# Plumbing the Depths

## Exploring the nuances of risk in well systems

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MSU Extension

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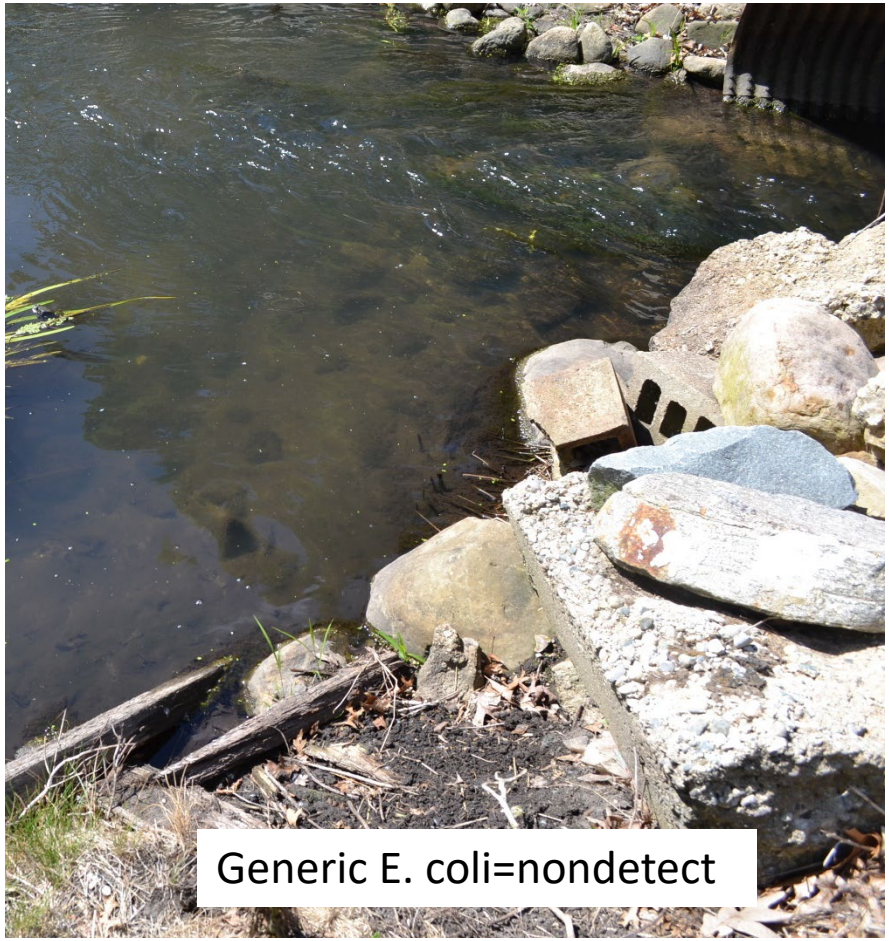
# All things being equal, which is safer?

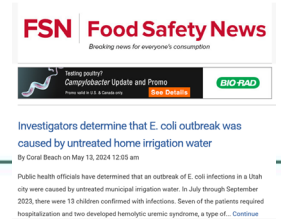



# Probability of Contamination

**Lower Risk** → **Higher Risk**

## Public Water Supply

Treated




## Ground Water

## Surface Water

Open to Environment

Produce Safety ALLIANCE

# Is a well *always* safer?

# What the rule says…

21 CFR 112.42(b) *Maintenance of your agricultural water systems.* You must adequately maintain all agricultural water systems, to the extent they are under your control, as necessary and appropriate to prevent the systems from being a source of contamination to covered produce, food contact surfaces, or areas used for a covered activity. Such maintenance includes:

(2) Correcting any significant deficiencies (such as control of cross-connections and repairs to well caps, well casings, sanitary seals, piping tanks, and treatment equipment);

Formerly 112.42 (c)

