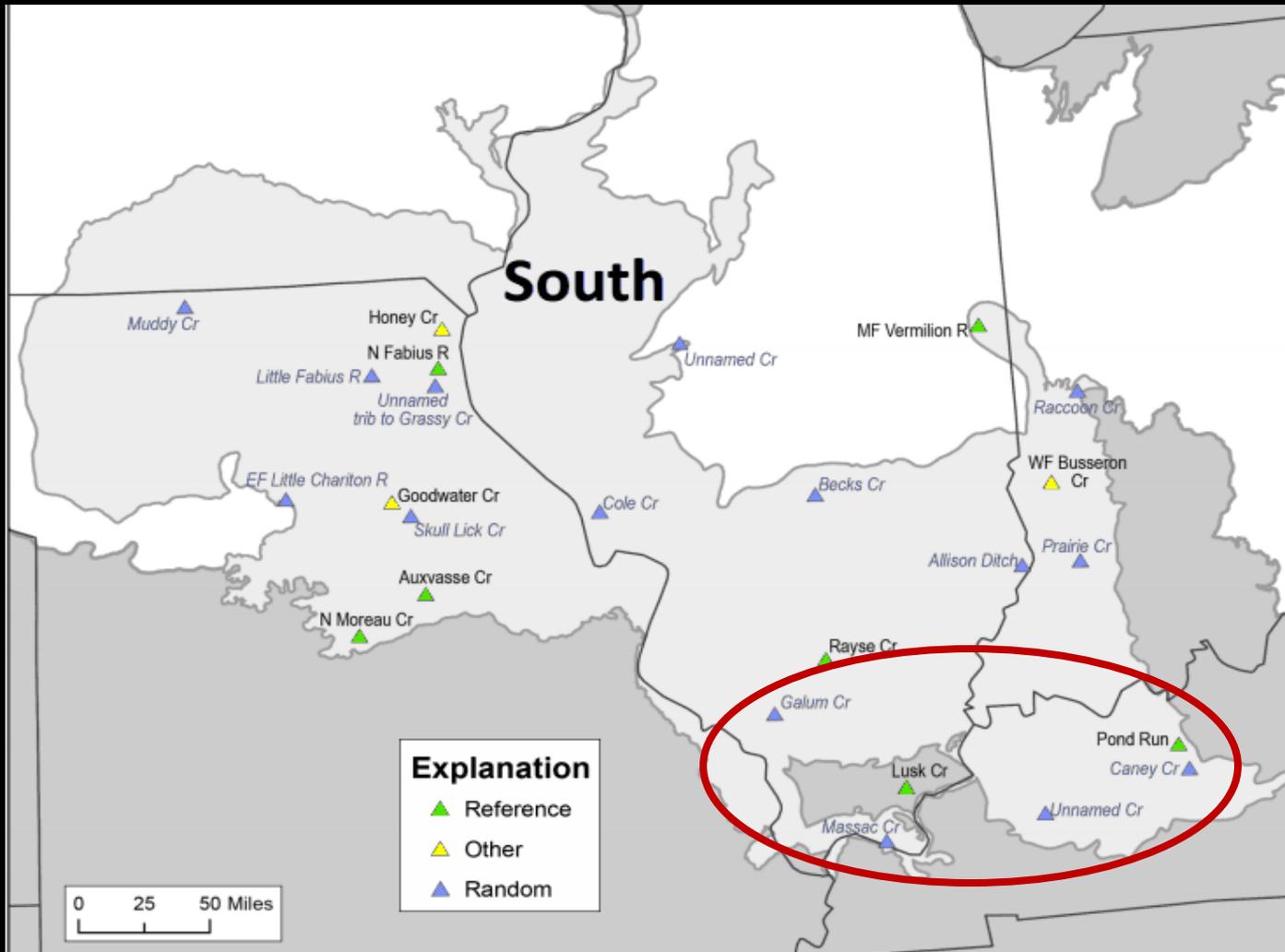
What is MSQA?

- **Collaboration with USEPA National Rivers and Streams Assessment (NRSA)**
- **Network of 100 stations in Midwest perennial streams**
 - **KY WSC samples 6 sites (3 in KY; 3 in southern IL)**
- **Study Components**
 - **Ecological conditions – 1 time in summer**
 - **Water-quality sampling – weekly for 12 weeks**
 - **Sediment sampling – weekly for 12 weeks**
 - **Passive samplers – deployed 4 to 6 weeks**

MSQA objectives

- **Assess status of ecological conditions; assess geographic distribution of spring-summer concentrations of nutrients, sediment, pesticides**
- **Assess relations among constituent concentrations and ecological conditions in sampled streams**
- **Identify and evaluate statistically the factors affecting constituent concentrations and ecological conditions**

