

# ***Irrigation and Nutrient Management Workshop***

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# **USFDA GAPs Guidance “Mandates”**

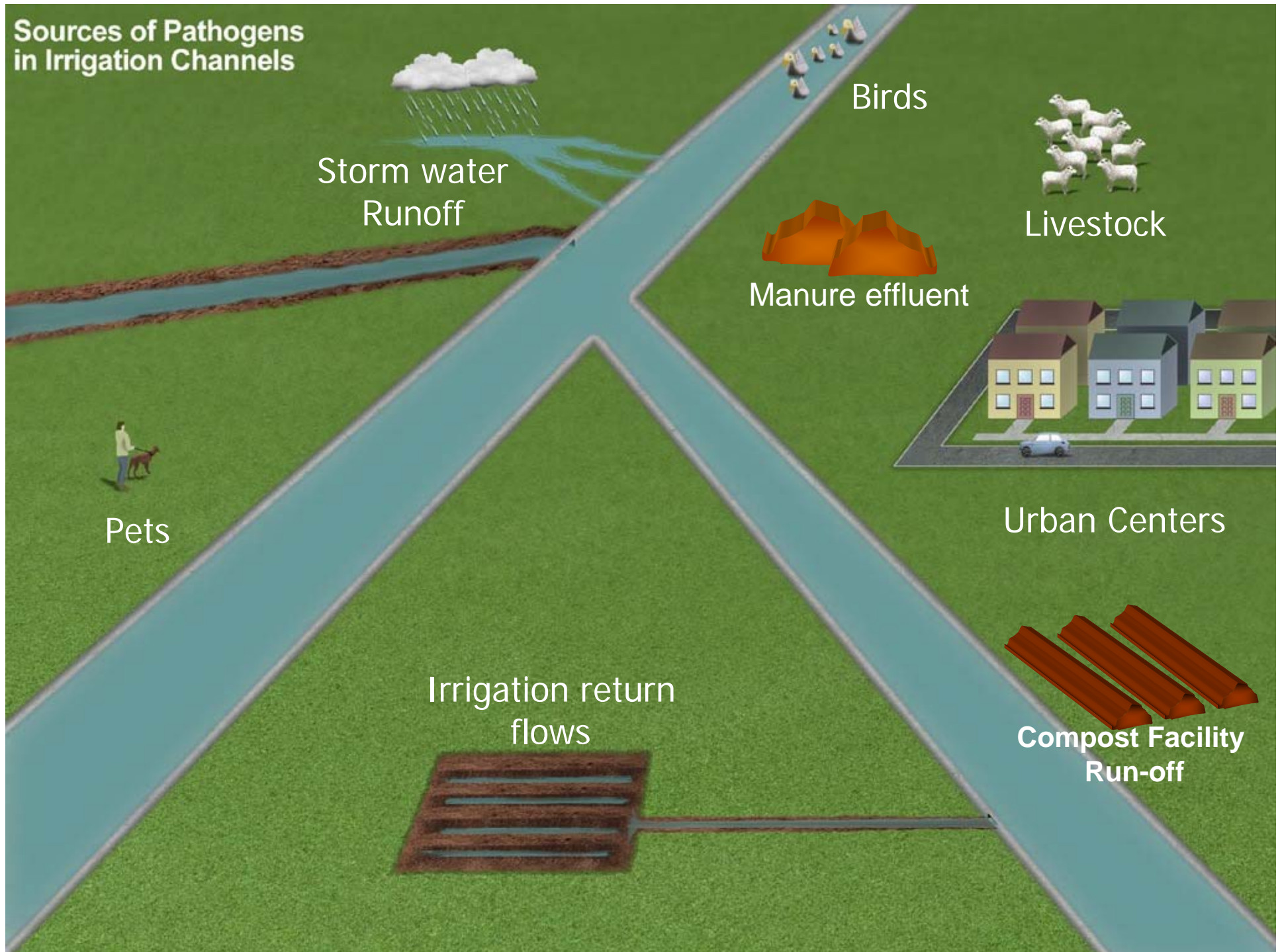
❖ **Water must be.....**

➤ **Adequate for the intended purpose**

❖ **Produce irrigated with inadequate water**

➤ **Shall be considered adulterated**

# Sources of Pathogens in Irrigation Channels





## Identify the Hazards Associated with YOUR Water Source

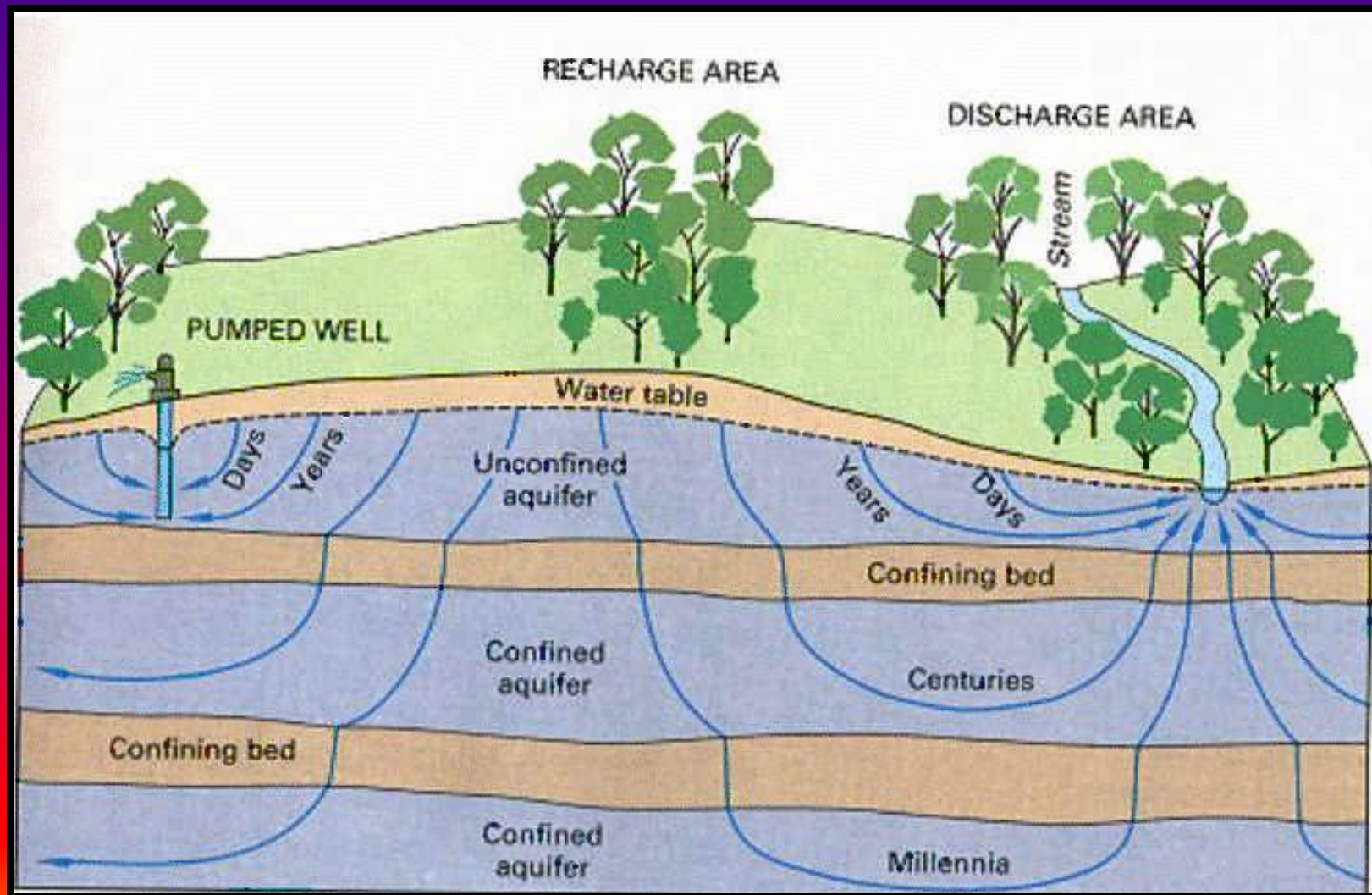


*Credit: Les Lanyon, Penn State Univ.*

# Survival of Fecal Pathogens in Water

<u>Pathogen</u>	<u>Frozen</u>	<u>Cold (5C)</u>	<u>Warm (30C)</u>
Giardia	< 1day	2 mo	< 3 wk
Cryptosporidium	> 1 year	> 1 year	< 3 mo
Salmonella	> 6 mo	> 9 mo	> 6 mo
Campylobacter	2-8 weeks	< 2 wk	< 1 wk
Yersinia	> 1 year	> 1 year	< 2 wk
E. coli O157:H7	> 6 mo	> 9 mo	< 3 mo

## Shallow or Poorly Constructed Wells are Susceptible to Surface Run-off Effects







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# Recommended Water Source Setbacks from Potential Contamination Point-Source