# Basic Well Design

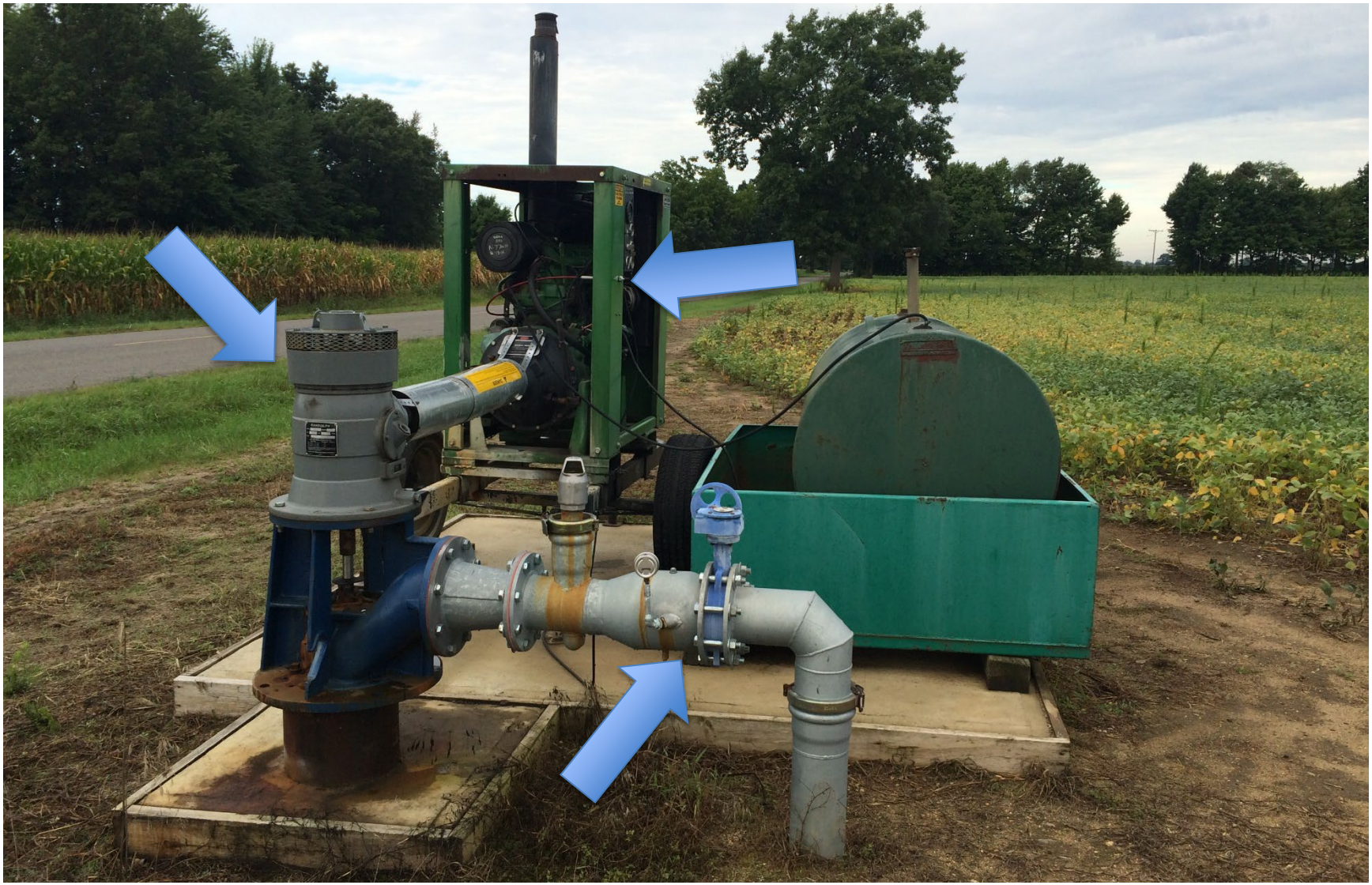
- All wells need:
  - A source of power
  - A pump to draw water
  - A method to regulate flow
- Common additions:
  - Air bladders
  - Backflow preventers
  - Concrete pads

