

# Drinking Water Assessment at Underserved Farms in Virginia's Coastal Plain: Interpretation of Survey Results



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## **Who are the Underserved Farmers?**

**.....those farmers and ranchers who, when compared to other farmers, ranchers, and farm operations in a given geographic area, such as a state, county, or project area, have distinct disadvantages in obtaining Department of Agriculture (USDA) program assistance.**



## Objectives:

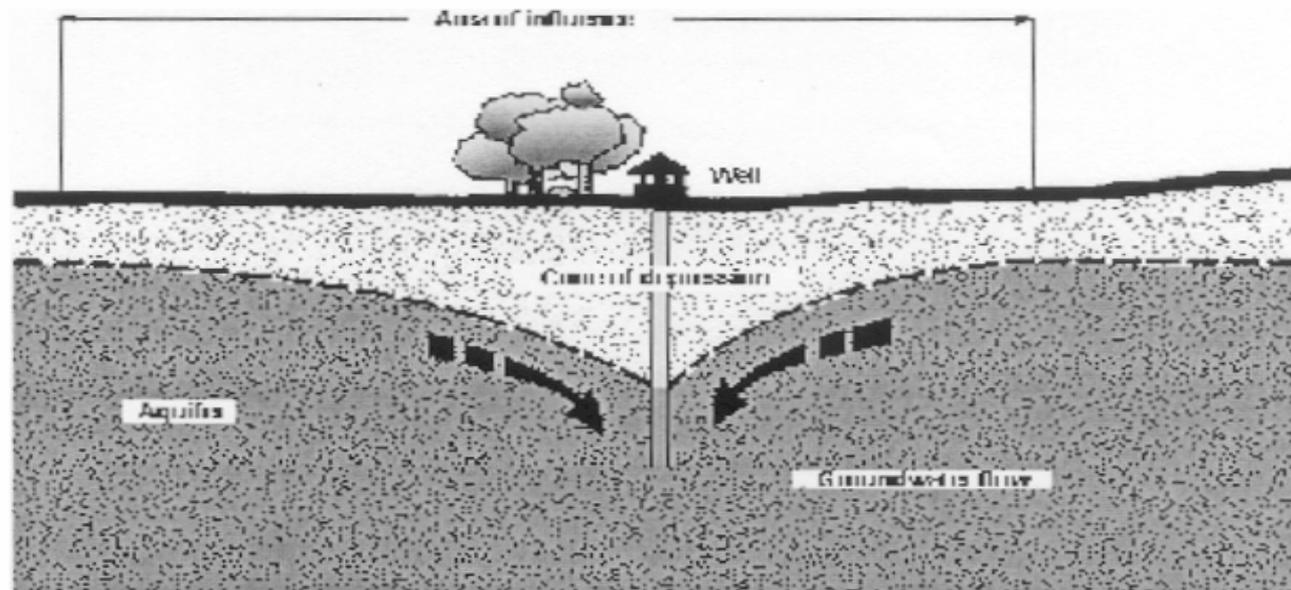
- To assess drinking water quality at underserved farms.
- To evaluate responses to water quality assessment questions.
- To compare results with other data sources as well as federal and state drinking water standards.



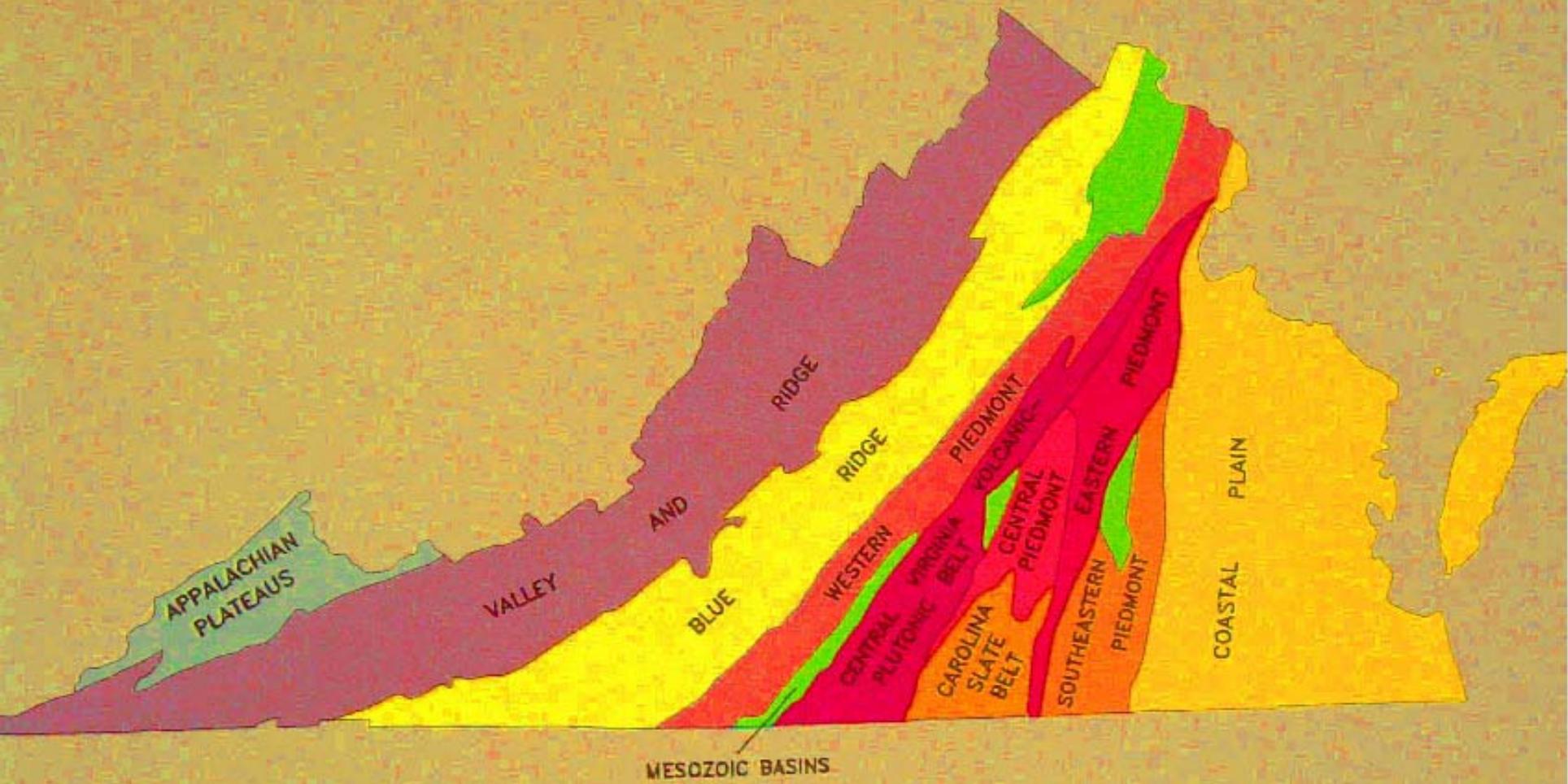
# Approach

- Collect drinking water (well water) samples from rural underserved homes.
- Collect responses to questionnaire during water sampling.
- Analyze water samples for selected drinking water quality indicator parameters.
- Interpret obtained data.