## Wellhead

300+ ft	Best
200-300	Good
50-200	Fair
< 50 ft	Poor

## Surface Water

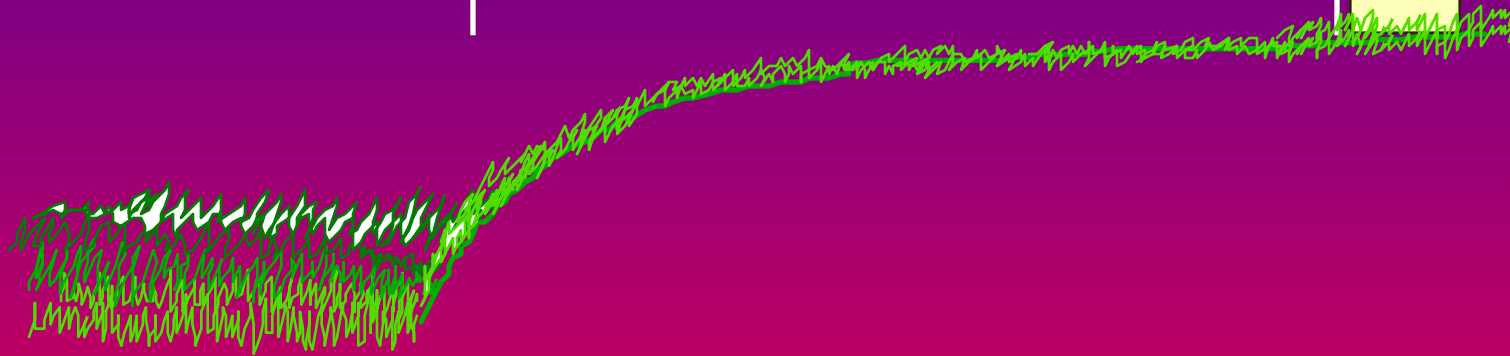
400+ ft	Best
300-400	Good
100-300	Fair
< 100 ft	Poor

*adapted from various EPA guidance*



**Wellhead**

**100 feet separation distance**



**Septic system drain field**

Wells should be located at least 100 feet  
from the septic drain field.

## Recommended Shock Treatment Dose Calculations

Laundry bleach (about 5.25% Hypochlorite)					
	Casing Diameter				
Depth of water in well (in feet)	4 inch	6 inch	8 inch	10 inch	12 inch
10	1/2 cup	1 cup	1-1/2 cup	1 pint	2 pints
25	1 cup	1 pint	2 pints	3 pints	4-1/2 pints
50	1 pint	1 quart	2 quarts	3 quarts	1 gallon
100	1 quart	2 quarts	1 gallon	1-1/2 gallons	2 gallons
150	3 pints	3 quarts	1-1/2 gallons	2 gallons	3 gallons
High-Test Hypochlorite (HTH 65-75% Hypochlorite)					
	Casing Diameter				
Depth of water in well (in feet)	4 inch	6 inch	8 inch	10 inch	12 inch
10	-	-	-	-	-
25	-	-	-	1/4 lb	1/2 lb
50	-	-	1/3 lb	1/2 lb	3/4 lb
100	-	1/3 lb	3/4 lb	1 lb	1-1/2 lb
150	1/4 lb	1/2 lb	1 lb	1-1/2 lb	4 lb

# Concerns for Microbial Quality of Pre-harvest Water

## Foliar Applications and Contact

Pesticides

Nutrients

Thinning aides

Harvest aide

Growth regulators

Frost control

Anti-transpirants

Dust abatement

Microenvironment management





# **Foliar Sprays from an Uncharacterized Water Source May put YOU at Risk.**



**Among Other Issues, Macro-Algae are Known to Harbor *E.coli* Indicators and Pathogens**



# ***Salmonella* and *E.coli* O157:H7 Can Survive and Even Grow In Some Foliar Materials from a Contaminated Water Source**