Site Location

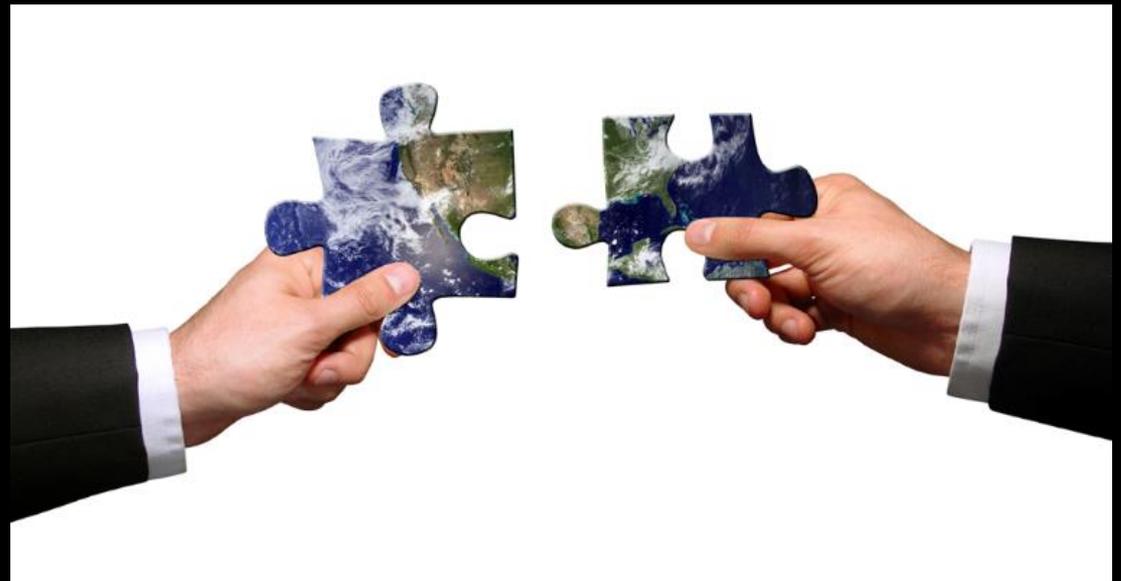


MSQA sample collection

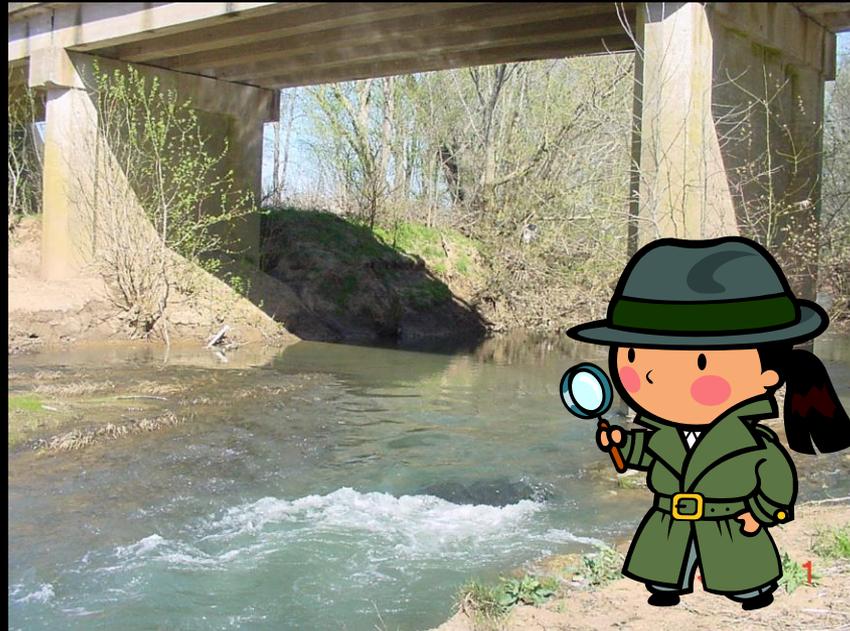
- **Field parameters: Temp., SC, DO, pH**
- **Discharge**
- **Suspended sediment and percent <63 um**
- **Nutrients and major ions**
- **Pesticides (~250)**
- **Biological: algae, benthic macroinverts, fish**
- **Physical habitat**

Cooperative Projects

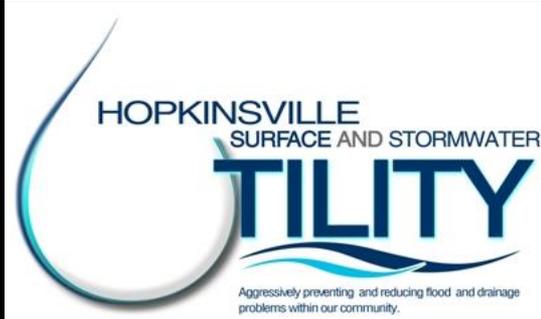
- Multiple-Source Tracking
- Nutrient/Sediment Monitoring--Quantifying Loads in Ohio and Green Rivers
- Nutrient Monitoring--Inner Bluegrass Ecoregion