# Participation in Water Quality Assessment for Underserved Farms



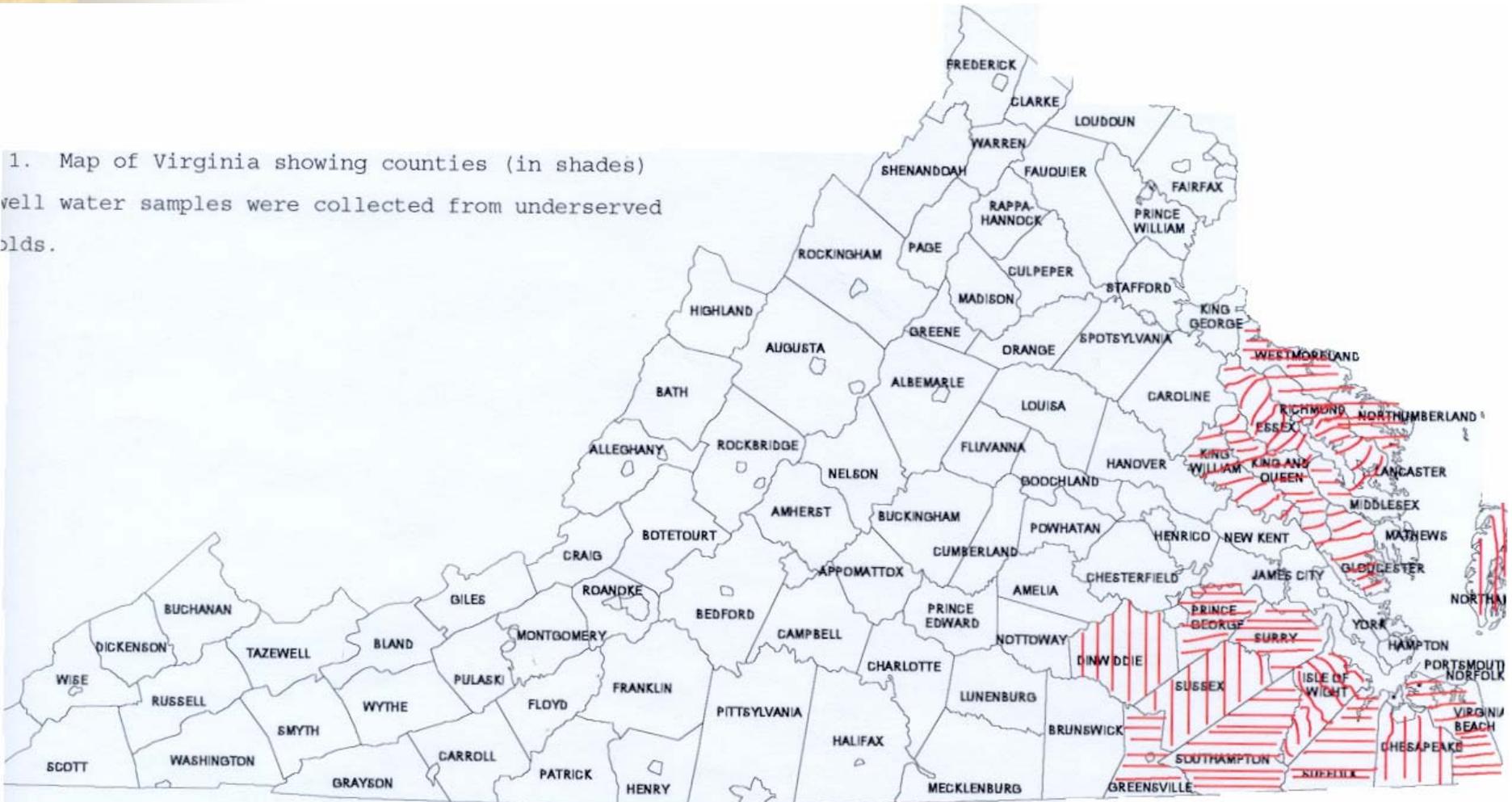
The purpose of this notice is to solicit volunteers from underserved farmers, who are willing to participate in the water quality survey. The goal of the water quality assessment is to understand the existence of any pollution in your well or spring water that may be caused by natural or man-made sources. The information will only be used in workshops and seminars for the purposes of educating such communities about water quality protection. Only general information will be used without any names mentioned. The survey consists of water sampling from wells, streams, and taps and answers to a short list of questions. Sample analysis will include pH, turbidity, hardness, selected nutrients, metals, and Coliforms. The results obtained will be provided to each participating farmer and anonymously presented at a workshop to the community at the end of the project period. The funding agency is very much interested in understanding water quality issues that may exist at underserved communities. Therefore, your participation is vital to the success of the project. The next phase of the project, when funded, could help address some of the problems that may be identified by this study in your community.



# LOCATION MAP FOR GEOLOGIC COLUMNS

# Counties Where Water Samples Were Collected

1. Map of Virginia showing counties (in shades) where water samples were collected from underserved populations.





# Water Quality Parameters Assayed

- Selected metals
- Oxy-anions
- Other water quality parameters
- Biological: Total coliforms, fecal coliforms, *E. coli*

# Biological Assay

- Well water samples (100-mL) were collected in polyethylene vials containing 10mg sodium thiosulfate tablet.
- Samples were sealed and transported on ice for microbial testing within 24 h



# Microbial Testing

- The levels of total coliform, fecal coliform, and *E. coli* bacteria were analyzed using either a 5- or 3-tube most probable number (MPN) evaluation according to Standard Method for Water and Wastewater Analysis.

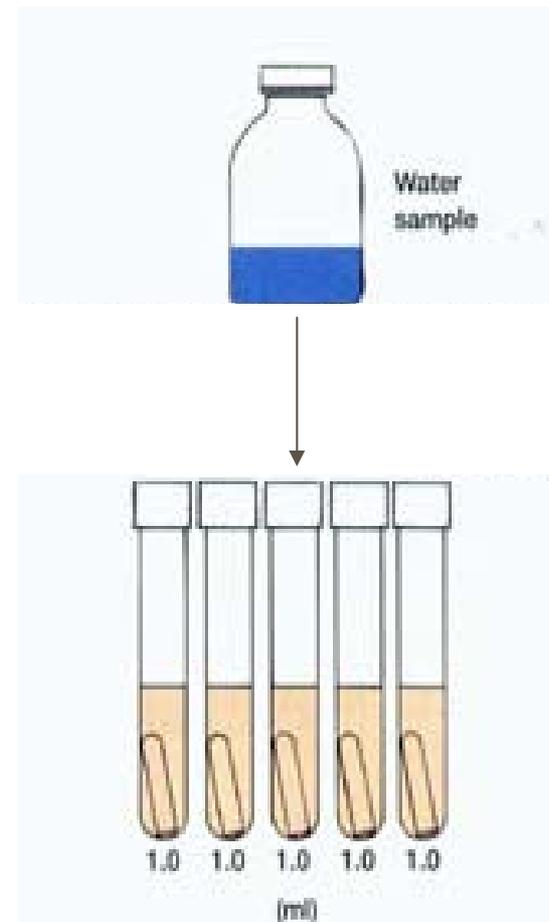


Table 1. Concentrations of selected metals in drinking water wells from 22 counties of underserved rural homes in Virginia's Coastal Plain.