## **Dies**

**Dithane M45**

**Maneb**

**Mancozeb**

**Kocide**

**Ridomil 240EC**

## **Survives**

**many**



## **Grows**

**Ambush 500EC**

**Bravo 500**

**Lorsban 4E**

**Scholar**



***From***

**Guan et al. 2001. J. Sci. Food Agri. 81:503-512**

**Guan et al. 2005.. J Food Prot. 68:296-304.**

**AND Suslow, Zuniga and Fernandez,; unpublished data 2001.**



# **Water for Foliar Sprays Should Come from a Potable Source**



# **USFDA GAPs Guidance “Mandates”**

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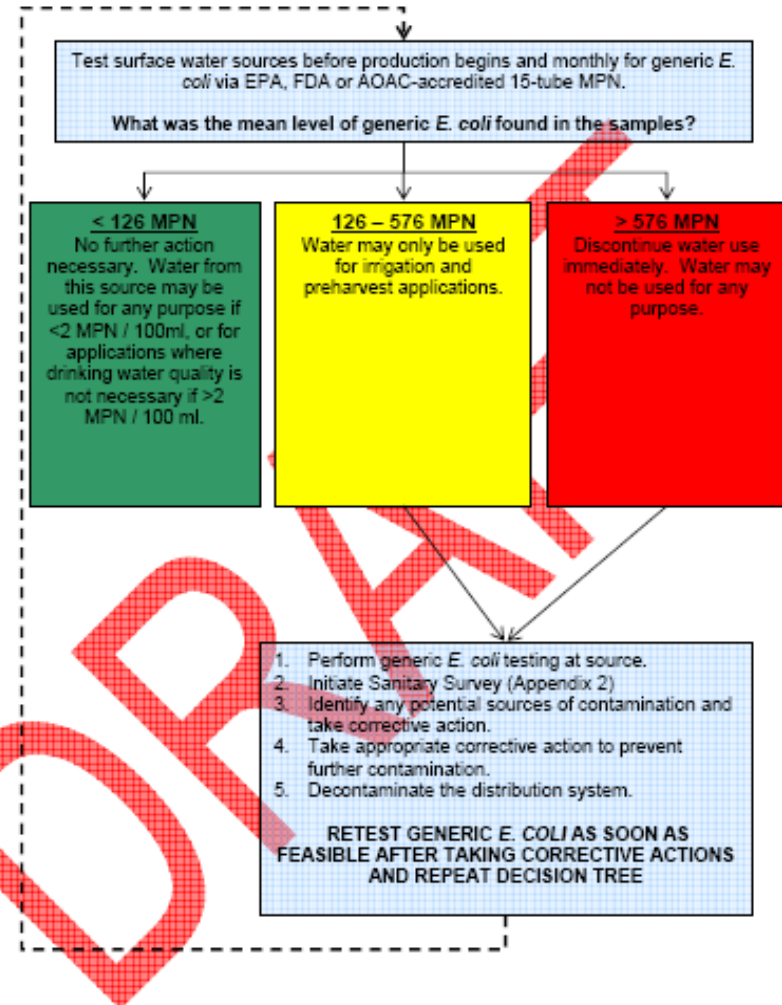
# Currently in Revision to Incorporate More Specific “Metrics”