# Parts of a well

# Sources of Power

# Pump to Draw Water

# Flow Regulation



# Where the Rules Break Down

# Well or Hydrant?

# Well or Hydrant?

# Well Parts

# Sandpoint Well

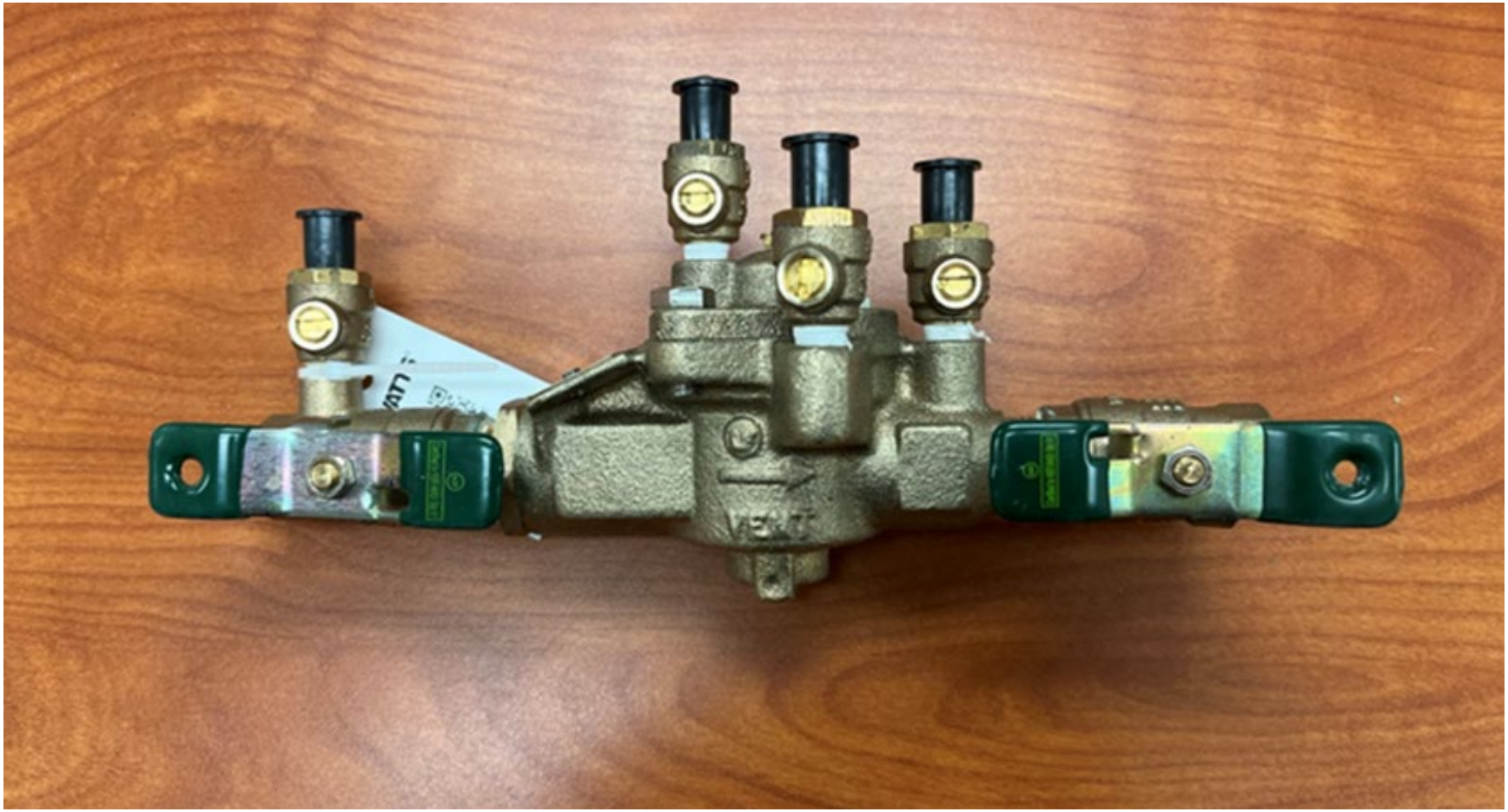
# Pressure Relief Valve

# Foot Valve

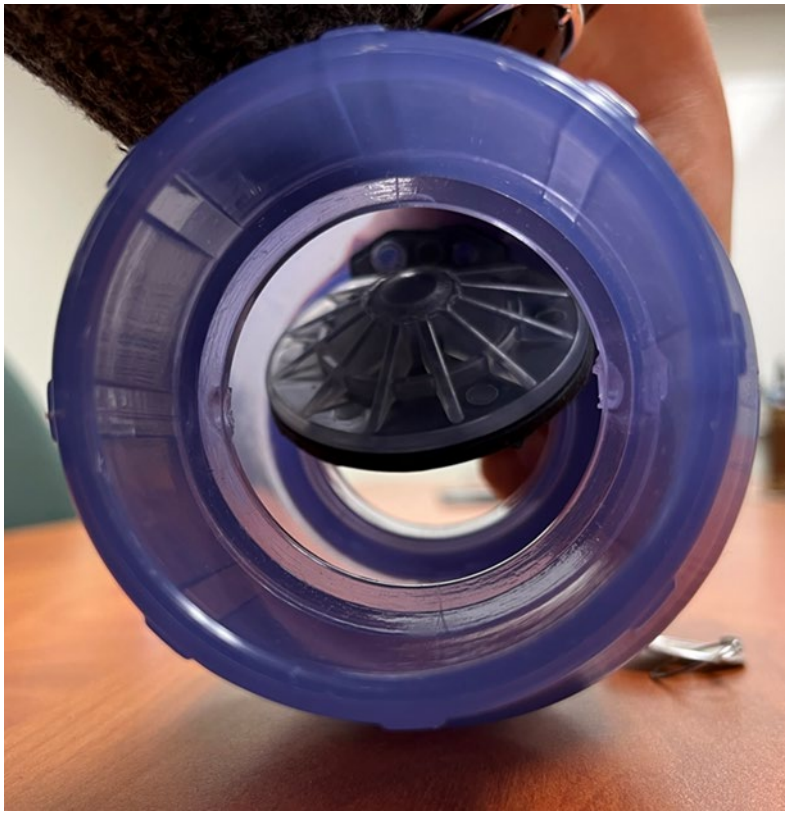