Parameters Measured	EPA Limits	VSU Avg. Val	VT Avg. Val	SE VA Avg. Val	Samples > Limit
Na	30-60	97.0	62.1	159	22
K	--	266	--	--	--
Ca	--	306	--	--	--
Mg	--	45	--	--	--
Cu	1.0	nd	0.09	0.035	0
As	0	nd	nd	nd	0
Pb	0	nd	nd	nd	0
Hg	0.002	nd	nd	nd	0



Table 2. Levels of oxy-anions (mg/L) in drinking water wells from 22 counties at underserved rural homes in the Coastal Plain of Virginia.

Parameters Measured	EPA Limits	VSU Avg. Val	VT Avg. Val	SE VA Avg. Val	Samples >Limit
F	2.0	1.53	1.01	2.66	11
Cl	250	104.7	47.6	8.97	2
NO <sub>3</sub>	10	5.84	1.44	0.01	25
NO <sub>2</sub>	1	0.15	--	--	4
SO <sub>4</sub>	250	268.7	9.22	4.1	4
PO <sub>4</sub>	--	7.9	--	--	--



Table 3. Other water quality parameters measured in well waters from 22 Counties at underserved farms in the Coastal Plain of Virginia.

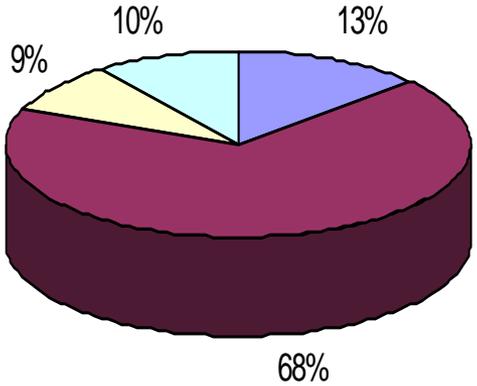
Parameters Measured	EPA Limit	VSU Avg. Val	VT Avg. Val	SE VA Avg. Val	Samples >Limit
pH	6.5 - 8.5	7.06	7.22	8.19	53
TDS (mg/L)	500	322	239	346	15
Hardness (mg/L)	--	75	53.8	50	--
Sat. Index	--	-2.0	-1.15	2.02	--
Turb (NTU)	5	1.15	--	--	10
Alk. (mg/L)	--	87.5	--	--	--

Table 4. Biological parameters measured (log CFU/mL) in well waters from 22 Counties at underserved farms in Virginia's Coastal Plain.

Parameters Measured	EPA Limits	VSU Avg. Val	VT Avg. Val	SE VA Avg. Val.	Samples >Limit
<b>Total coliforms</b>	0	98.4	35.98	36.87	71
<b>Fecal coliforms</b>	0	3.66	--	--	22
<b>E. coli</b>	0	21.2	4.8	0	12

