



Empowering Virginia's Well and Spring Users: The Virginia Household Water Quality Program

Erin Ling, Program Coordinator
Virginia Tech Biological Systems Engineering



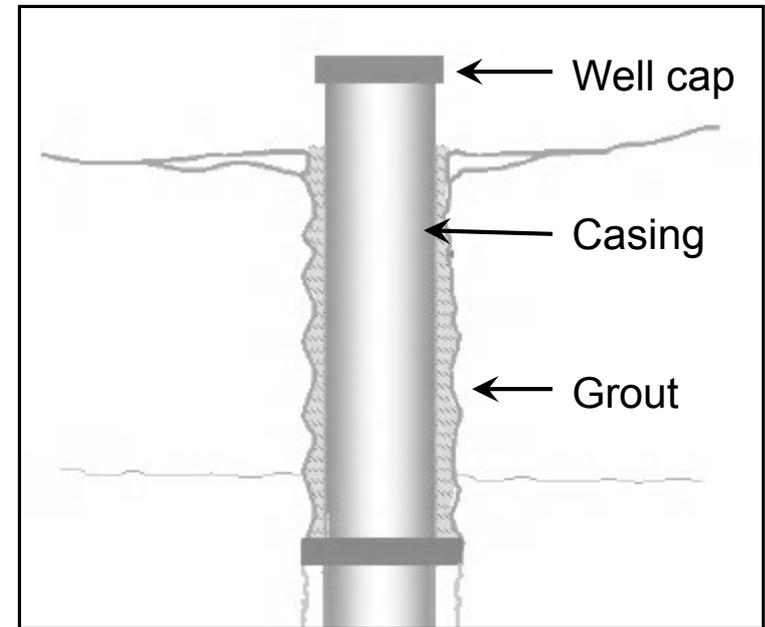
Private Water Supplies in Virginia

- About 1.7 million people, or 22% of Virginians rely on wells, springs or cisterns (USGS, 2010)
- Decrease in waterborne disease outbreaks overall since the 1980's, relative **INCREASE** in outbreaks associated with private water supplies (Craun, et al., 2010)
- Homeowners relying on private water supplies:
 - Are responsible for all aspects of water system management
 - Often lack knowledge and resources to effectively manage
 - Usually don't worry about maintenance until problems arise



Overview of private water supplies

- Wells
 - Drilled or bored
 - Range from 20-1000' feet deep
 - Locate at least 100' from sources of contamination
 - Casing, grouting, sanitary well cap protect well from surface water contamination



Overview of private water supplies

▶ Springs

- ▶ Formed when side of a hill, valley bottom, or other excavation intersects groundwater
- ▶ Highly susceptible to contamination

▶ Cisterns

- ▶ Collection and storage of rainwater, often from rooftop



What is the VAHWQP?



- Established in 1989
 - County-based drinking water clinics
 - Coordinated with trained local extension agents
 - Confidential and affordable
 - Homeowners collect samples; samples analyzed at VT labs
 - Interpretation meeting: test results, interpretation and basic information about maintenance and addressing problems
 - 22,500 samples analyzed from 93/95 counties
-



Drinking water clinics

- Testing for :
 - Total coliform (MPN)
 - E. Coli (MPN)
 - Nitrate
 - Fluoride
 - Sodium
 - Manganese
 - Copper
 - pH
 - Total dissolved solids
 - Sulfate
 - Hardness
 - Arsenic
 - Lead

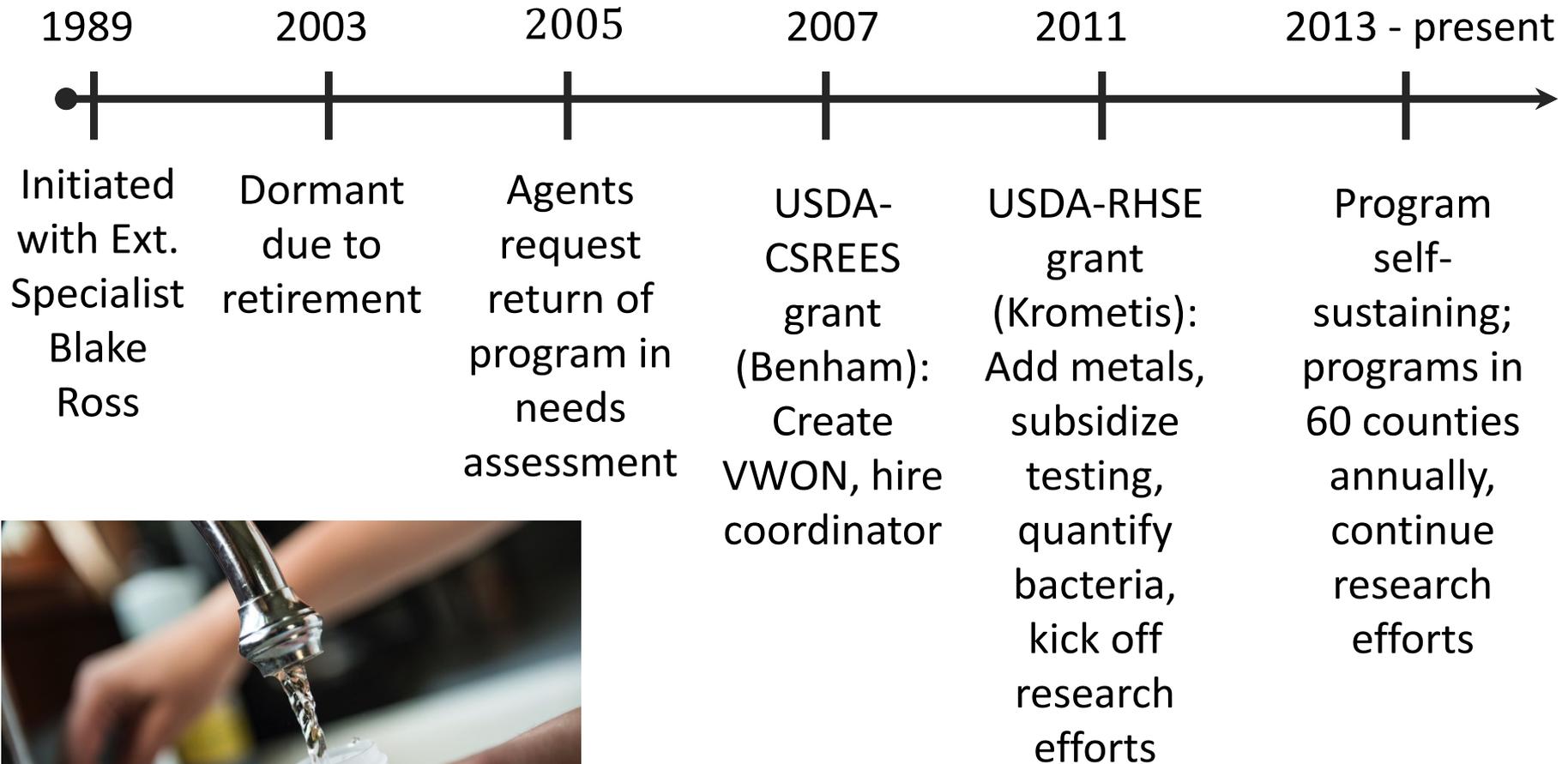


Virginia Well Owner Network (VWON)