## Commodity Specific Food Safety Guidelines for the Lettuce and Leafy Greens Supply Chain



25 APRIL 2006

Figure 4. Decision Tree for Surface Water Sources





**Figure 4. Decision Tree for Surface Water Sources**

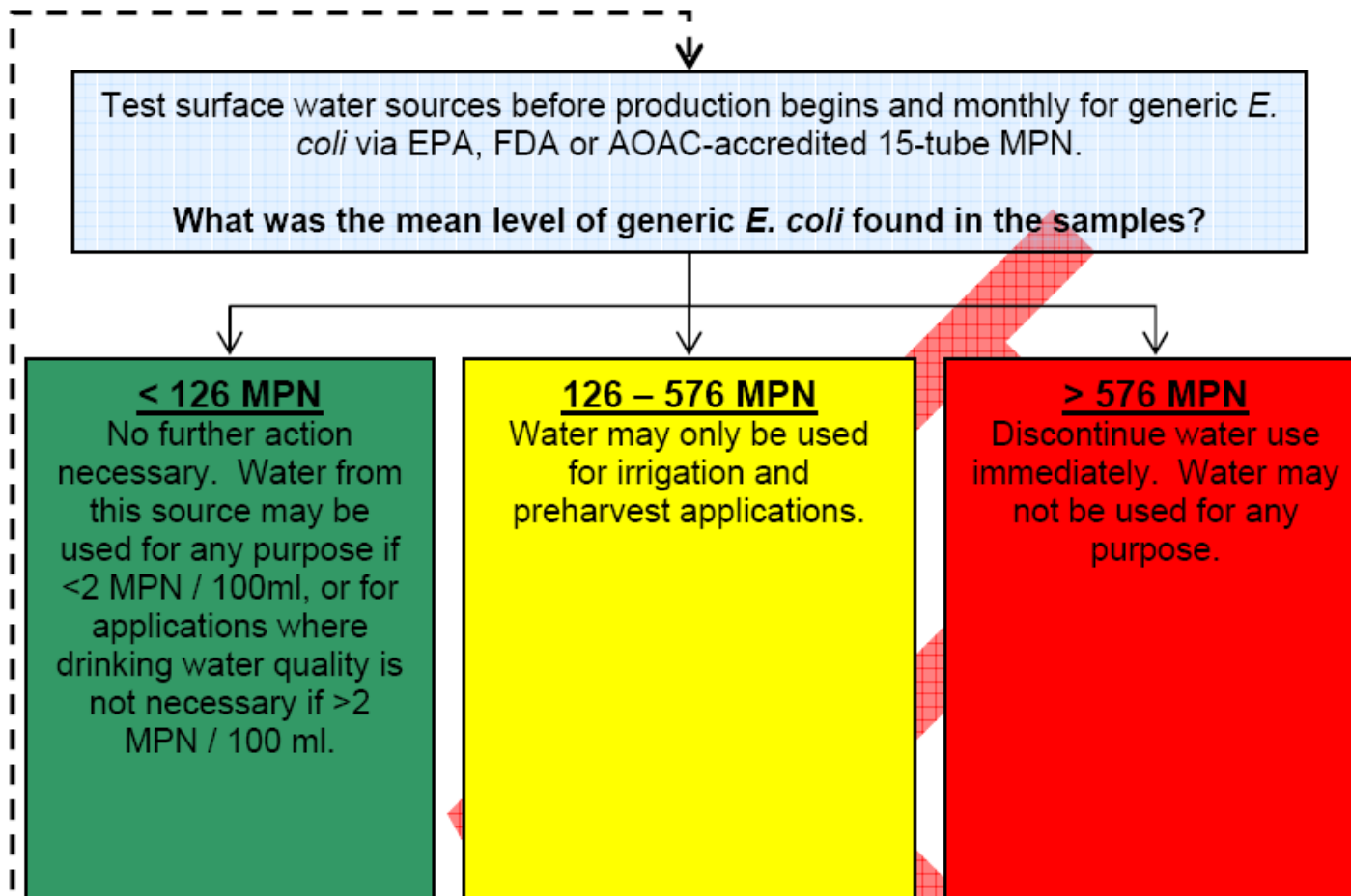
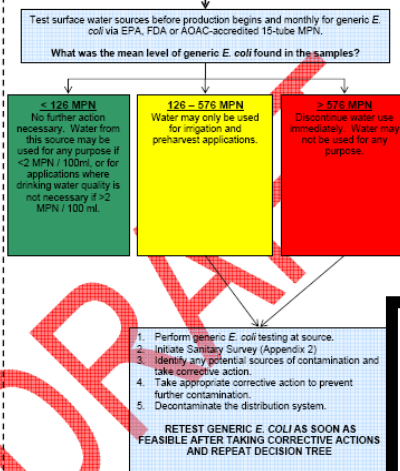


Figure 4. Decision Tree for Surface Water Sources



## Specific and Uniform Action Path is Being Debated

1. Perform generic *E. coli* testing at source.
2. Initiate Sanitary Survey (Appendix 2)
3. Identify any potential sources of contamination and take corrective action.
4. Take appropriate corrective action to prevent further contamination.
5. Decontaminate the distribution system.

**RETEST GENERIC *E. COLI* AS SOON AS FEASIBLE AFTER TAKING CORRECTIVE ACTIONS AND REPEAT DECISION TREE**

# Summary Lettuce Field Survey 2004-2005

## 14 fields x 40 plants at commercial harvest

	E. coli			TTC		
	Furrow	Sprinkler	Drip	Furrow	Sprinkler	Drip
mean log cfu/25g	0.92	1.88	0.98	1.89	2.25	2.12
median log cfu/25g	0.92	0.91	0.91	1.89	2.23	1.84
max log cfu/25g	0.93	2.58	1.09	2.13	2.62	2.48