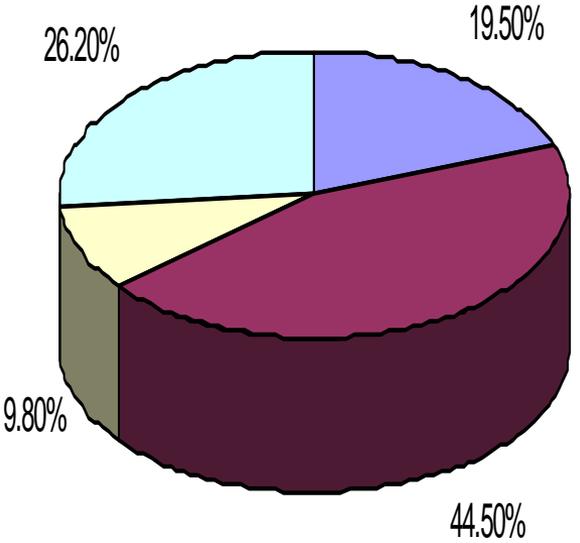
# Housing Environment Distribution

VSU



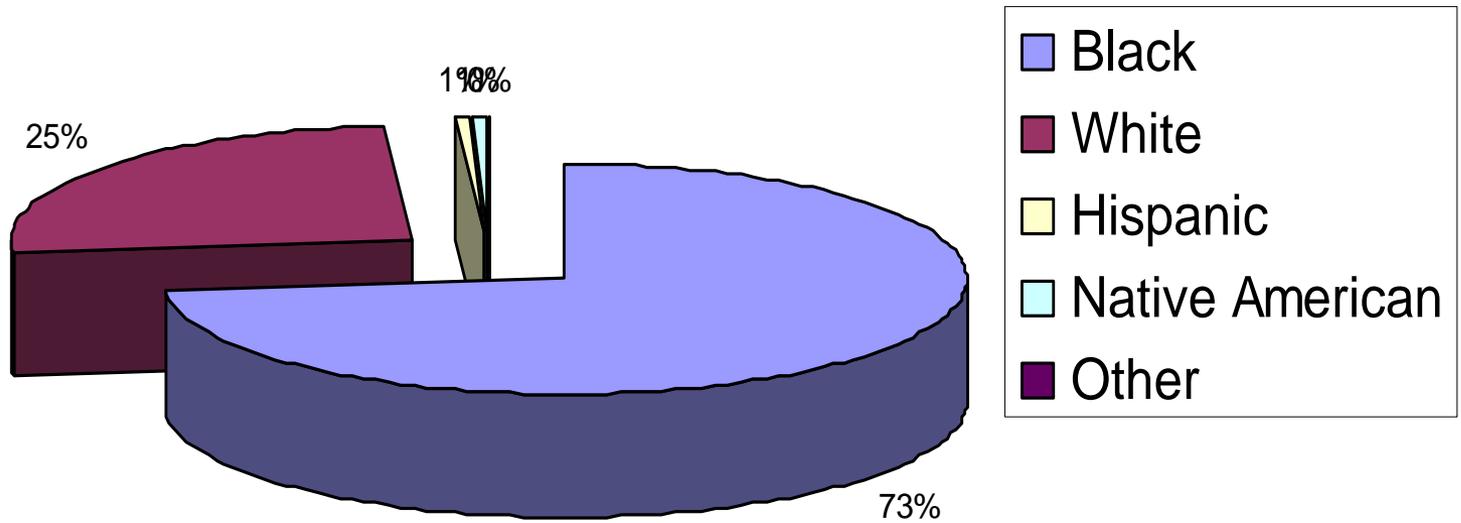
Rural Lot	Rural Com
Subdivision	Farm

VT



N = 341

## Respondents DHS Classification



N = 180

## Respondents' Age Group

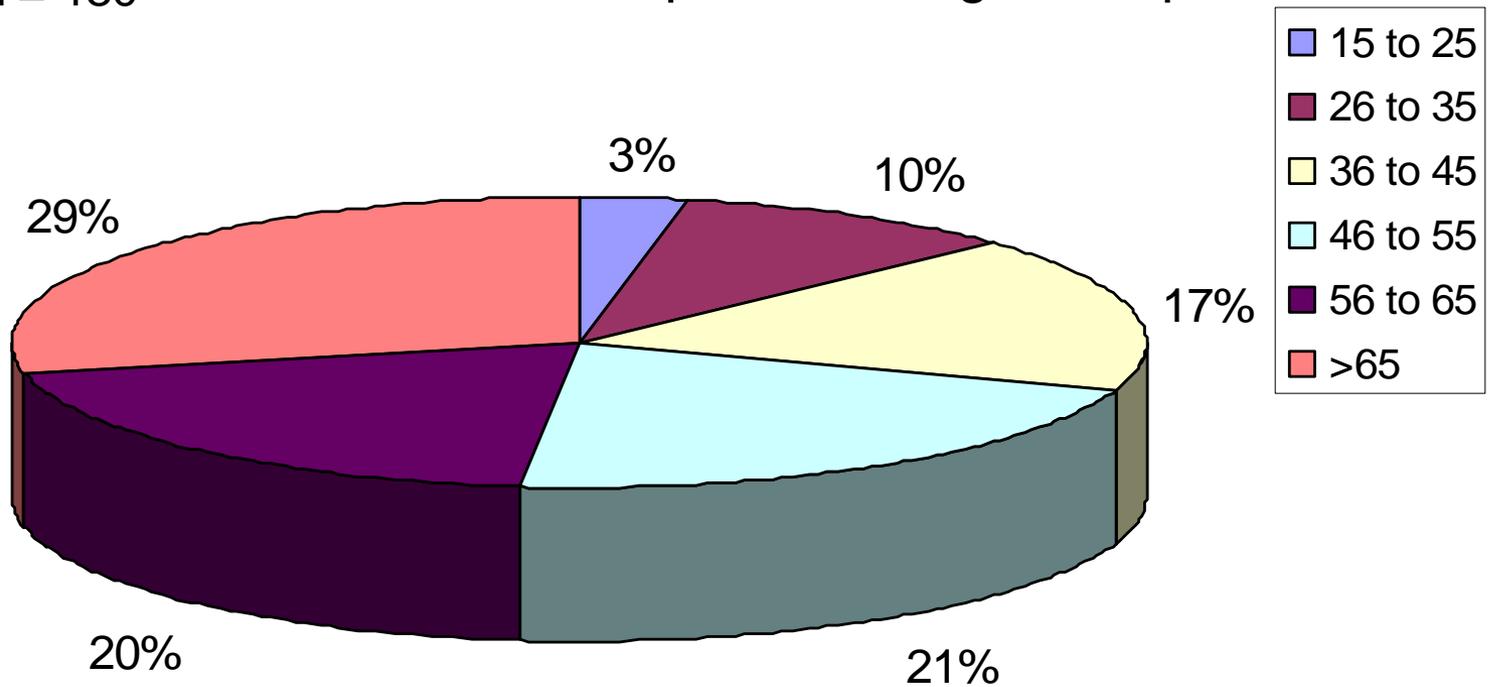


Figure 1. Annual income of respondents.

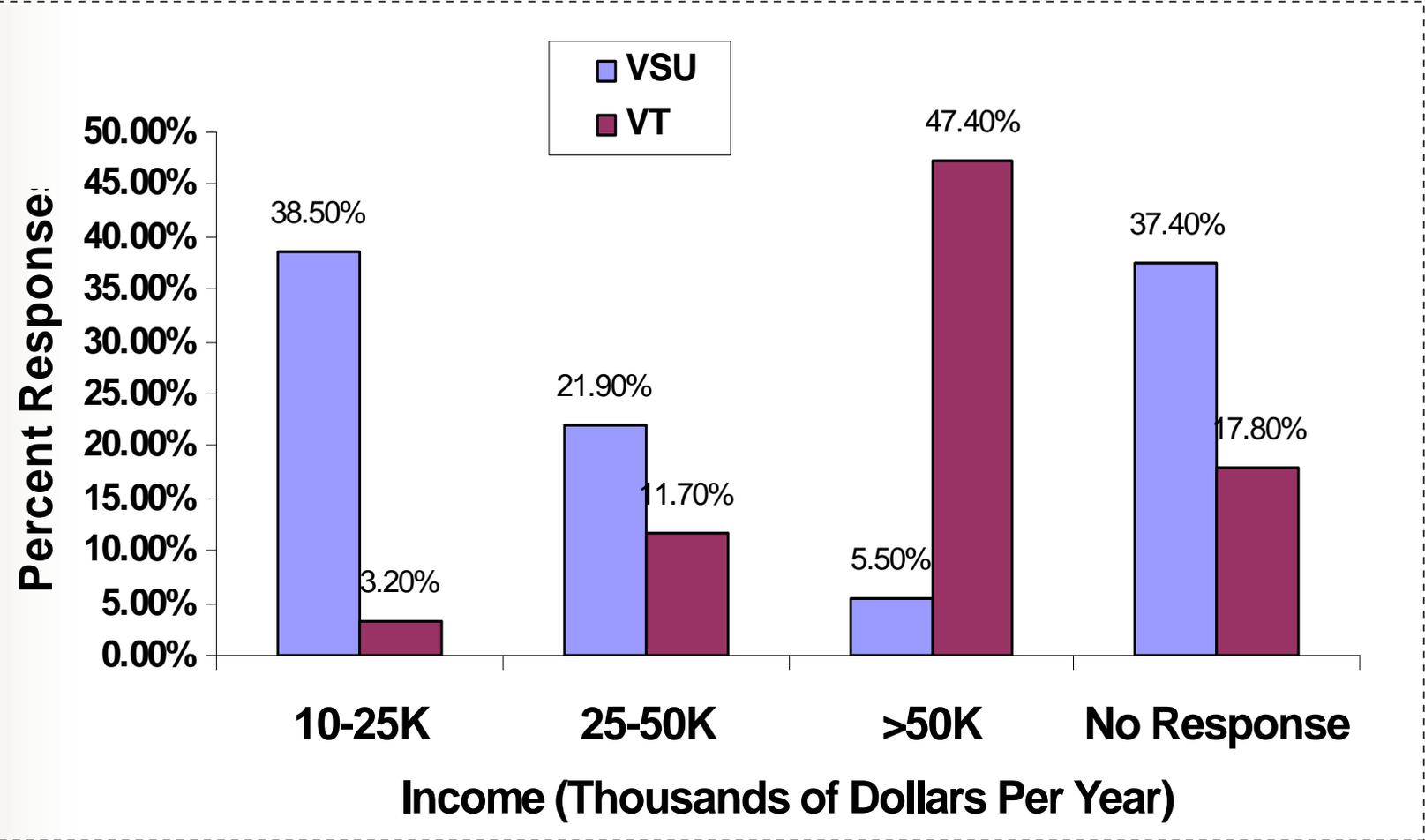


Figure 2. Level of Education Achieved by Respondents.