# Spring-swing valve

# Bladder Tank

# Reduced Pressure Zone (RPZ) Valve



# Swing Gate Valve

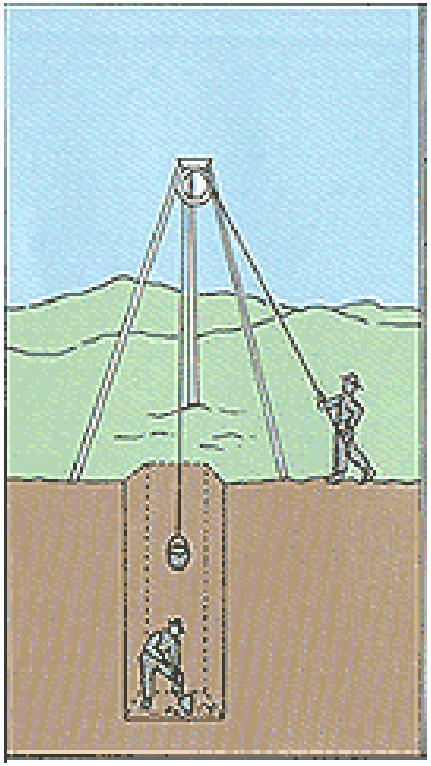
# Ball Valve


# Submersible Pump

# Centrifugal Pump

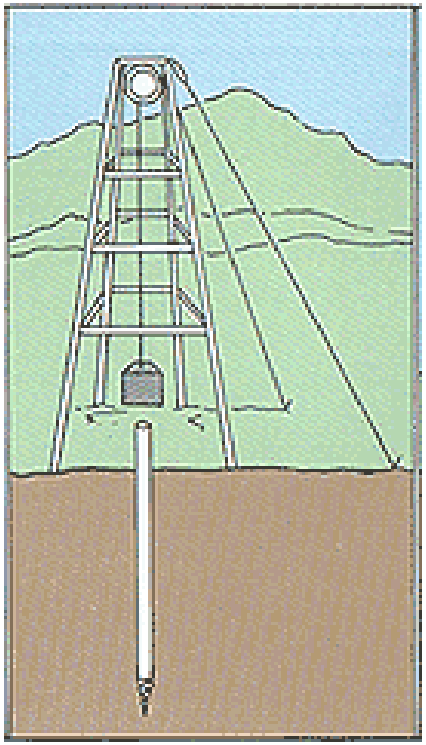
# Dug Wells

- Shallow (10-30 ft)