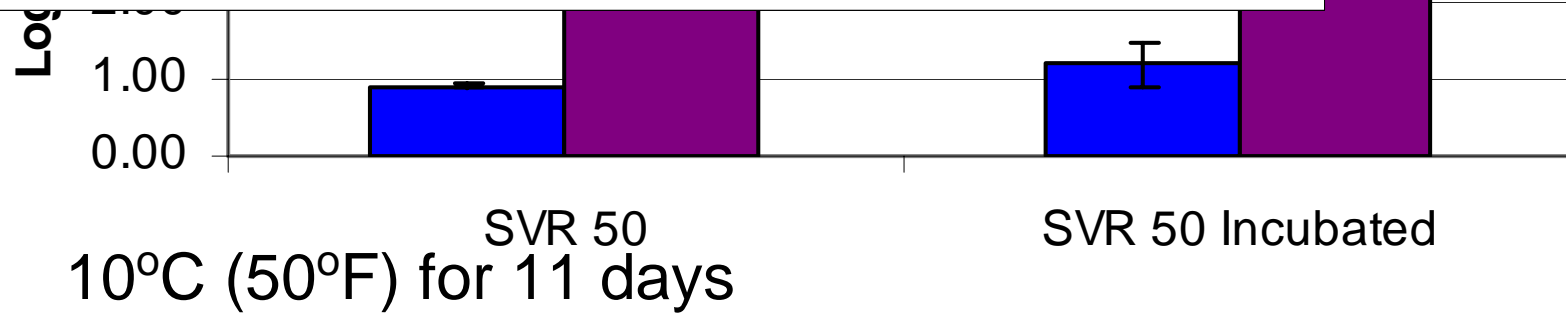
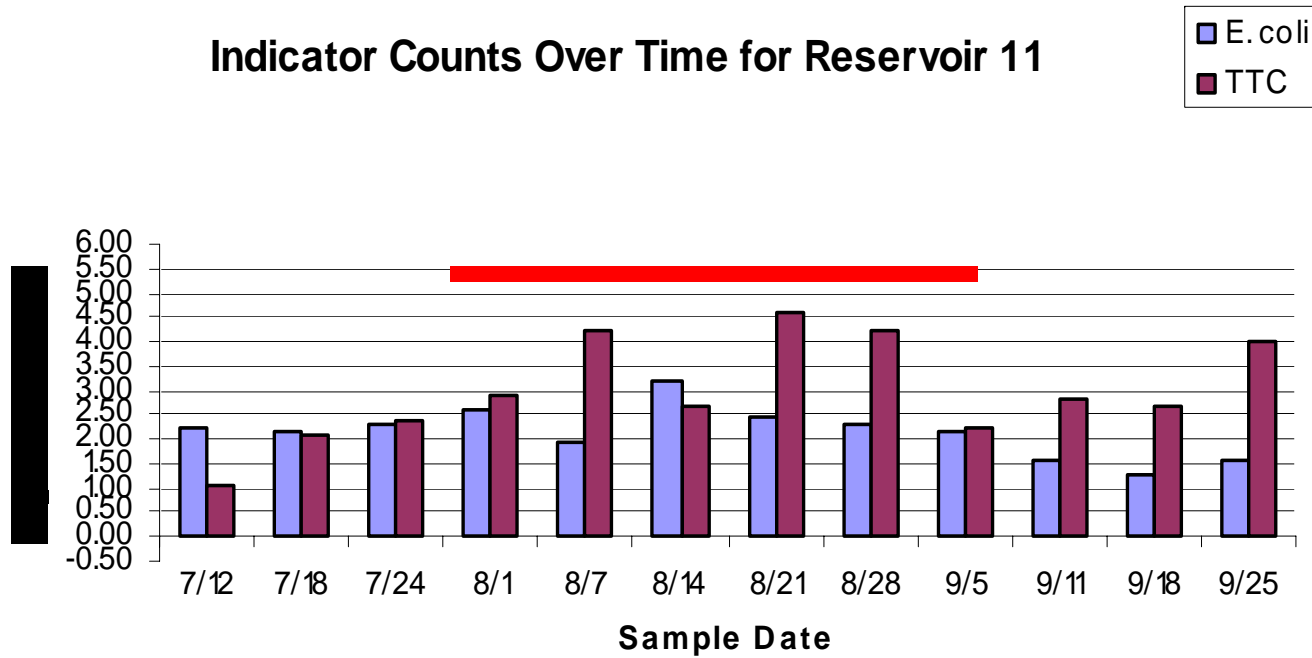