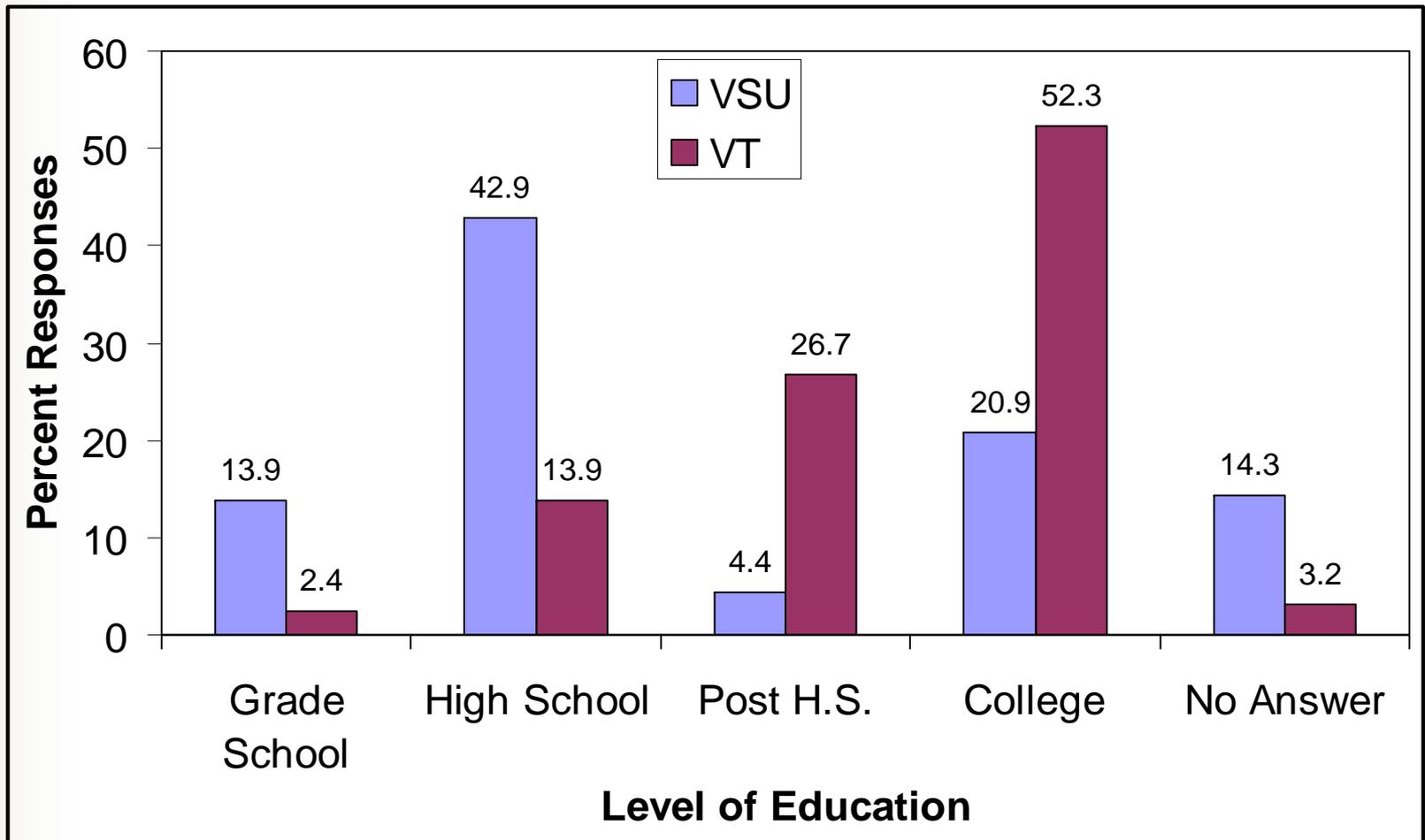


Figure 3. Source of drinking water.