- Adapted from PA MWON in 2007; mechanism for training extension agents (to conduct drinking water clinics), volunteers and agency collaborators (VDH and DEQ)
 - One-day training workshops held across VA; vary regionally
 - Guest speakers: drilling companies and state agencies
 - Topics:
 - Groundwater hydrology
 - Proper well location, construction and maintenance
 - Land use impacts /wellhead protection
 - Water testing and interpretation
 - Solving water problems/treatment
 - **80 extension agents; 70 volunteers; 31 agency collaborators**
-



VAHWQP Timeline



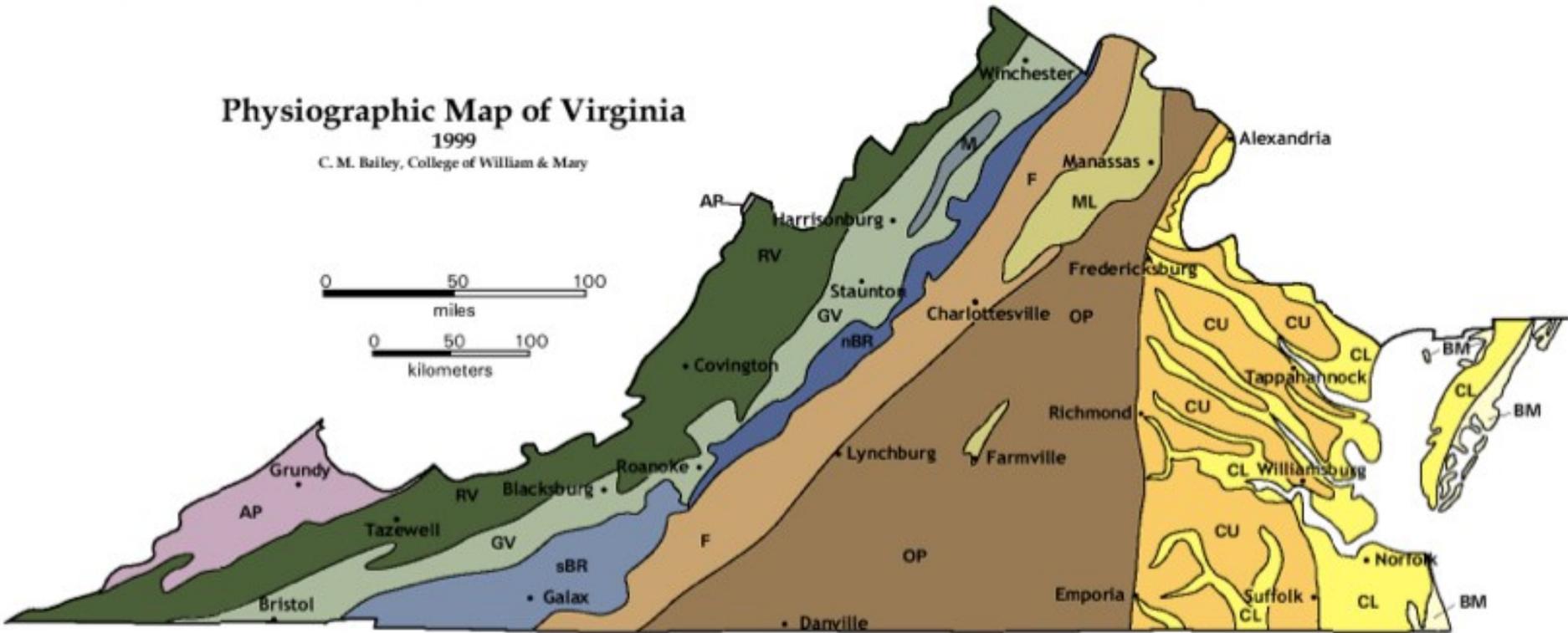
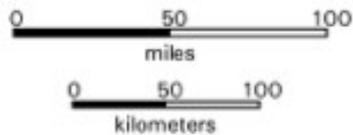
Place-based GROUNDWATER Education?



Physiographic Provinces of Virginia

Physiographic Map of Virginia 1999

C. M. Bailey, College of William & Mary



Appalachian Plateau province

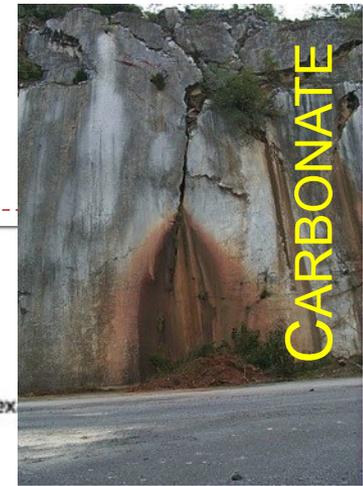
Valley & Ridge province

Blue Ridge province

Piedmont province

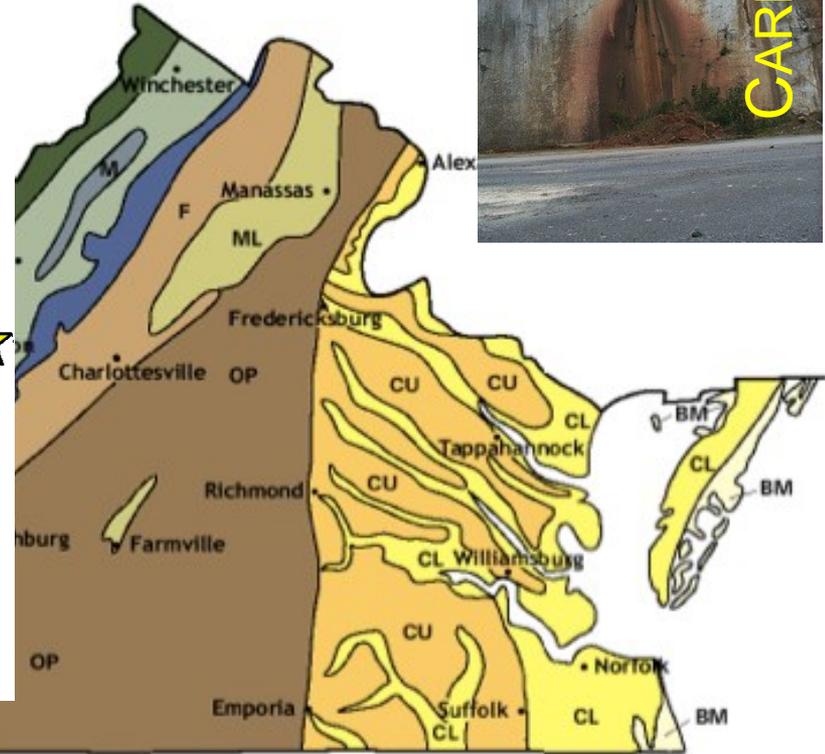
Coastal Plain province

Augusta County



KARST LANDSCAPE; LOTS OF AG
CARBONATE ROCK – LIMESTONE
HIGH CONNECTIVITY BETWEEN
SURFACE AND GROUNDWATER
SANDSTONE ON RIDGES
WELL WATER QUALITY TENDS TO BE:

- HIGH IN MINERALS (HARD)
- BACTERIA AND NITRATE
- NEUTRAL PH
- POCKETS OF FE AND MN



**Appalachian
Plateau province**

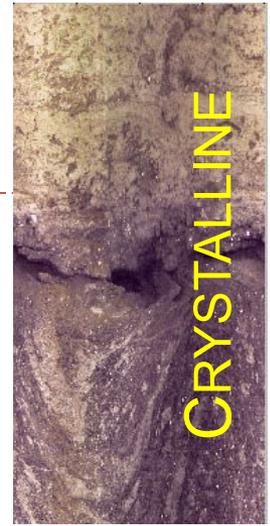
**Valley & Ridge
province**

**Blue Ridge
province**

**Piedmont
province**

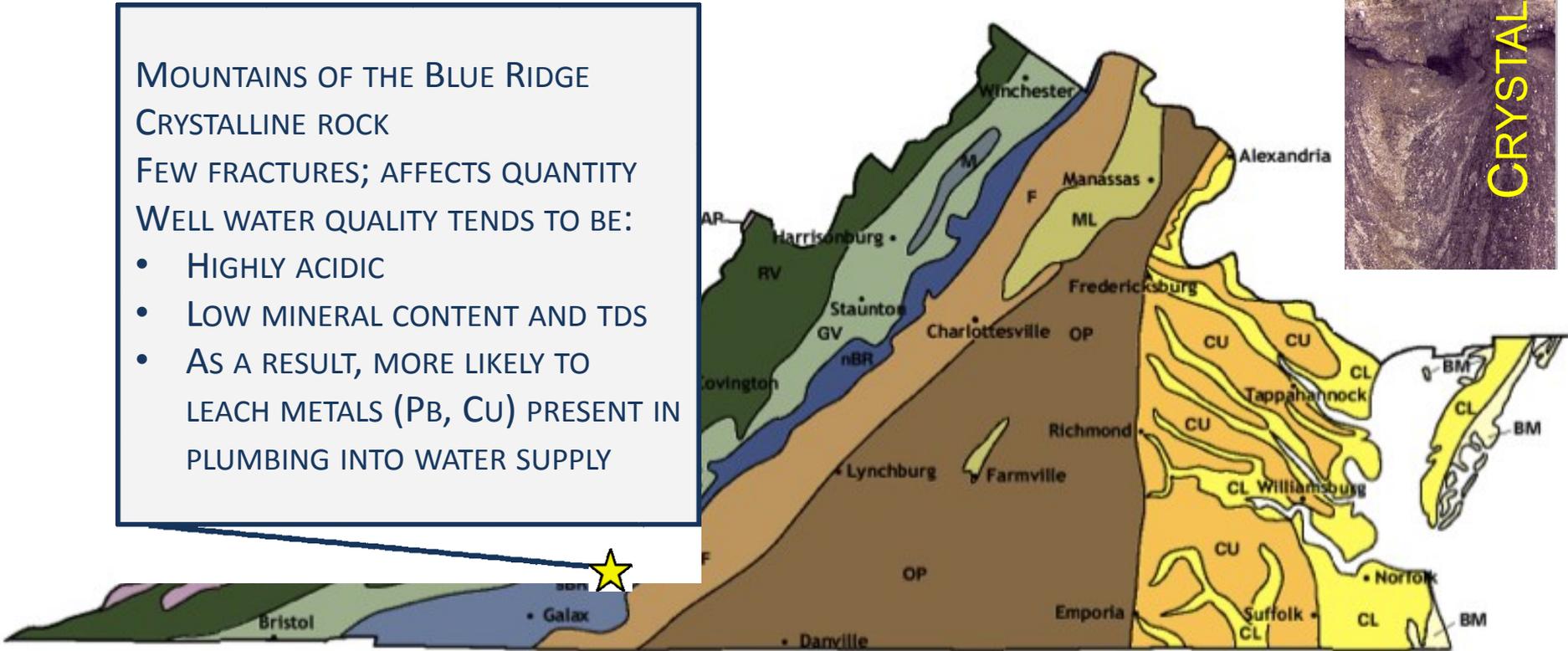
**Coastal Plain
province**

Floyd County



MOUNTAINS OF THE BLUE RIDGE
CRYSTALLINE ROCK
FEW FRACTURES; AFFECTS QUANTITY
WELL WATER QUALITY TENDS TO BE:

- HIGHLY ACIDIC
- LOW MINERAL CONTENT AND TDS
- AS A RESULT, MORE LIKELY TO LEACH METALS (Pb, Cu) PRESENT IN PLUMBING INTO WATER SUPPLY



Appalachian Plateau province

Valley & Ridge province

Blue Ridge province

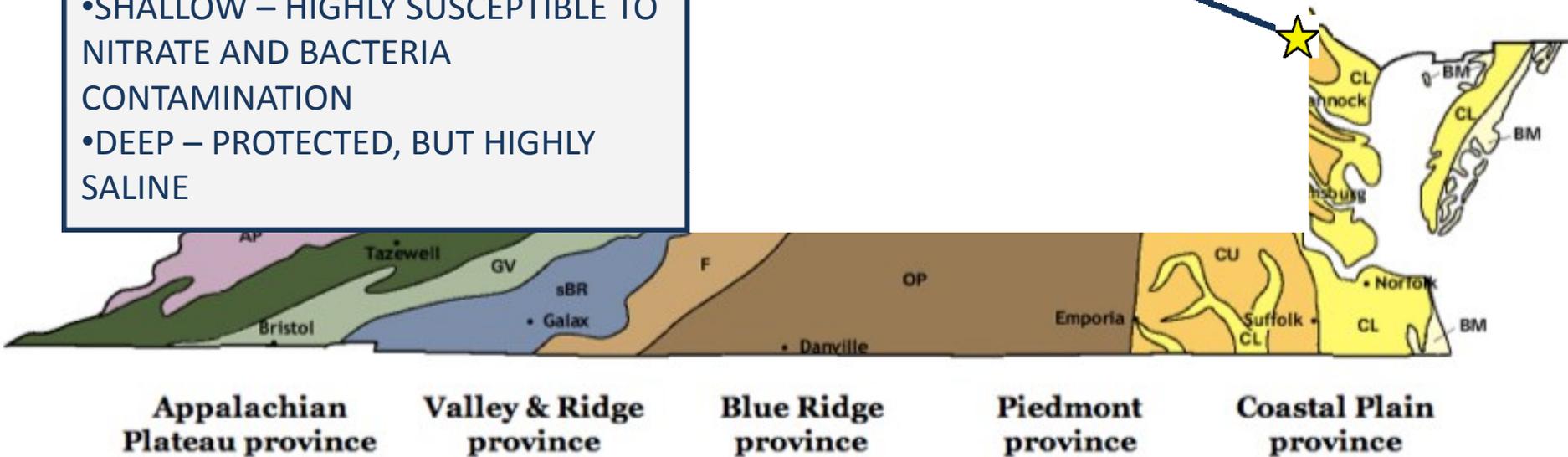
Piedmont province

Coastal Plain province

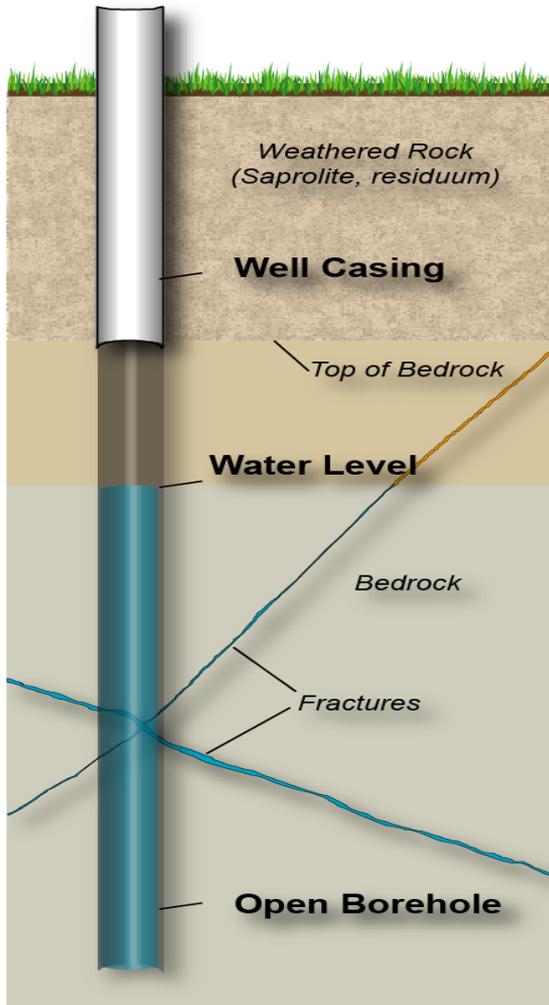
Northumberland County

UPPERMOST PENINSULA INTO THE BAY
UNCONSOLIDATED SANDY SEDIMENT
WELL WATER QUALITY TENDS TO BE:

- DIFFERENT DEPENDING ON DEPTH
- SHALLOW – HIGHLY SUSCEPTIBLE TO NITRATE AND BACTERIA CONTAMINATION
- DEEP – PROTECTED, BUT HIGHLY SALINE



Basic well concepts: How does water move to my well?



Basic well concepts:

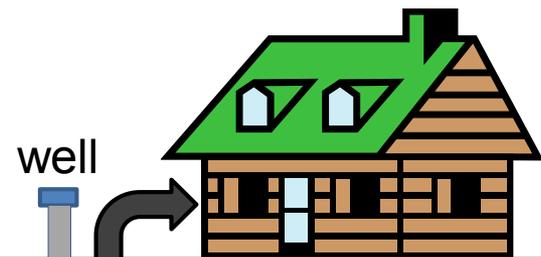
Proper well location and construction

- At least 50-100' and upslope from contamination sources
- Not in an area that receives runoff
- Ground surface slopes away from well
- Well casing at least 12" above ground
- Grout seal around casing (have checked by a well driller)
- Sanitary well cap (left; drilled well) or sealed concrete cover (right; bored well)



Sources of potential contaminants or issues of concern

Surface water contamination: nitrate, bacteria



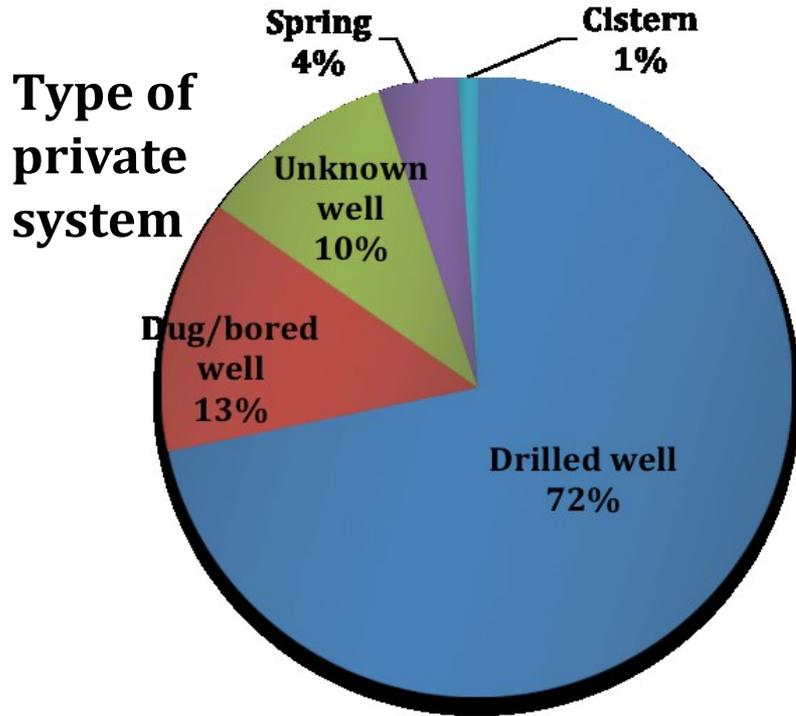
Source may be plumbing materials or existing water treatment device:
sodium
copper
lead
bacteria

Where a contaminant comes from affects how we can deal with it!

Some are found in groundwater naturally, or due to human activities on or below ground:

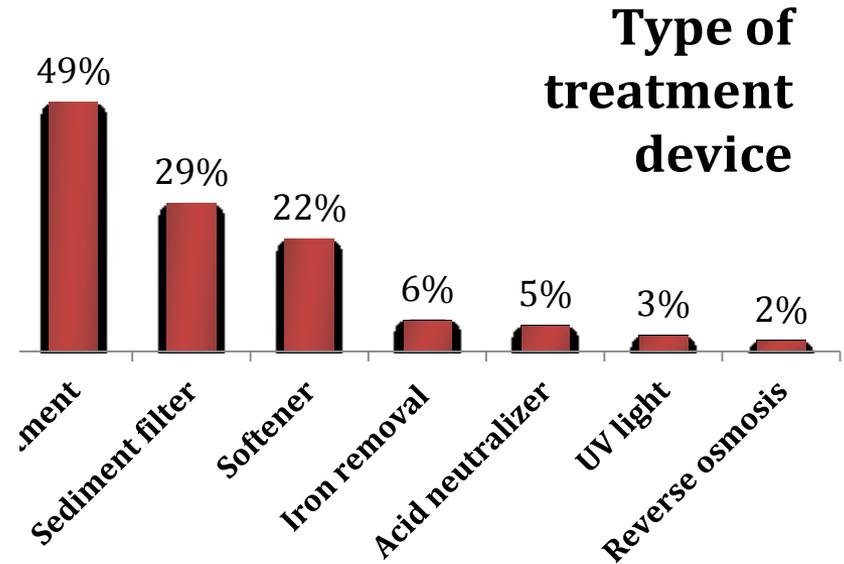
- pH/corrosivity
- chloride
- nitrate
- fluoride
- manganese
- sulfate
- TDS
- sodium
- iron
- arsenic
- hardness

System Characteristics (2008-2015; n=6866)