- Requires high water table.
- High risk of contamination.



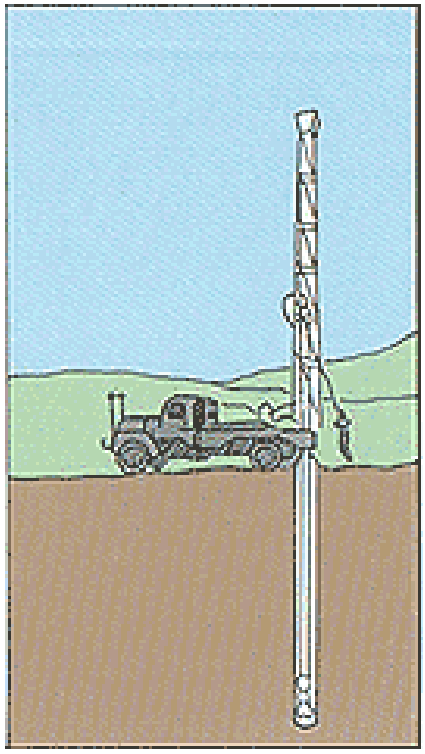
# Driven Wells

- Shallow (Up to 30 ft)
- Requires high water table and sandy soil.
- Often used for irrigation.
- High risk of contamination.
- Also called sand point wells.



