#### ISSUES ASSOCIATED WITH THE USE OF UNTREATED ROADSIDE SPRINGS AS A SOURCE OF DRINKING WATER

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#### Project funding:

- U.S. Geological Survey through the Pennsylvania Water Resources Research Center
- Penn State Extension

#### **Regional Use of Home Springs for Drinking Water**



#### PSU Water Testing Project (Eight North Central PA Counties)



Type of Water Supply

## **Roadside Spring Background**

- Number and use of roadside springs is largely unknown
- Referrals from physicians and homeowners with gastrointestinal issues has increased
  - High % consume spring water
- Summer 1990
  - 13 of 23 roadside springs in northeast PA found to contain coliform bacteria
- Users of roadside springs are passionate!



### Roadside Spring Users are Passionate!



## **Restoring a Frozen Spring**

(which wasn't really a spring)



#### **PA GENERAL ASSEMBLY**

SPECIAL REPORT JOINT LEGISLATIVE AIR AND WATER POLLUTION CONTROL AND CONSERVATION COMMITTEE – OCTOBER 1990

#### THE USE AND REGULATION OF ROADSIDE SPRINGS IN PENNSYLVANIA



#### **RECOMMENDATIONS FROM REPORT**

- 1. Create an inventory of roadside springs
- 2. Periodic microbiological testing of some better known springs by PA DEP
- 3. Disinfection of high-use springs



4. Expanded public information by Penn State Extension, PA DEP, etc.

#### **2013 Preliminary Roadside Spring Study**

- April August 2013
- Samples collected from 35 roadside springs by 7 Extension Educators
- Most springs located in PennDOT or local road right-of-ways
- Samples analyzed by Penn State laboratory for 20 inorganic and microbiological parameters





## **Roadside Springs Locations**



### WHAT DO THEY LOOK LIKE?



#### Beautiful stonework







#### **Liability Concerns**



#### **Liability Concerns – Disinfection**





### Penn State Extension Water Quality Parameters

Parameter	Units	Drinking Water Standard			
Health-Related Parameters					
Total coliform bacteria	Colonies per 100 mL	0			
<i>E. coli</i> bacteria	Colonies per 100 mL	0			
Arsenic	mg/L	< 0.010 mg/L			
Barium	mg/L	< 2.0 mg/L			
Copper	mg/L	< 1.0 mg/L, <1.3 mg/L			
Lead	mg/L	< 0.015 mg/L			
Nitrate-N	mg/L	< 10 mg/L			
Aesthetic Parameters					
рН	unit-less	6.5 to 8.5			
Total Dissolved Solids (TDS)	mg/L	< 500 mg/L			
Chloride	mg/L	< 250 mg/L			
Sulfate	mg/L	< 250 mg/L			
Iron	mg/L	< 0.30 mg/L			
Manganese	mg/L	< 0.05 mg/L			
Corrosivity Index (LSI)	unit-less	Non-corrosive			
Aluminum	mg/L	< 0.20 mg/L			
Other Parameters					
Alkalinity	mg/L	NA			
Total Suspended Solids	mg/L	NA			
Hardness	mg/L	NA			



#### **Summary**

- Most of the springs tested failed at least one drinking water standard
  - Bacterial contamination prevalent, aesthetic issue rare
  - Untreated roadside springs should generally not be recommended for drinking water sources

#### **Remaining Questions**

- How frequently are roadside springs used?
- How variable is the water quality seasonally?
- Given the prevalence of bacteria, are other pathogens (protozoans) also present in roadside springs

### **Giardiasis Illness Rates**



PA County Health Profiles, 2013, PA Department of Health Annual Cases per 100,000

### Follow-Up Study 2014-2015

Goal = better quantify and reduce the public health risk from the use of untreated roadside springs as a drinking water source.

Objectives

- 1. Obtain survey data about the use of roadside springs for drinking water in Pennsylvania.
- 2. Quantify seasonal variability in water quality among select roadside springs.
- 3. Determine the presence of *Giardia* and *Cryptosporidium* in select roadside springs prone to *E. coli* contamination.
- 4. Create several educational resources to increase awareness about the risks of drinking water from untreated roadside springs.

## Additional Roadside Spring Results

- Questions about the use of roadside springs were added to presentations given by Water Resources Extension Educators at events throughout the state.
- 10 roadside springs which contained *E. coli* bacteria in 2013 were selected for seasonal water quality testing during 2014-15.
  - Samples delivered to Penn State Ag Analytical Lab within 24 hours for analysis of 20 inorganic/microbiological parameters.
- 8 springs tested for Giardia and Crypto in Fall 2014 and Spring 2015 by Analytical Services, Williston, VT
  - 10 Liter delivered within 24 hours
  - EPA Method 1623.1



### **SURVEY OF ROADSIDE SPRING USE**

- 1,034 responses at 55 educational programs
- Most responses from TurningPoint response cards

#### **Regional Responses**

- Northcentral = 312
- Northeast = 173
- Northwest = 41
- Southcentral = 287
- Southeast = 156
- Southwest = 66
- 310 (30%) have consumed water from a roadside spring at least once
- 722 (69%) have never consumed roadside spring water
- 6 (1%) gave no response

## FREQUENCY OF ROADSIDE SPRING USE



### WHY ARE ROADSIDE SPRINGS USED?



## **Roadside Springs Locations**



- = roadside springs sampled in 2013
- = roadside springs re-tested in 2014-15 for additional parameters