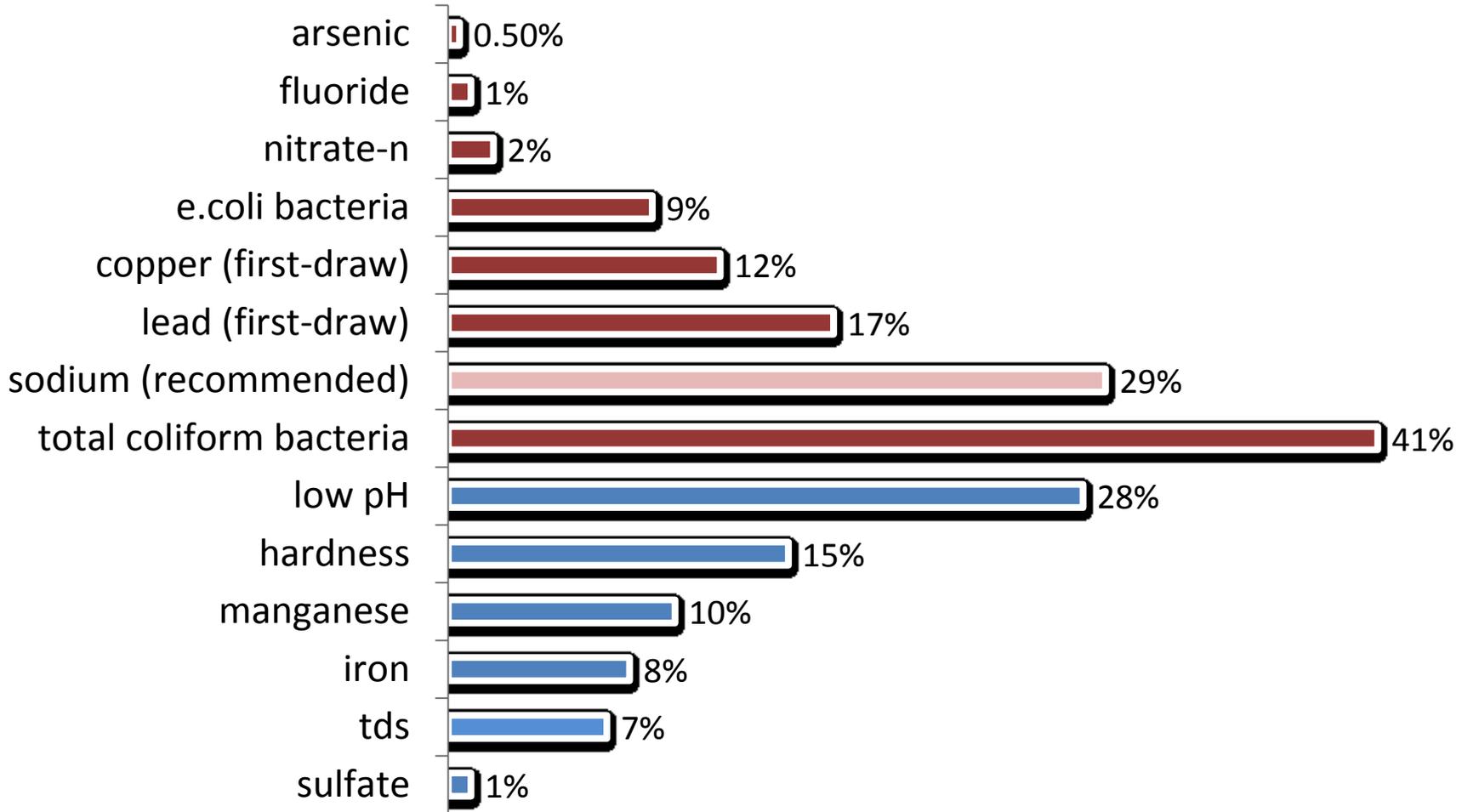
Wells are an average of **25** years old.

80% of participants have never tested or tested only once.



The most common treatment devices are for **aesthetic** contaminants.

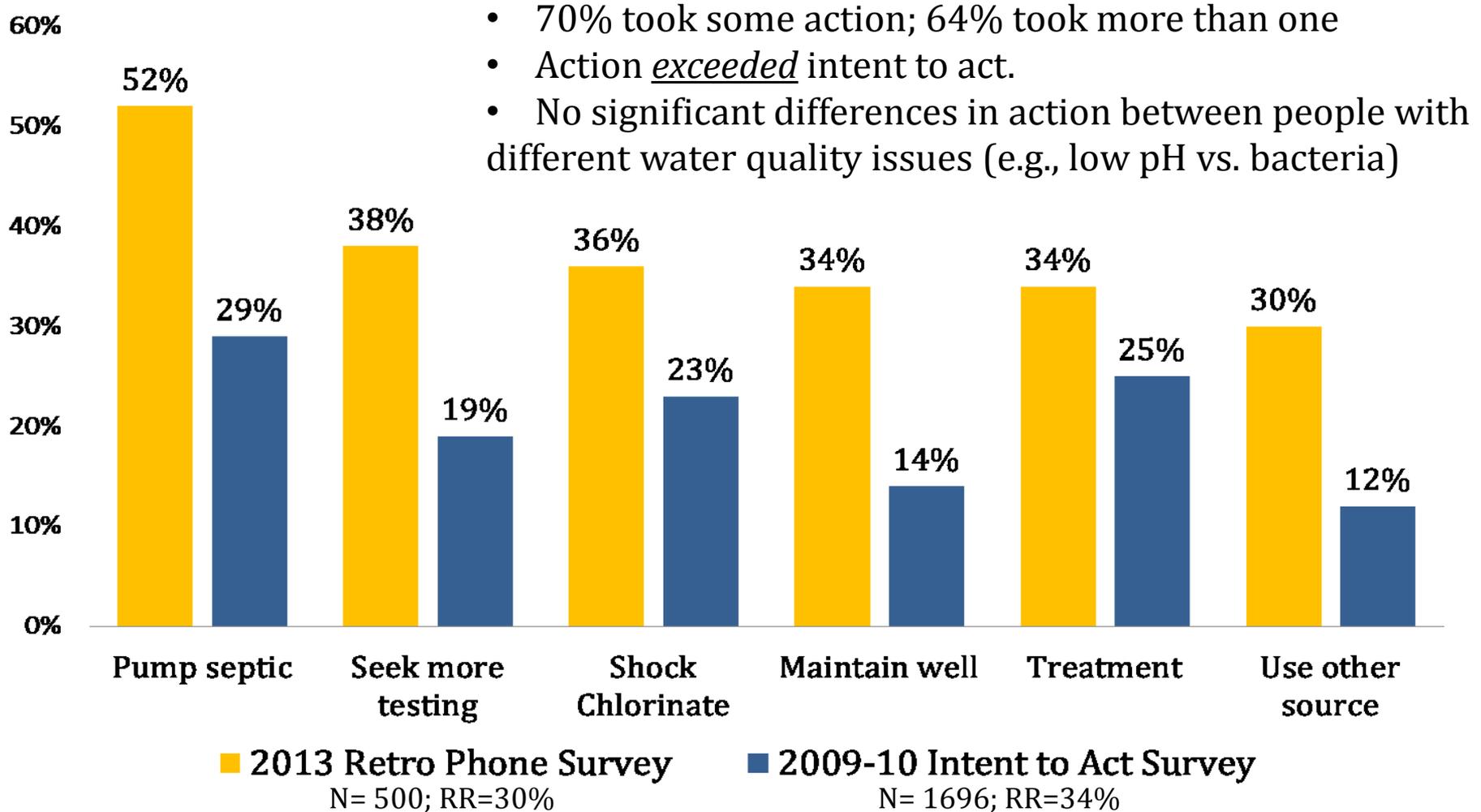
What's in the water*? (2008-2015; n=6866)



*% exceeding EPA standards or recommendations according to SDWA (municipal regulations)

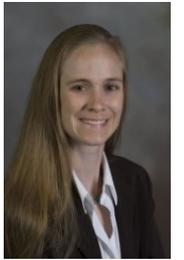


Intent to Act vs. Action



Key Partnerships

- Virginia Water Well Association
 - WellCheck initiative
 - Guest speakers, resources, technical assistance
 - Federal and state agencies – USGS, Dept of Health, Dept of Environmental Quality
 - Southeast Rural Community Assistance Project
 - Research collaboration with faculty and grad students
 - Bacteria source tracking
 - Metals (lead) profiling
 - Student involvement in outreach
 - Arsenic risk model
 - Emerging contaminants
-



Informed homeowners need help!



I need help figuring out my options for water treatment!

I need help shock chlorinating my system!



I need a new well cap!



I need my well repaired!