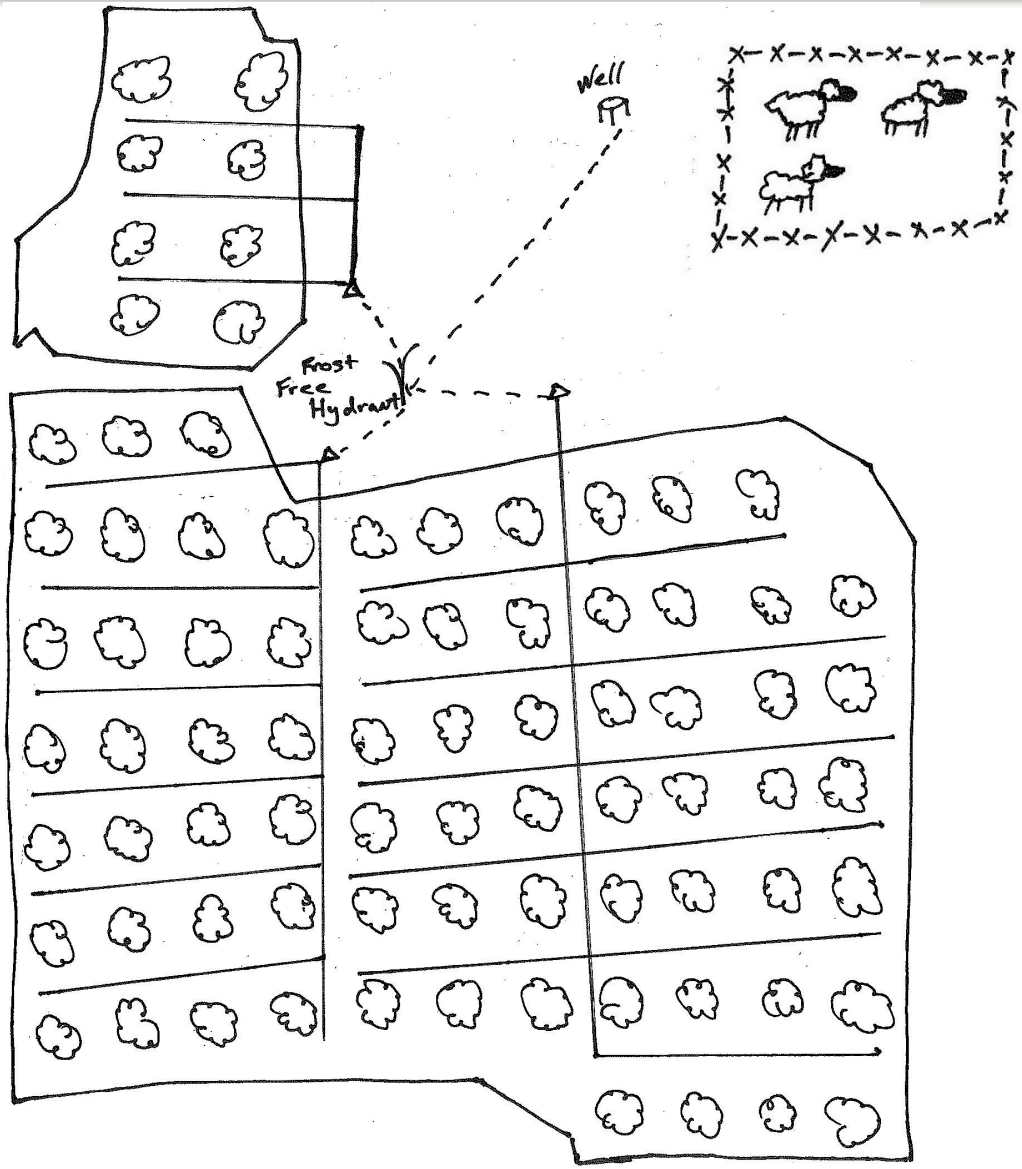
# Drilled Wells

- Can be very deep.
- Well is dug into bedrock.
- Casing is sunk to bedrock.
- Bentonite seals the outside of the casing



# Whole Group Scenario

1. What are the potential hazards?
2. How risky are they? (Think severity and likelihood.)
3. How can they be mitigated?
4. Are there any underlying factors to consider?



# Scenario Breakouts

- Your table has a scenario.