A Multiple-Source Tracking Approach for Identifying Pollution Sources in the Little River Basin, Kentucky



Partnerships



AGRI^FCHEM, LLC

And many others

Purpose

- Apply a multiple-source tracking approach to identify various source(s) of pathogens, sediment, and nitrogen
- Study will help guide placement of effective best management practices in the basin



Scope and Objectives

- Three-year study with two years of water-quality sampling under various hydrologic and seasonal conditions
- Third year—Document techniques used for data collection and analysis along with study findings.

Objectives

1. Identify source(s) of bacterial contamination using microbial-source tracking (host-specific markers)
2. Evaluate utility of stable isotopes for characterizing nitrogen sources
3. “Fingerprint” potential sources of fine-grained suspended sediment

What is Microbial-Source Tracking?

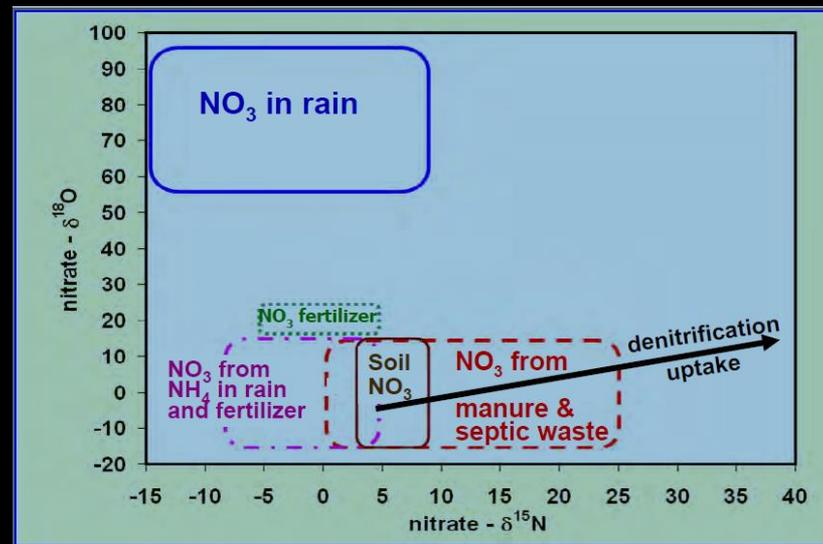
- **Concept**—the intestinal microbes of animal groups are expected to be different because of:
 - **Basic habitat**
 - Body temperature, food supply, digestive system
 - **Natural selection**
 - Direct competition, prior exposure to agents like antibiotics
- **Differences can lead to host-associated genetic markers (genes)**

The process

- 1. Choose host-associated targets that are in the feces of local source groups**
- 2. Characterize “known-source material” (also known as manure and sewage) from local sources**
- 3. Test water for fecal contamination**
- 4. Associate contamination with sources**

Use of stable isotopes

- Many different sources of nutrients have distinctive isotope ratios;
- Many different process (e.g., denitrification, nitrification) change the isotope ratio of the reactants and products;
- In other words, different sources of nitrate often have **distinctive isotope “fingerprints”** that can provide a better understanding of the system than just chemical data alone.

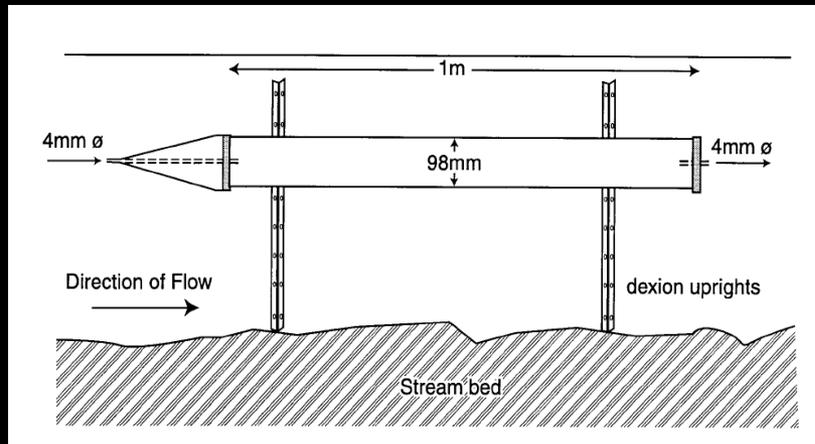


What is Sediment Fingerprinting?