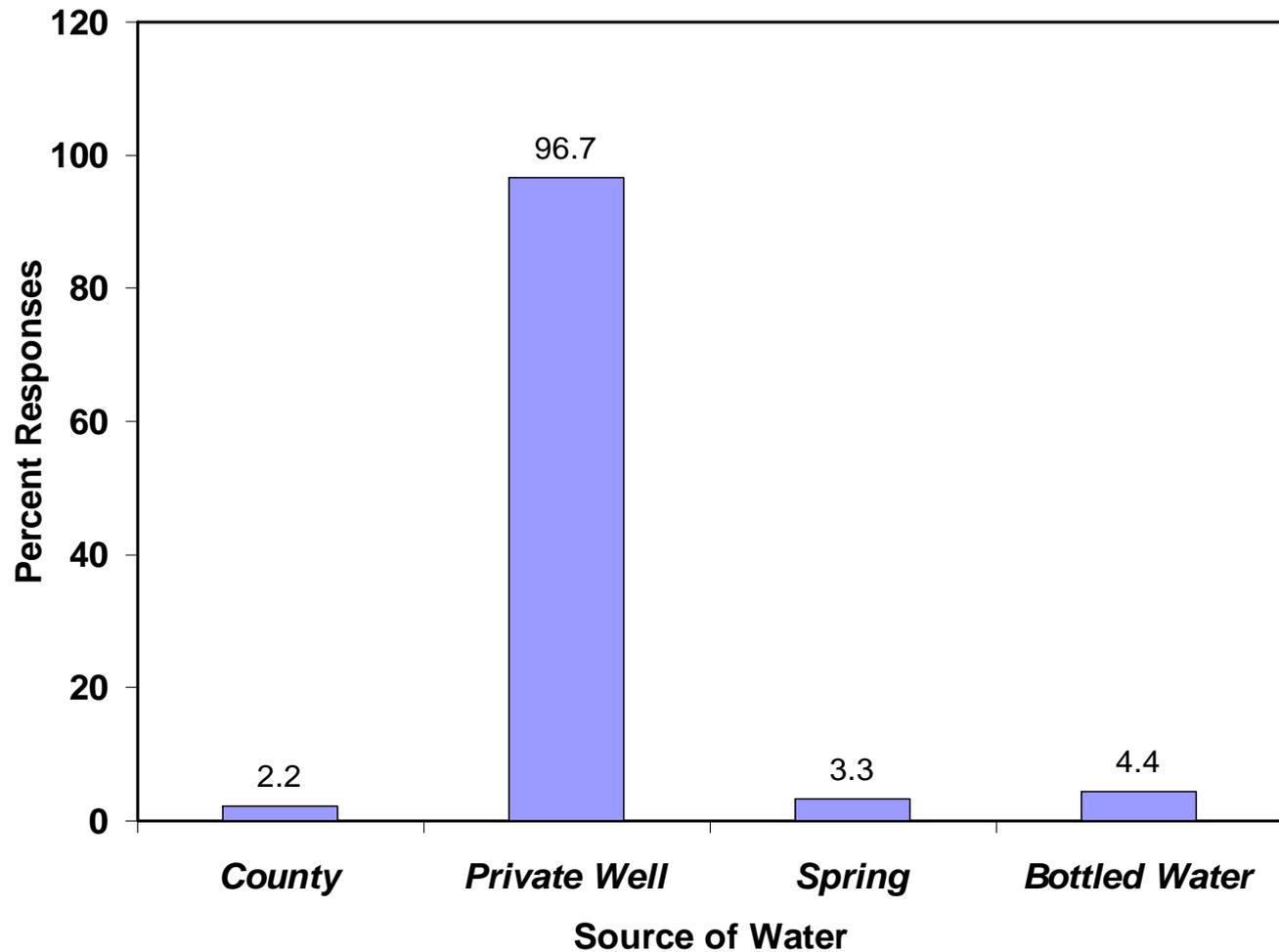


Figure 4. Type of well

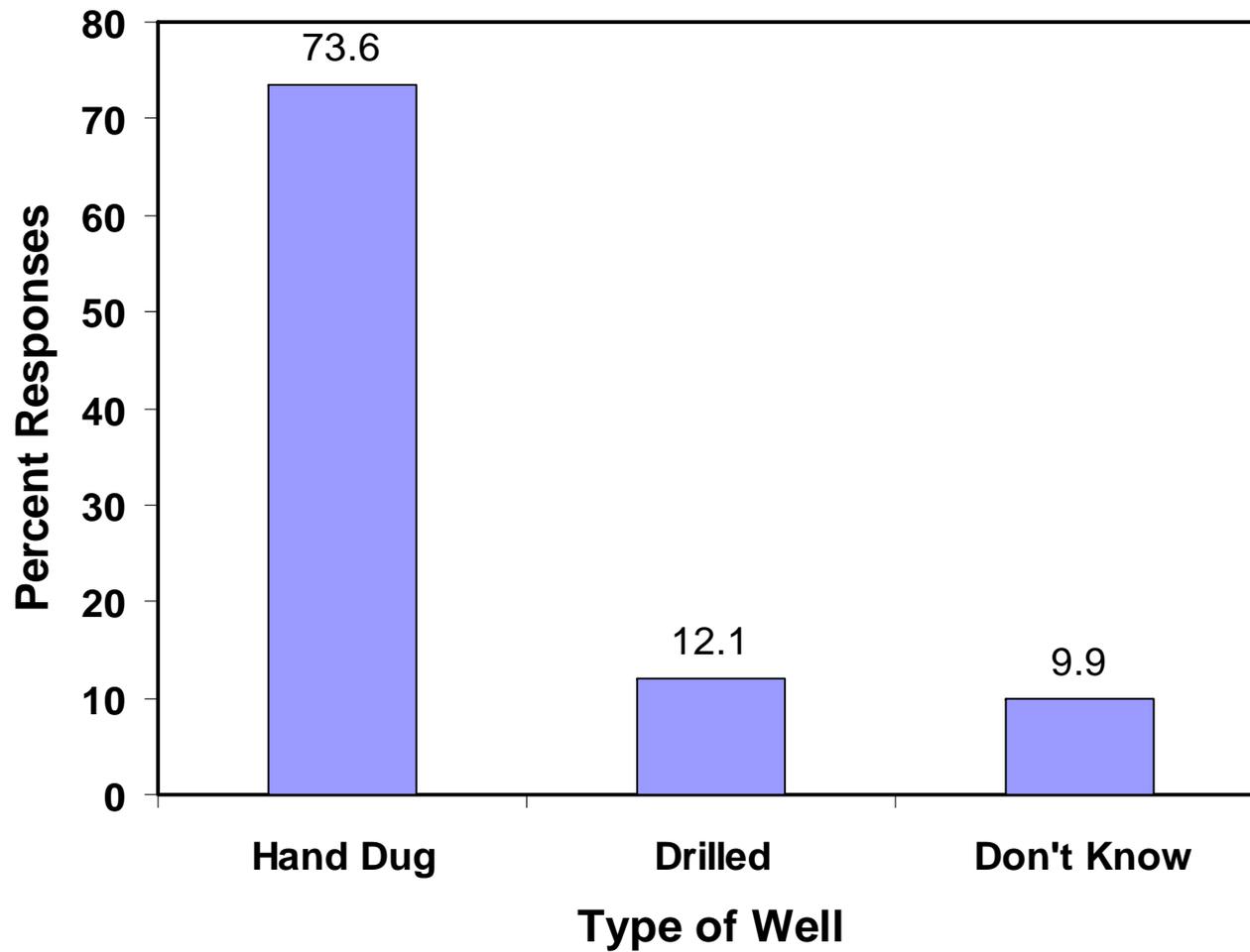


Figure 5. Protective casing on wells.