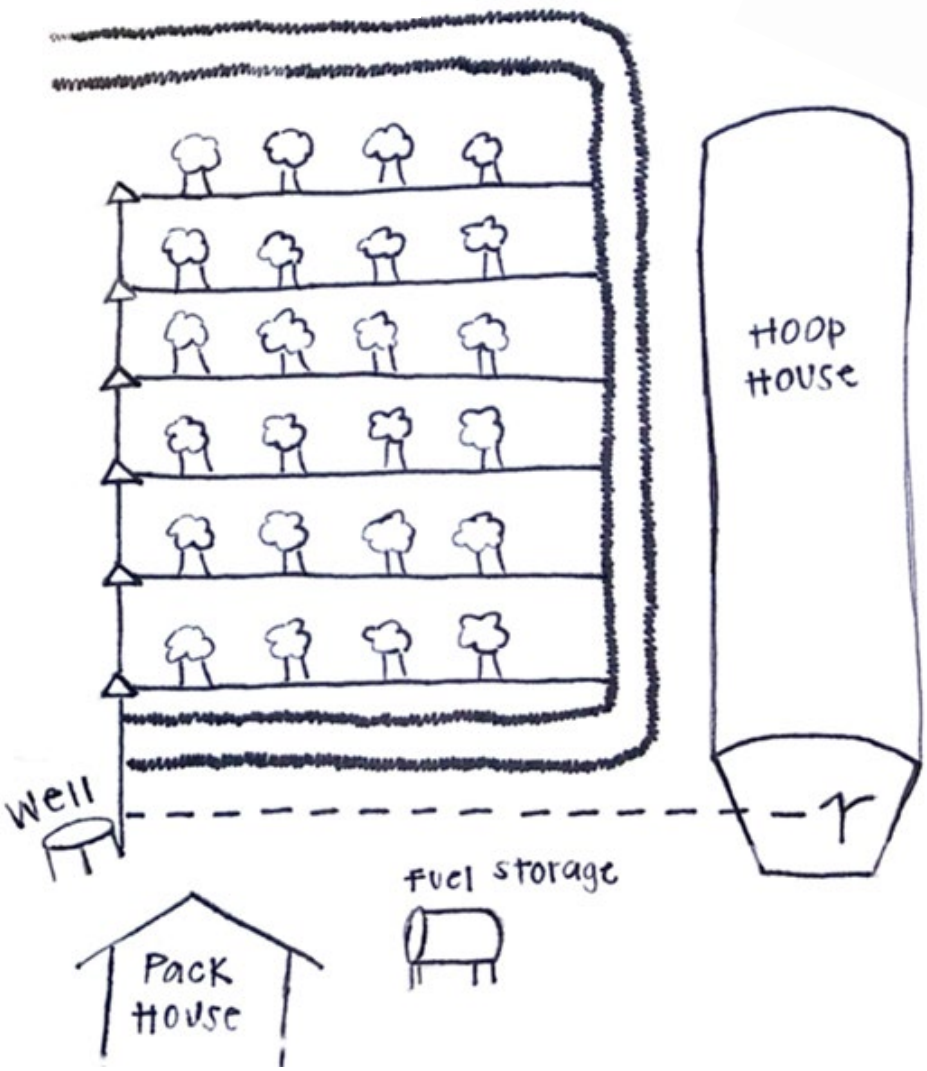
- Discuss the following points together.

- 1. What are the potential hazards?
- 2. How risky are they? (Think severity and likelihood.)
- 3. How can they be mitigated?
- 4. Are there any underlying factors to consider?

# Scenario 1

- House well
- 125 ft deep
- Frost free hydrant
- Geometric Mean=ND generic *E. coli*

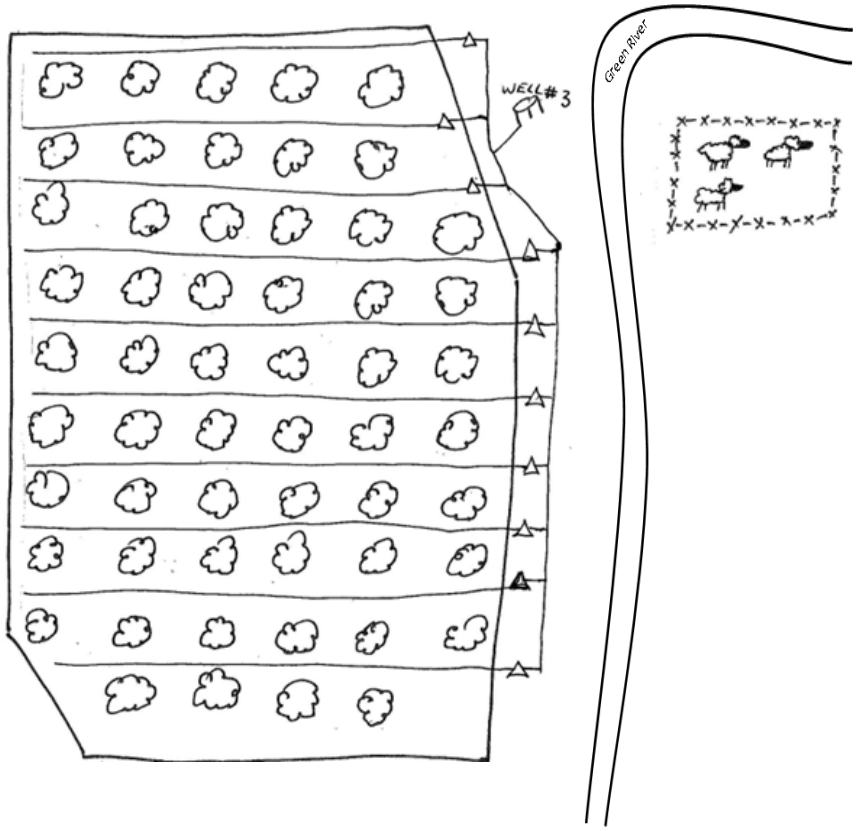
- Is the delivery system protected?