- **Concept** and underlying principle—potential that fine-grained sediment sources can be characterized in a watershed using a number of diagnostic physical and chemical properties
- Comparison of these fingerprints (tracers) with equivalent information for suspended-sediment samples at the watershed outlet permits the relative importance of the potential sources

Sediment Fingerprinting

- Collect sediment-source samples from identified source areas (i.e. agriculture, forest) and from stream banks and bed
- Collect fine sediment samples using passive sediment samplers



Passive sediment sampler

Improving Comprehensive Nutrient Monitoring for Quantifying Nutrient Loads from Kentucky



Objectives

- Establish a new, but critical, streamflow-gaging station with a nitrate sensor near the mouth of the Green River; a basin targeted by the NRCS Mississippi River Basin Initiative (MRBI).
- Determine relations between nitrate sample concentrations and nitrate sensor readings.
- Determine concentrations and loads of nutrients and sediment near the mouth of the Green River, and at Ohio River at Greenup Dam near Greenup, Kentucky (former NASQAN site)

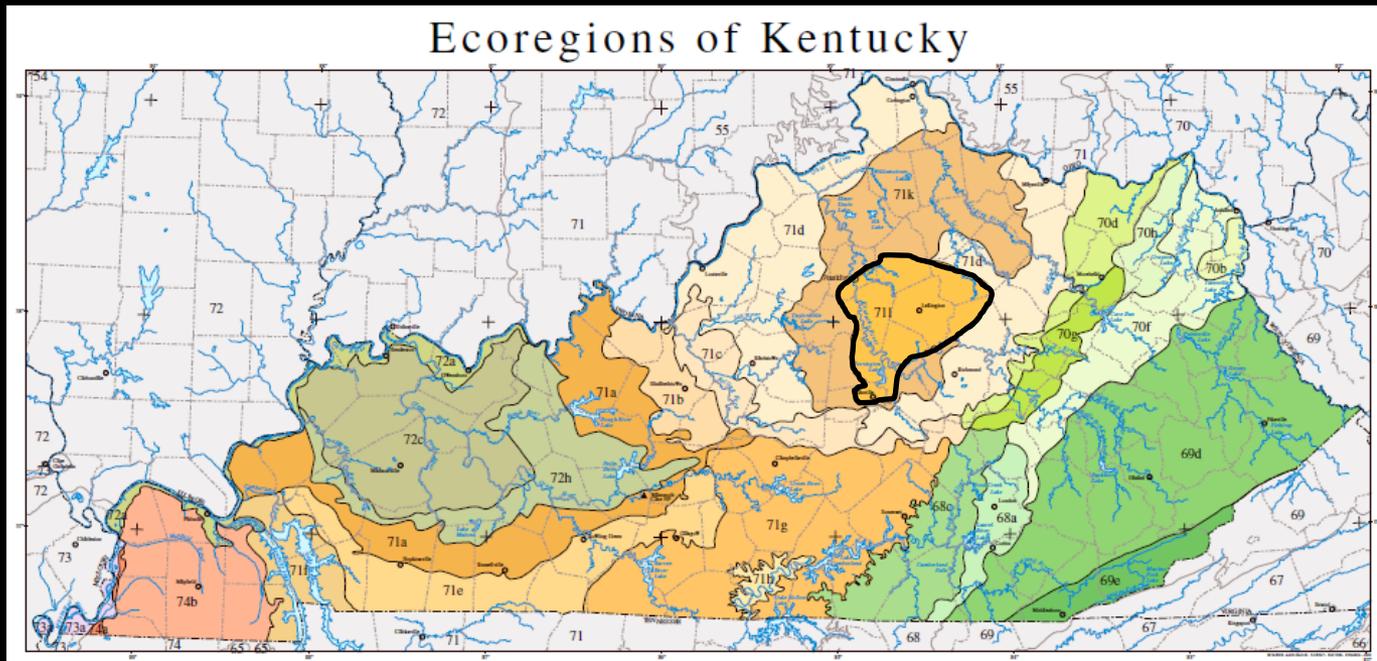
Site Location



Sample collection

- **Field parameters: Temp., SC, DO, pH, and turbidity**
- **Discharge**
- **Real-time nitrate sensor**
- **Nutrients**
- **Silica**
- **Suspended sediment**
- **Stable isotopes**

Nutrient data-collection in wadeable streams in the Inner Bluegrass Ecoregion (71l) in Kentucky



Inner Bluegrass sample collection

- Scope: monthly sampling for 12 months
- Field parameters: Temp., SC, DO, pH, and turbidity
- Discharge
- Nutrients
- Physical habitat



Questions?



THANK YOU!