WellCheck Network

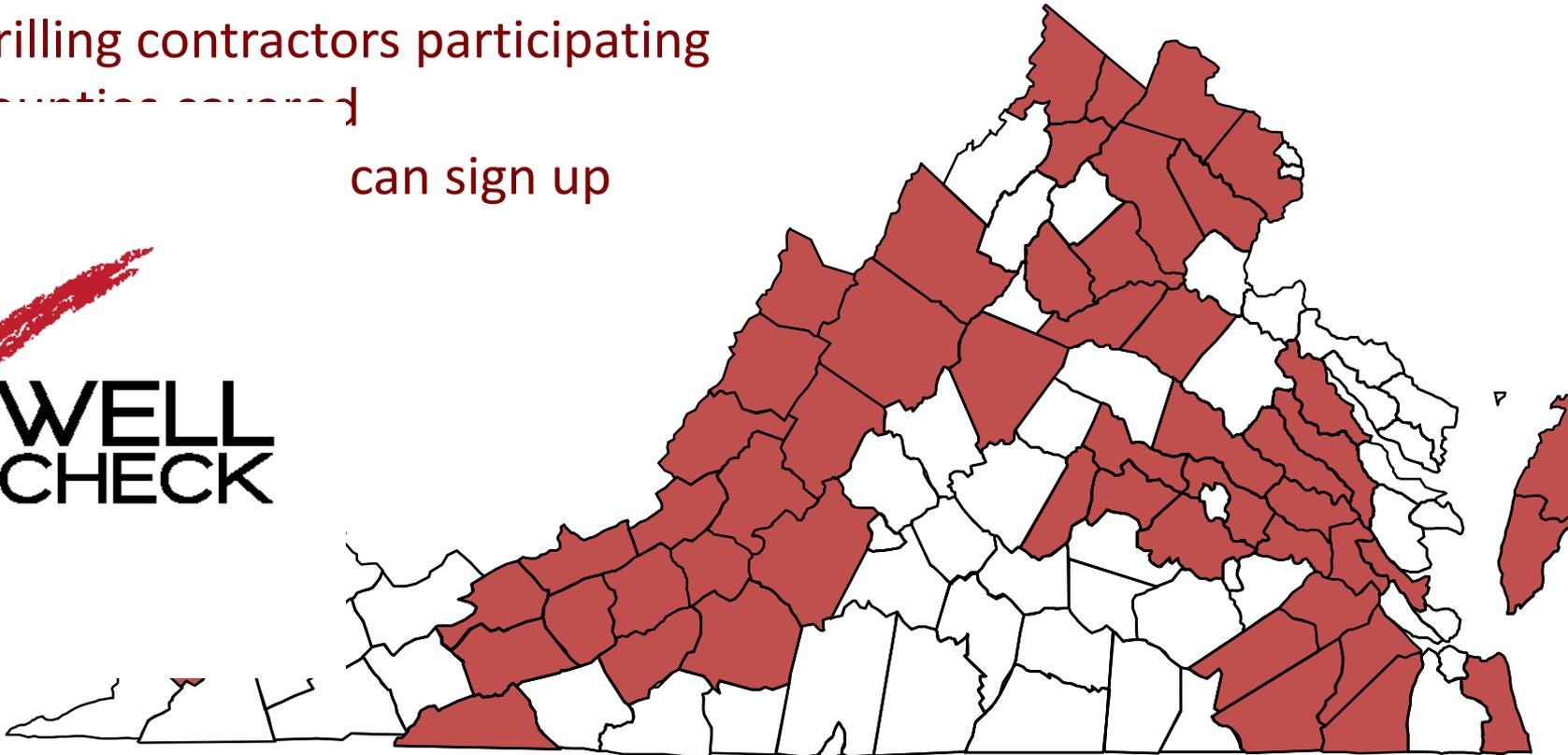
Partnership between VAHWQP and VWWA (well drillers' group)

Goal: Connect homeowners who want to learn more with licensed well drillers who provide standard, easy to understand inspections.

- 25 drilling contractors participating

- 50 counties covered

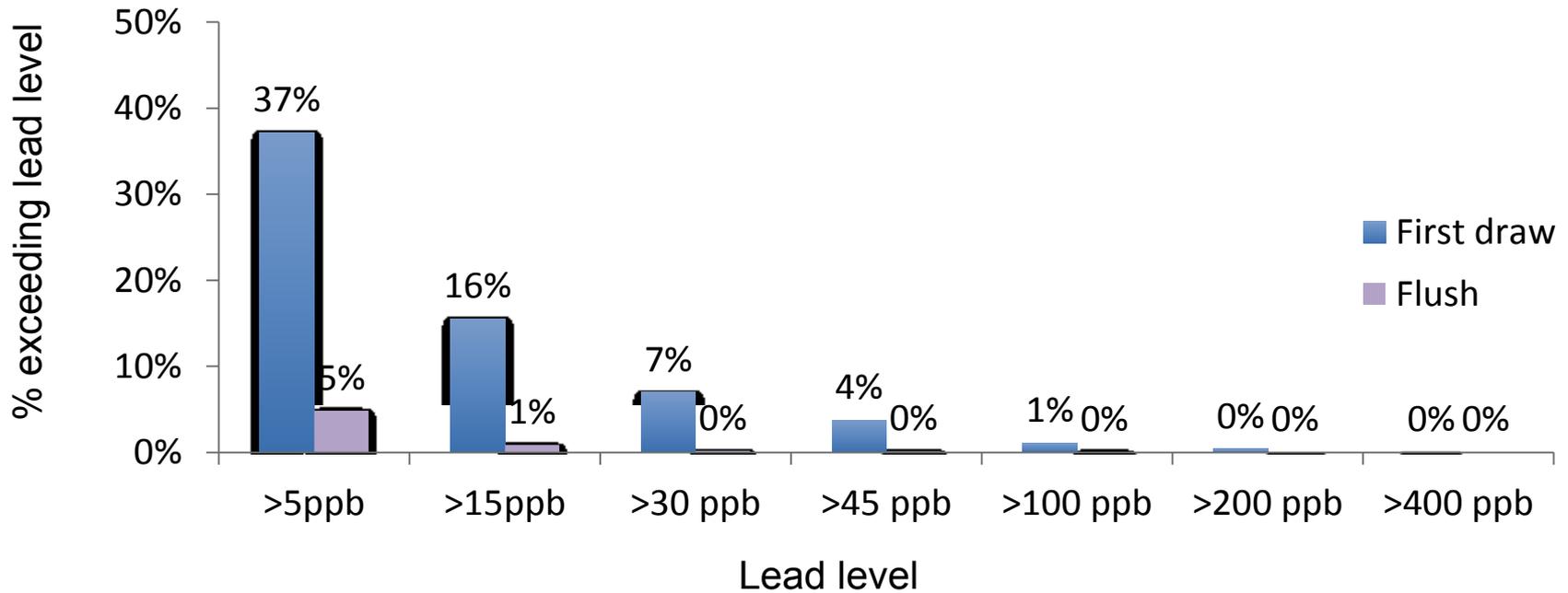
can sign up



Lead Occurrence (2011-2016)