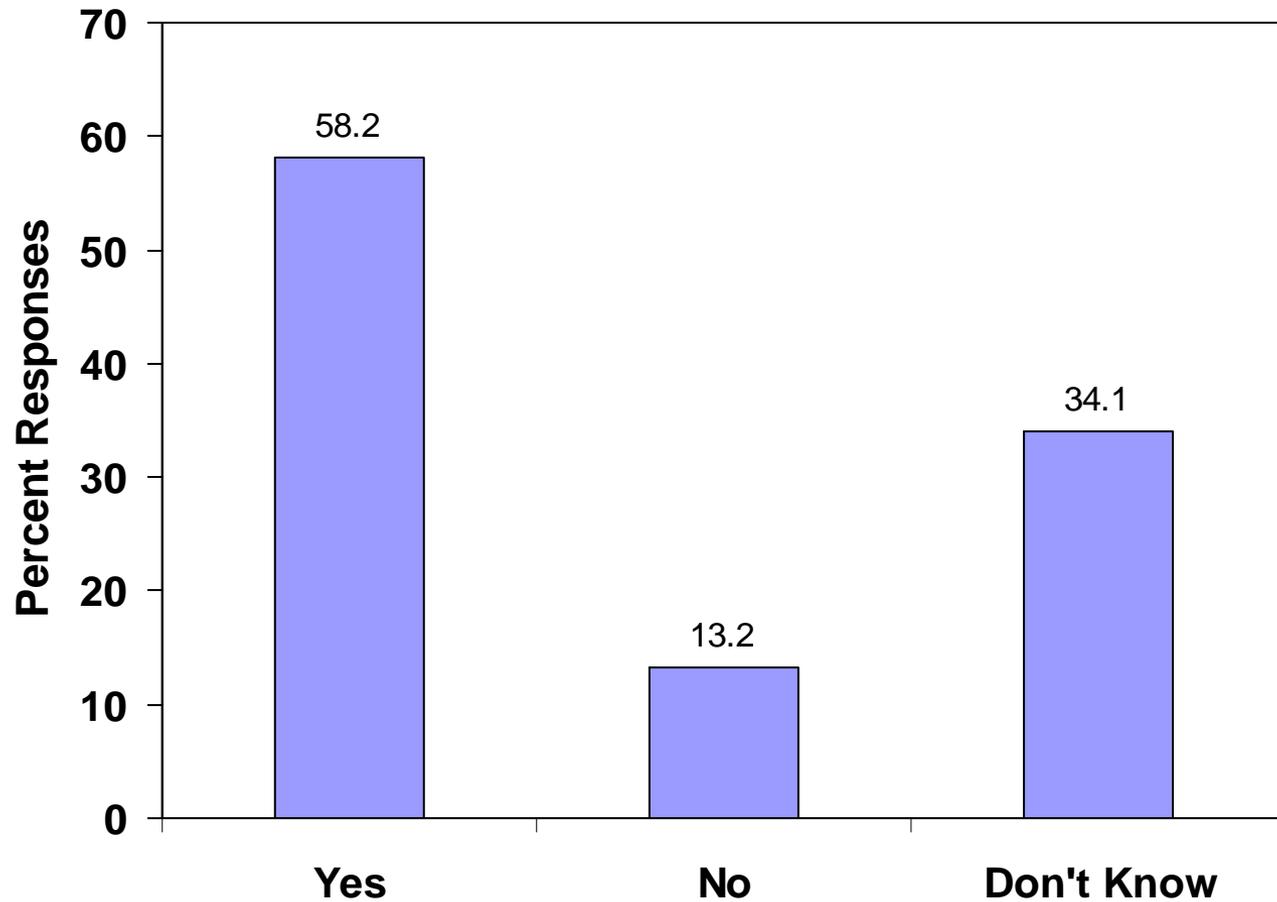


Figure 6. Treatment device used for well water.

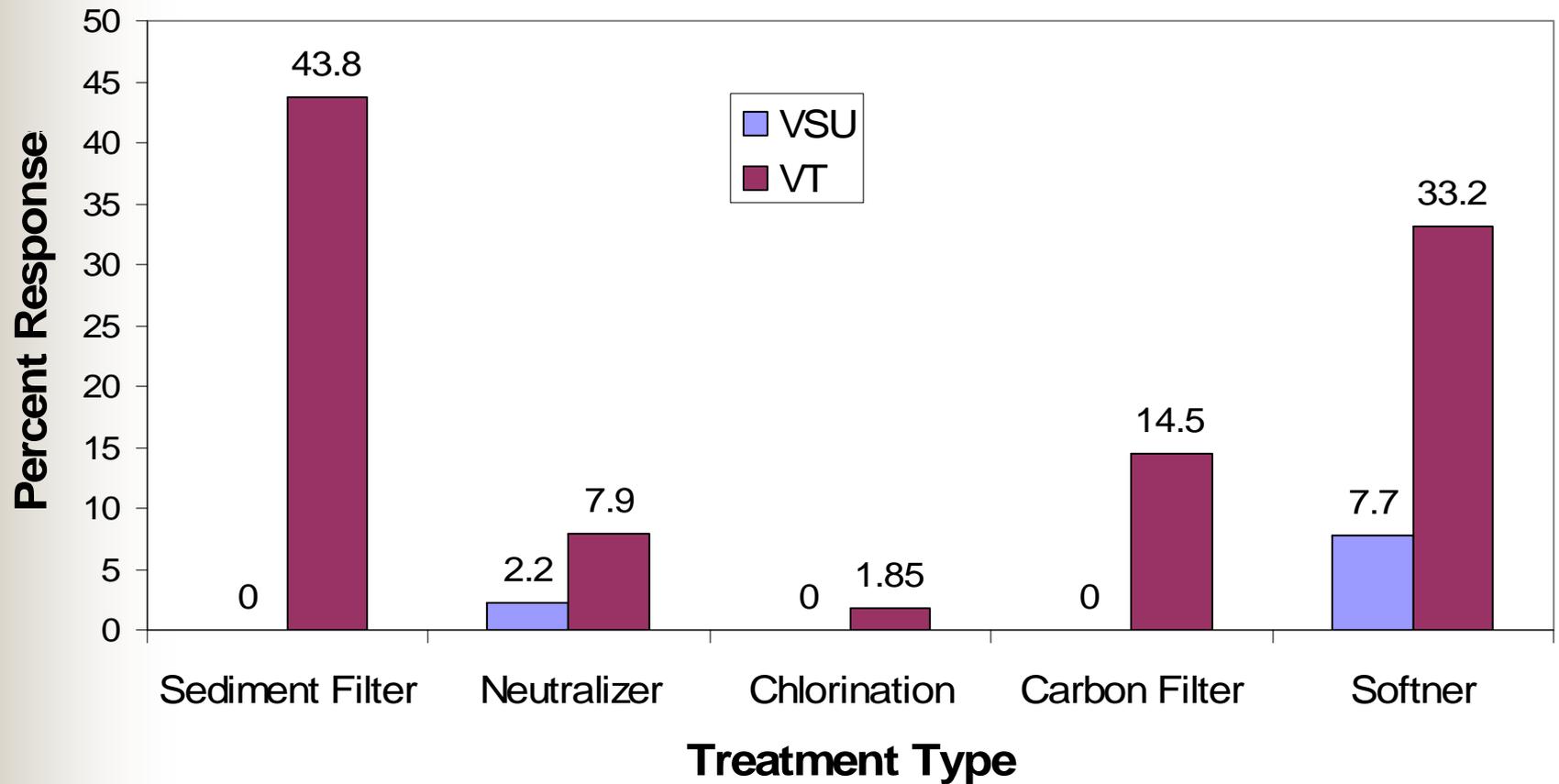


Figure 7. Taste description of well water.