### **Roadside Springs Sampled in 2014-15**

Spring name	Location	County	Min Flow (gpm)	Max Flow (gpm)
Lycoming	41.44149, -77.577726	Lycoming	0.41	1.69
Orviston	41.107285, -77.697819	Centre	1.54	27.5
Route 6	41.792680, -78.224632	McKean	0.15	5
Rippling Run	39.850927, -76.597183	York	2.3	10
Ridge Road	40.801122, -80.47606	Beaver	2.0	10
Chapman Dam Rd	41.771313, -79.136143	Warren	6.6	13.3
Heffley Spring	40.375233, -78.966547	Cambria	3.0	39.0
Laurel Forge	40.034661, -77.272190	Cumberland	1.5	14.8
Waterville	41.22679, -77.32473	Lycoming	2.97	5.26
West Middlesex	41.165823,-80.443087	Mercer	2.0	8.5

#### **Overall Results**

Parameter	Mean	Min	Max	% Springs Failing	% Samples Failing	
Health-Related Pollutants						
Coliform bacteria	192	3	2,420	100%	100%	
<i>E. coli</i> bacteria	11	0	165	80%	43%	
Barium	0.02	0.009	0.031	0%	0%	
Lead	0.001	<0.001	0.004	0%	0%	
Nitrate-N	0.89	<0.50	4.36	0%	0%	
Aesthetic Pollutants						
рН	7.02	5.84	8.03	30%	18%	
TDS	126	<20	842	10%	8%	
Chloride	11.3	<5	62.5	0%	0%	
Sulfate	41.9	<10	390	10%	8%	
Iron	0.09	<0.05	0.57	10%	10%	
Manganese	0.003	<0.005	0.01	0%	0%	
Corrosivity	-1.93	-4.72	1.19	80%	80%	
Aluminum	0.06	<0.005	0.398	20%	5%	
Alkalinity	47.7	3.1	253	N/A	N/A	
TSS	1.71	<1	8.0	N/A	N/A	
Hardness	89.1	5.9	654	N/A	N/A	

All results in mg/L except bacteria (colonies per 100 mL), pH and corrosivity. All results for arsenic and copper were below detection

## Giardia and Cryptosporidium

(Oocysts per L)

	Septem	ber 2014	March 2015			
Spring	Giardia	Crypto	Giardia	Crypto	Coliform Bacteria	<i>E. coli</i> Bacteria
Lycoming	5.28	5.01	0.09	0	62	0
Orviston	0	0	0	0	59	5
McKean	0	0	6.49	2.23	>201	0
Rippling Run	5.7	6.36	0	0	>201	0
Ridge Road	0	0	6.29	4.26	>201	8
Warren	4.07	4.71	6.75	6.93	50	0
Heffley	6.32	6.05	0	0	32	2
Laurel Forge	0	0	6.82	5.57	>201	0

#### **Seasonal Variability**

#### Rows show mean and (% exceeding drinking water standard)

Parameter	Summer 2014	Fall 2014	Winter 2014	Spring 2015		
Flow	9.5	3.4	5.3	10.4		
	Не	alth-Related Pollut	ants			
Coliform bacteria	402 (100%)	169 (100%)	87 (100%)	110 (100%)		
<i>E. coli</i> bacteria	20 (50%)	19 (50%)	1 (30%)	5 (40%)		
Barium	0.018	0.018	0.016	0.017		
Lead	0.002	0.001	0.001	0.001		
Nitrate-N	0.91	0.77	0.93	0.95		
Aesthetic Pollutants						
рН	6.85 (20%)	7.12 (10%)	6.99 (30%)	7.14 (10%)		
TDS	117 (10%)	144 (10%)	125 (10%)	118 (10%)		
Chloride	11.4	12.2	10.8	10.8		
Sulfate	39.7 (10%)	48.1 (10%)	44.8 (10%)	35.3 (10%)		
Iron	0.10 (10%)	0.07 (10%)	0.08 (10%)	0.10 (10%)		
Manganese	0.003	0.003	0.003	0.003		
Corrosivity	-2.2 (80%)	-1.74 (80%)	-1.97 (80%)	-1.82 (80%)		
Aluminum	0.05	0.03	0.04	0.10 (20%)		
Alkalinity	43	54	50	44		
TSS	2	1	2.1	1.7		
Hardness	83	102	94	76		

### Seasonal Variability of Coliform Bacteria



### Seasonal Variability of E. coli bacteria



## Getting the Word Out!

- Roadside spring education was a component in 56 different programs which were presented to 1,619 residents over the past year.
- Of these attendees 887 (55%) completed an onsite paper or TurningPoint evaluation.
  - 845 (95%) learned new information
  - 690 (78%) were planning on taking some action as a result of hearing the presentation.
- Education efforts will be ongoing
- We created a short publication summarizing results from this study and a video



### Summary

- Roadside springs are used routinely by a significant population in PA
- Seasonal testing of roadside springs during 2014-15 has found that most water chemistry is stable but bacteria levels are always present and tend to be highest during spring and summer
- Nearly all of the springs tested positive for low levels of *Giardia* and/or *Cryptosporidium* oocysts.
- The consumption of untreated roadside spring water represents a significant public health risk warranting future education and outreach efforts.

### **Questions?**