One field,  
one plant



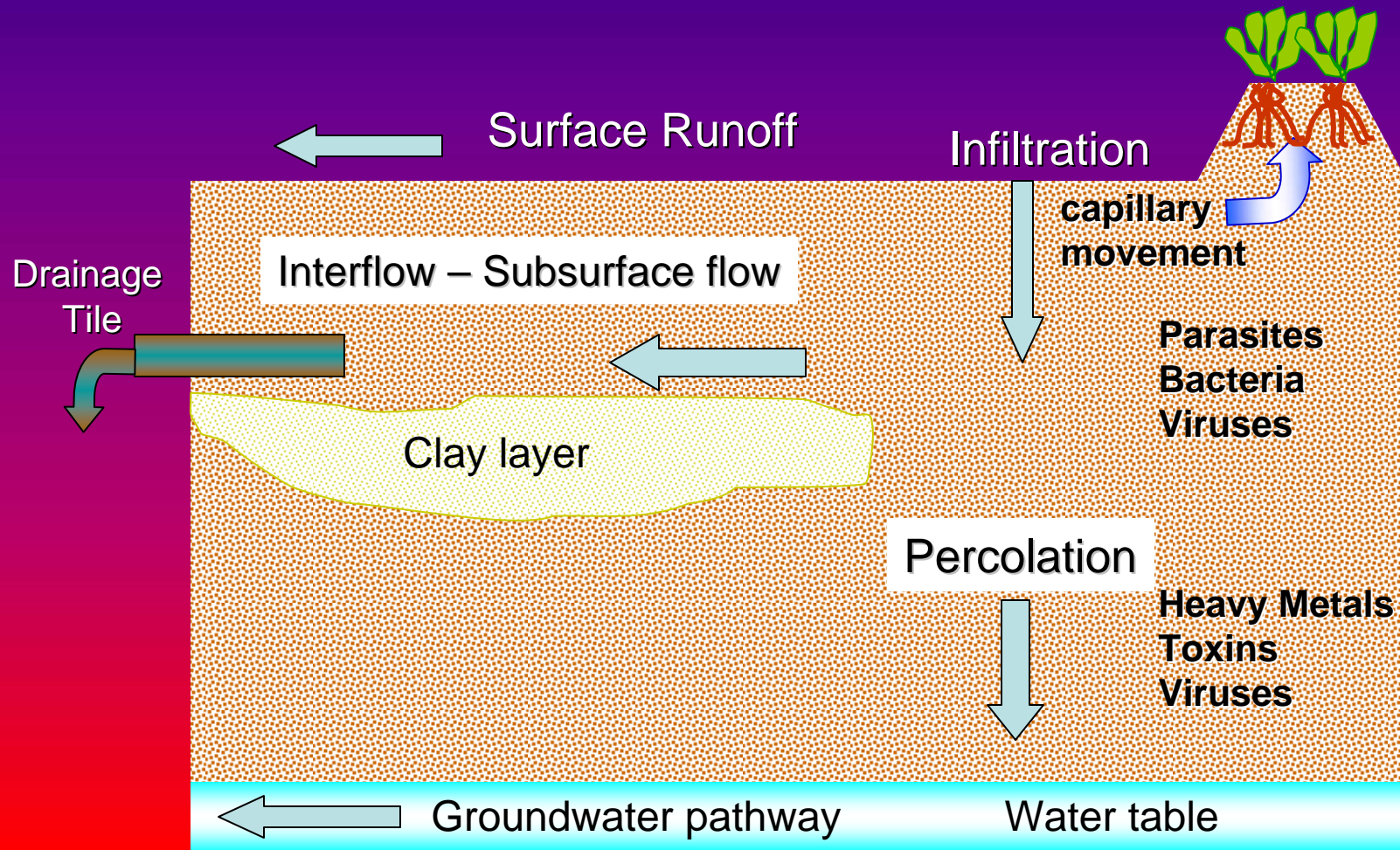


Indicator Counts Over Time for Reservoir 11





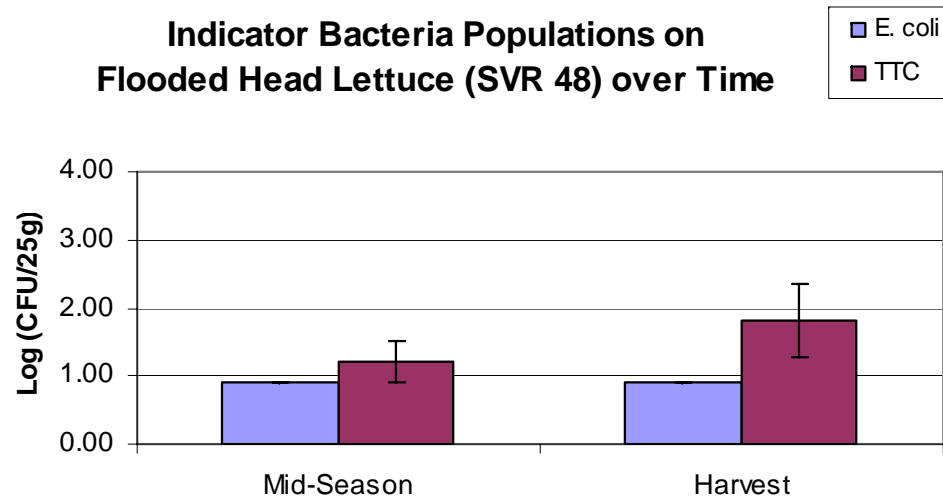
# Flooding May Impact Soil, Water Sources, and non-Flooded Root Zones