n=6423 samples; 93/95 Virginia counties

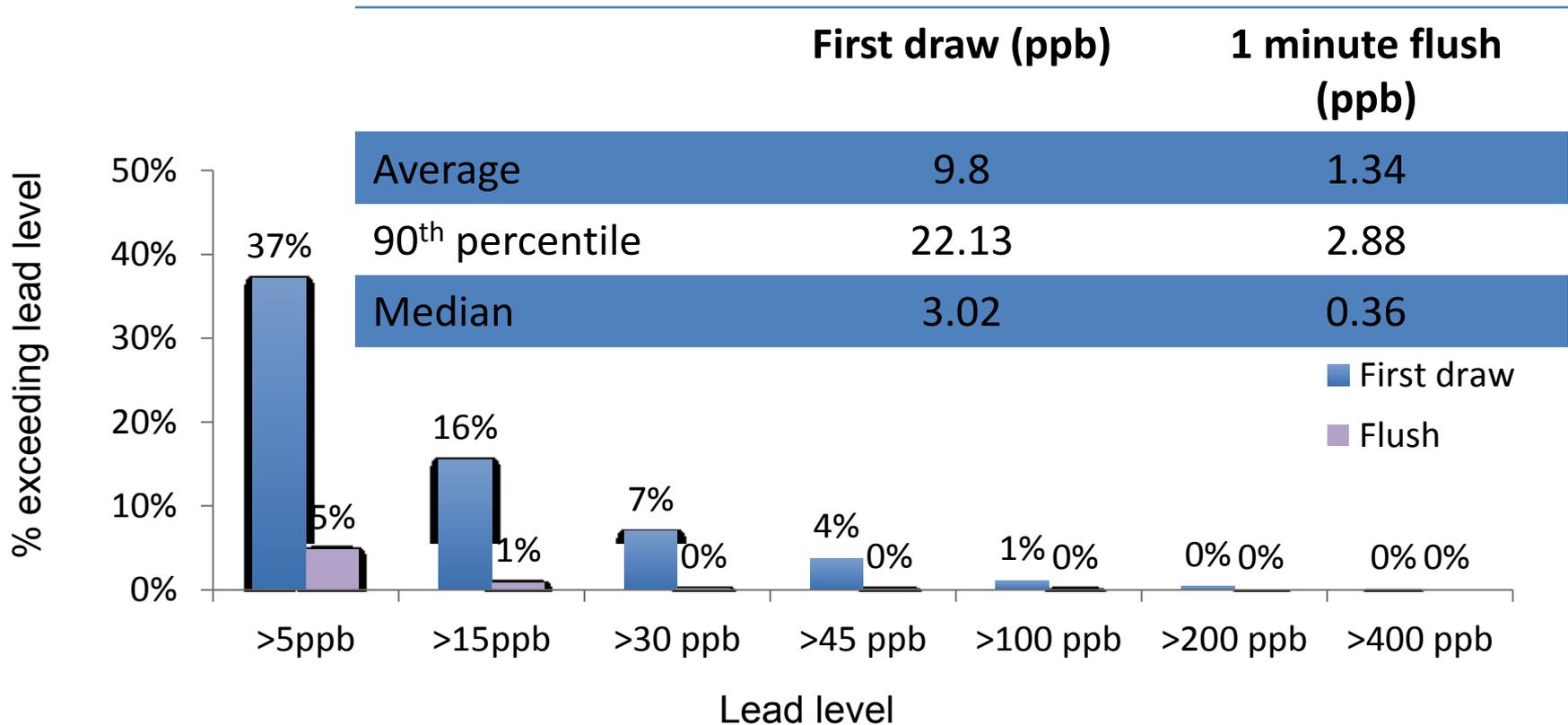
Homeowner collected; predominantly tap water



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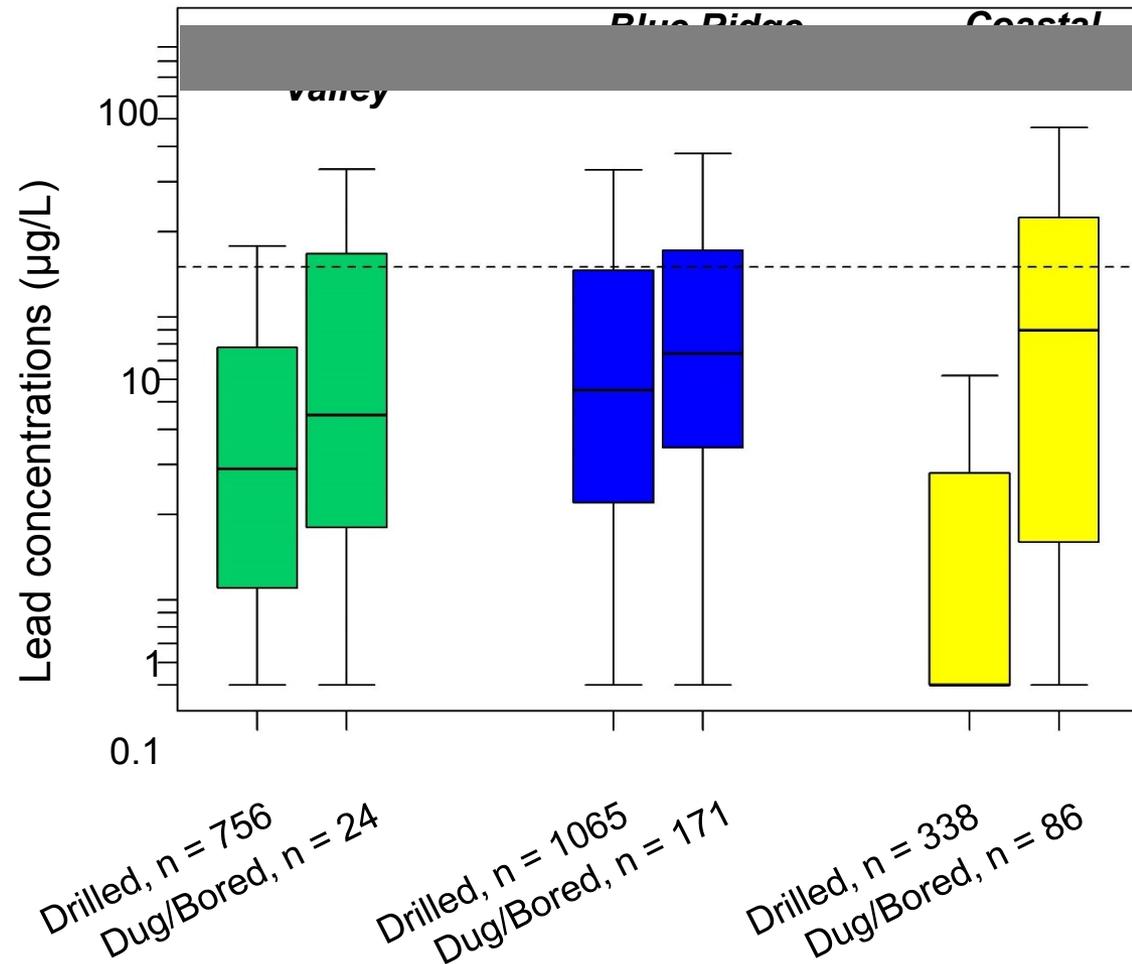
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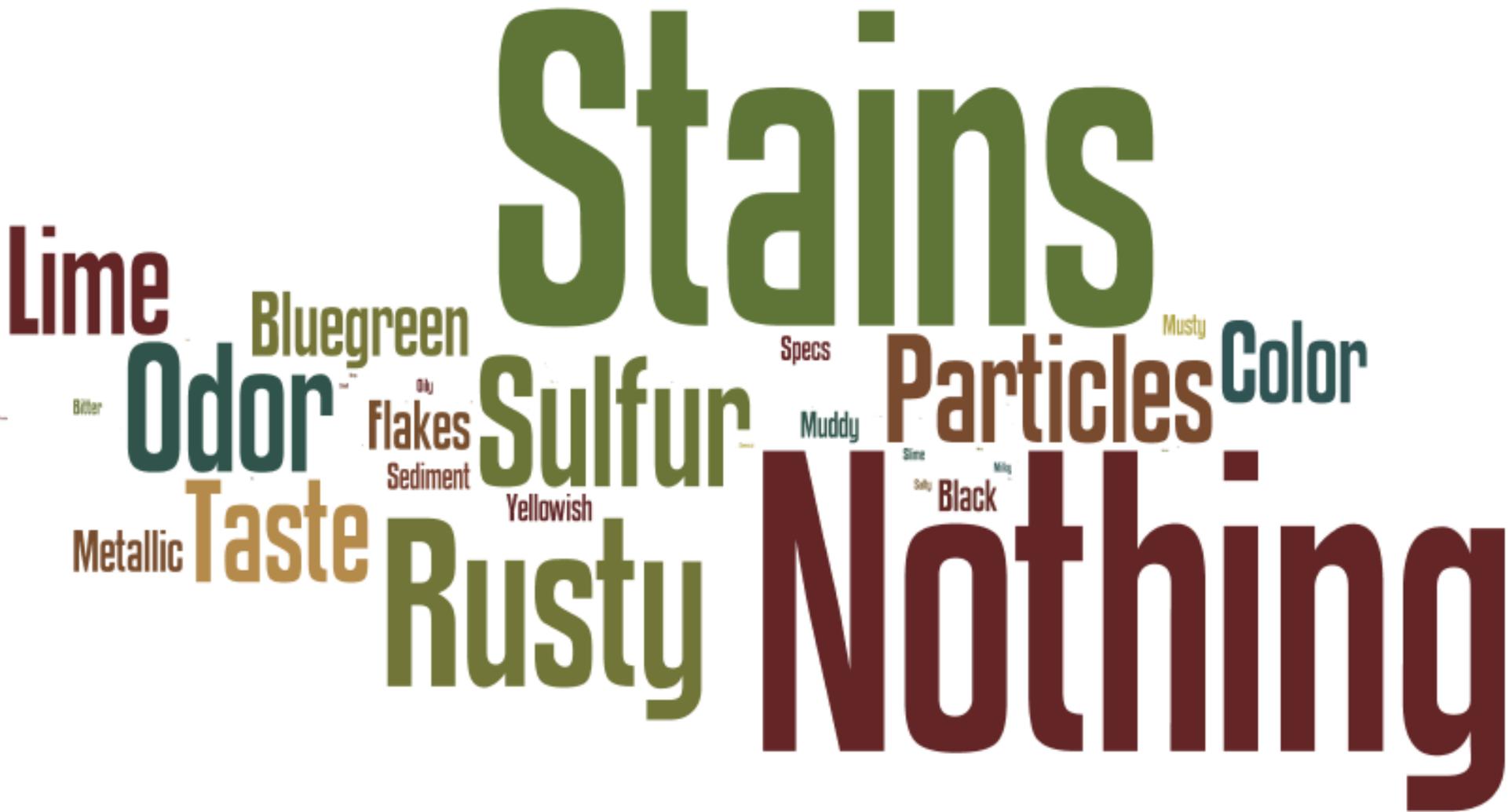
Influence of geology and system type