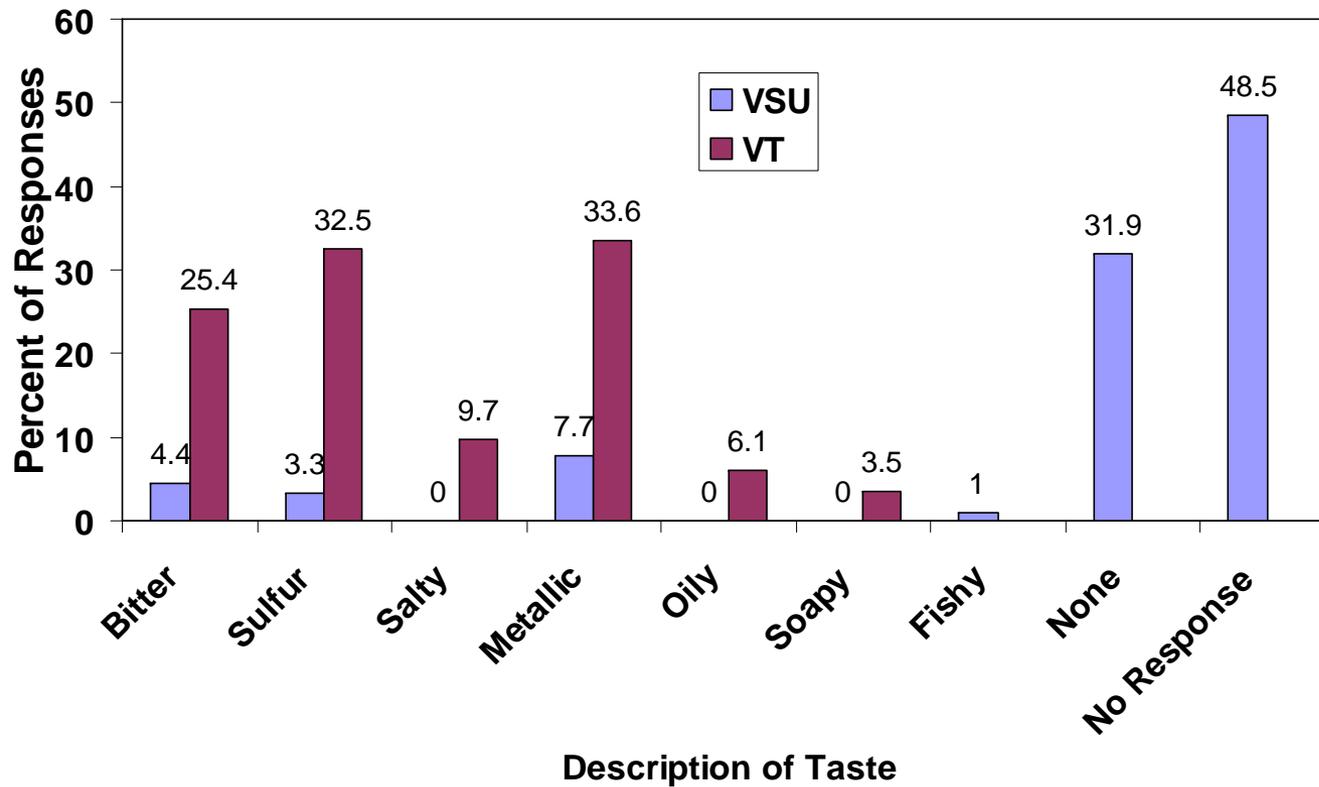
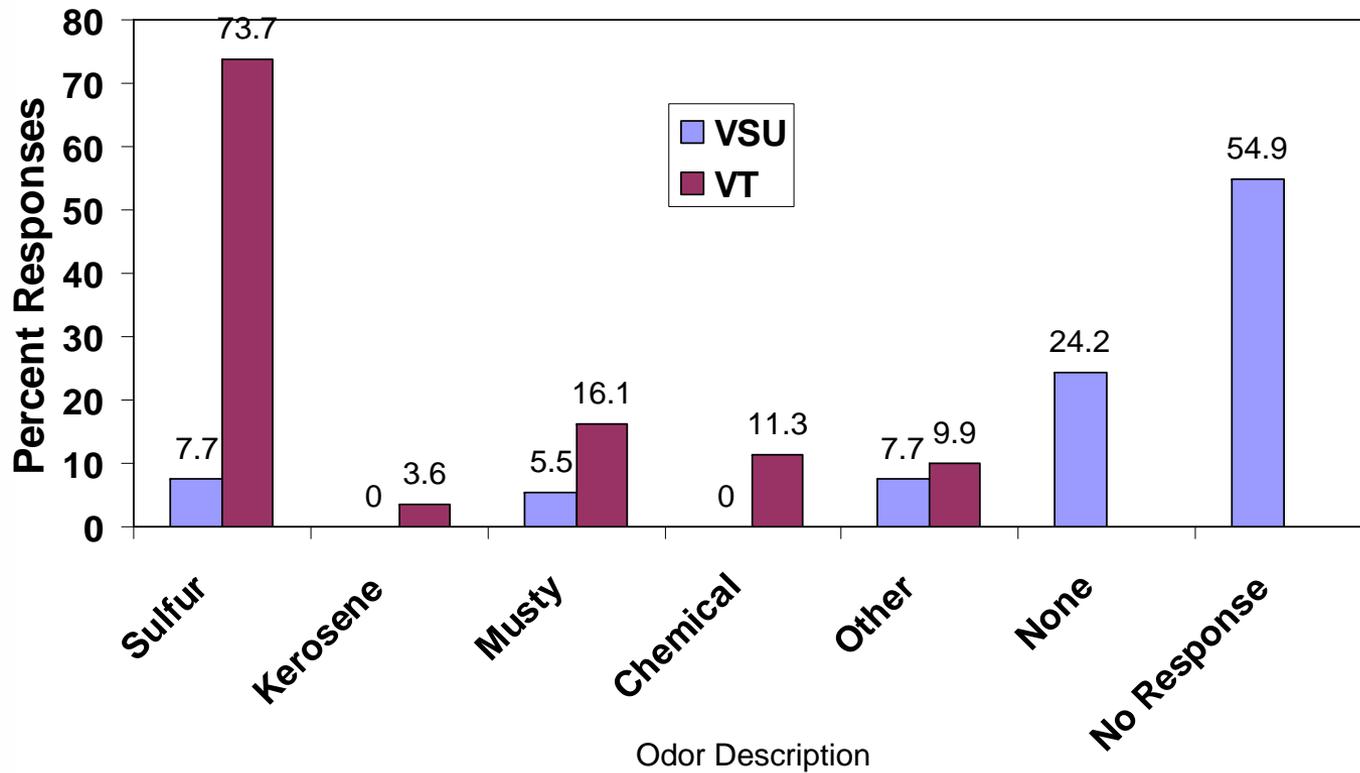


Figure 8. Response to objectionable odor in well water.





# Conclusions

- Underserved residents are less likely to provide responses to survey questions, which they consider personal or could lead to state action.
- Data indicate severe biological contamination of wells at underserved farms in Virginia's Coastal Plain.
- Obtained data suggest that some drinking water parameters may be worse at underserved farms in this region.



# Conclusions

- Income and education play significant roles in well water quality protection.
- There is a great need for extension education to protect drinking water wells in these communities.