*adapted from EPA Risk Management 2004*

# Survival of Indicators on Lettuce over Time

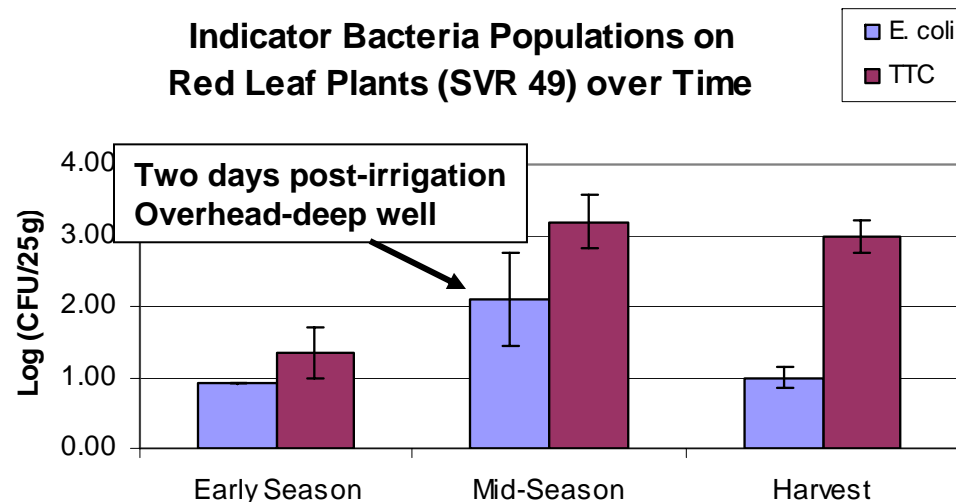
Indicator Bacteria Populations on Flooded Head Lettuce (SVR 48) over Time



LOD is 0.91 log CFU/25 g of lettuce



Indicator Bacteria Populations on Red Leaf Plants (SVR 49) over Time



LOD is 0.91 log CFU/25 g of lettuce



## Objective 1: Presence of *E. coli* O157:H7 in Lettuce

### Results

200 whole plant samples

500 seedlings



Pooled Seedlings from re-planted field  $\cong$  13g

***E. coli* O157 was not detected in any of the plant samples**  
**Pathogenic *E. coli* not detected by real-time PCR**  
**Inoculated controls always detected (10 CFU/sample)**

# Potential Control Actions: Preharvest Water Chlorination



**Not a Legal or Smart Set-up**

# **Hyperchlorination of Surface Water May Increase Formation of Undesirable Disinfection By-Products**

**Trihalomethanes**

**chloroform, bromodichloromethane**  
***Known or suspected cancer inducers***

**Ozone < Chlorine Dioxide < Chlorine**

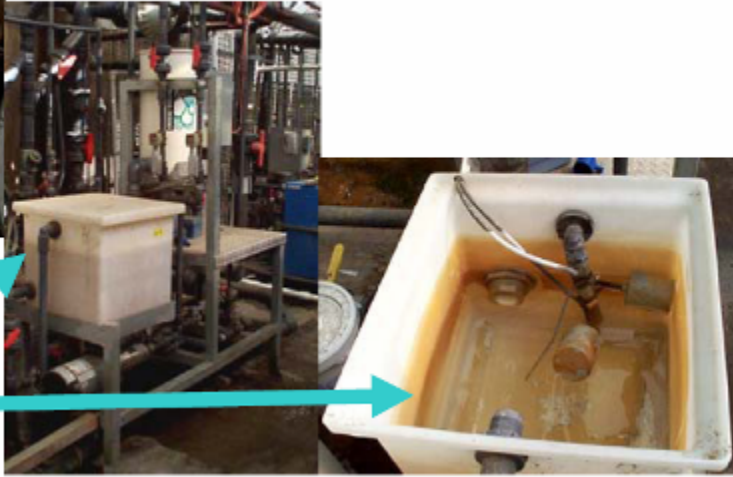
**S. Richardson, EPA**



Tablet  
reservoir

HOCl  
concentrate

High volume system



Calcium hypochlorite is delivered  
by Controlled Erosion





# Copper Ionization Treatment

- ❖ Low voltage electrodes release ions in water stream
- ❖ Cu ~ 300 ppb ; sometimes Ag ~ 40 ppb
- ❖ Research supports efficacy
  - Cooling towers
  - Ponds and pools
  - Well water holding tanks
- ❖ Very stable in 'clean' water systems
- ❖ Very slow acting
- ❖ Performance requires low (0.4-0.8 ppm) chlorination
- ❖ Kill during direct use from well or surface water unlikely

# **Water is the # 1 Big Ticket Item on the FDA Priority Watch List**

- ❖ **Water**
- ❖ **Waste**
- ❖ **Wildlife**
- ❖ **Workers**