Higher Pb concentrations linked to aggressive water (e.g. low pH)

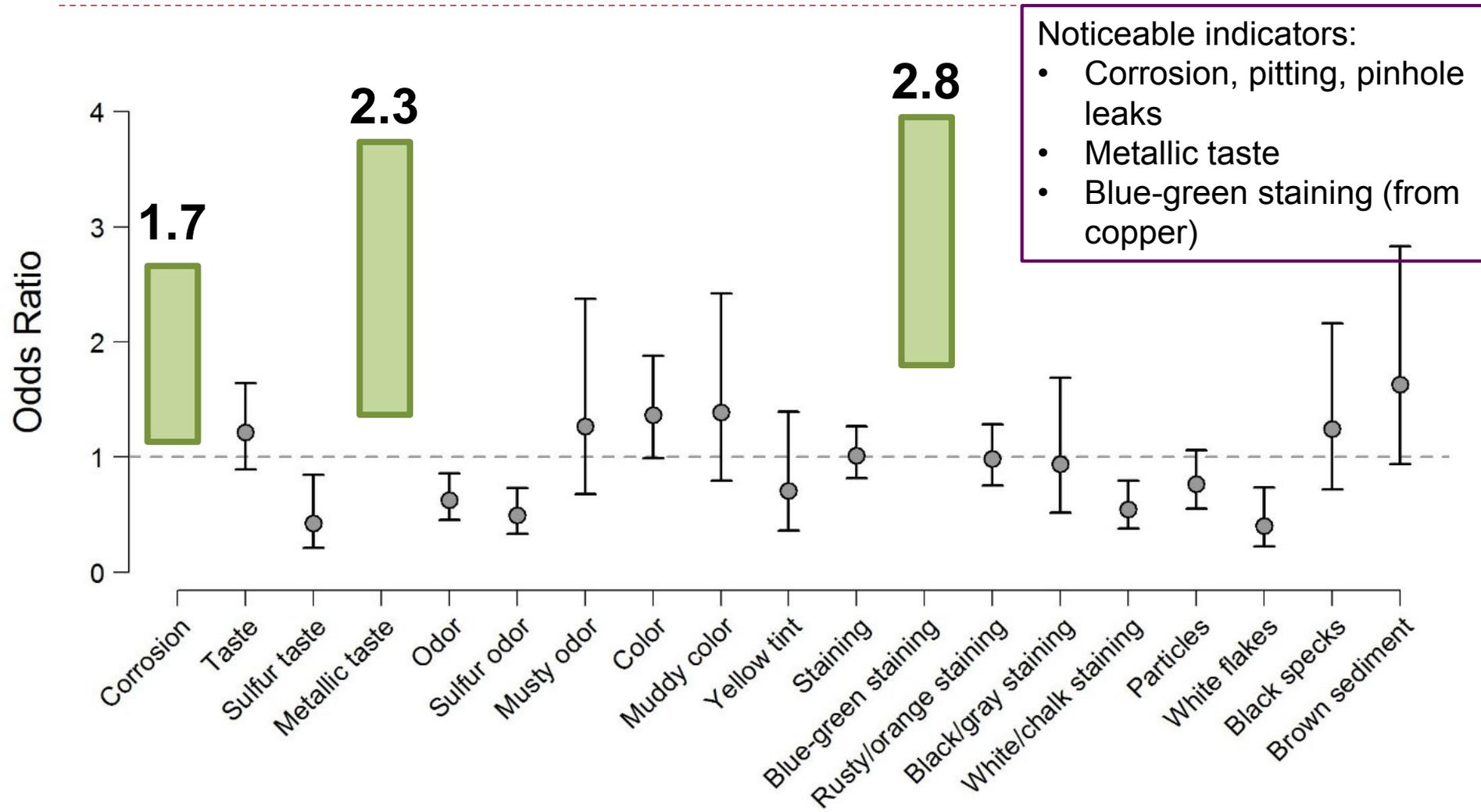
- Lack of buffering in crystalline bedrock
- Surface-groundwater interactions and shorter travel times



Describe your water...



Homeowner perception



VIRGINIA HOUSEHOLD WATER QUALITY PROGRAM

Erin Ling
Virginia Tech
Biological Systems Engineering
Virginia Cooperative Extension

www.wellwater.bse.vt.edu

email: wellwater@vt.edu

ph: 540-231-9058