# Scenario 2

- 50 ft deep
- Geometric Mean=15 cfu generic *E. coli*/100 ml
- Range of test values from 5 cfu/100 ml to 120 cfu/100 ml

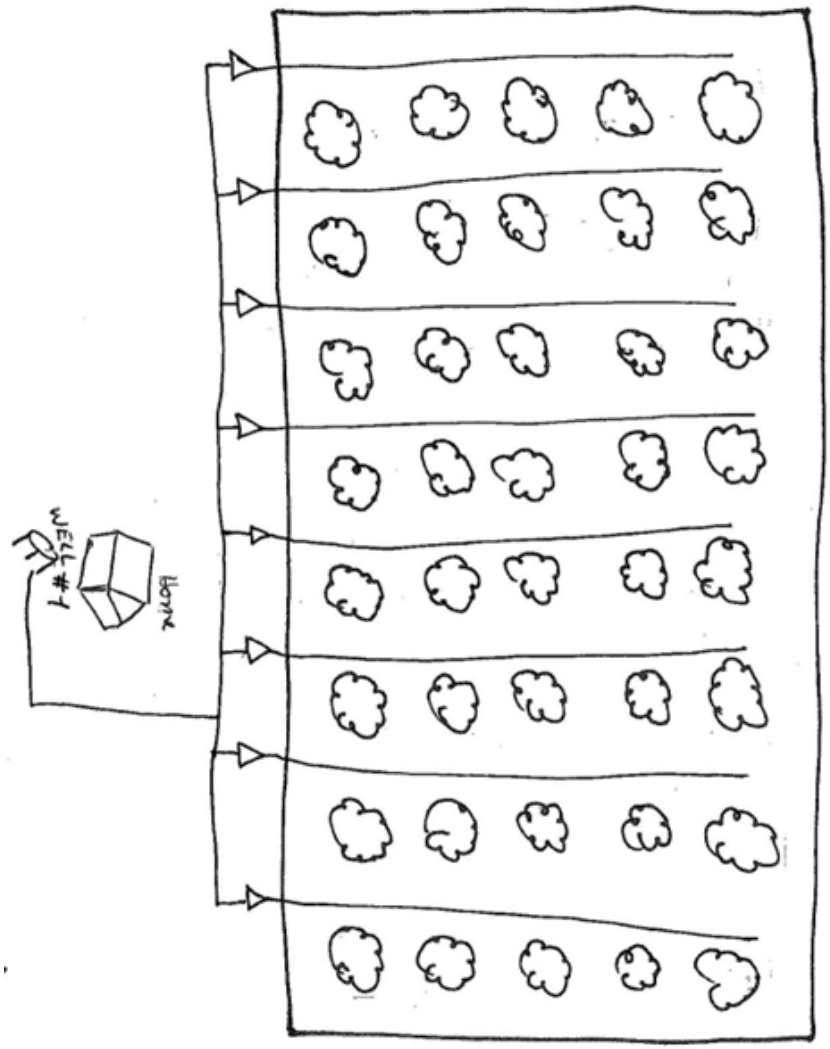
- Is the proximity of the wellhead to a surface water source an issue? (Comment 46)



# Scenario 3

- 15 ft deep
- Occasional positive generic *E. coli* test
- Well is shocked to get to ND

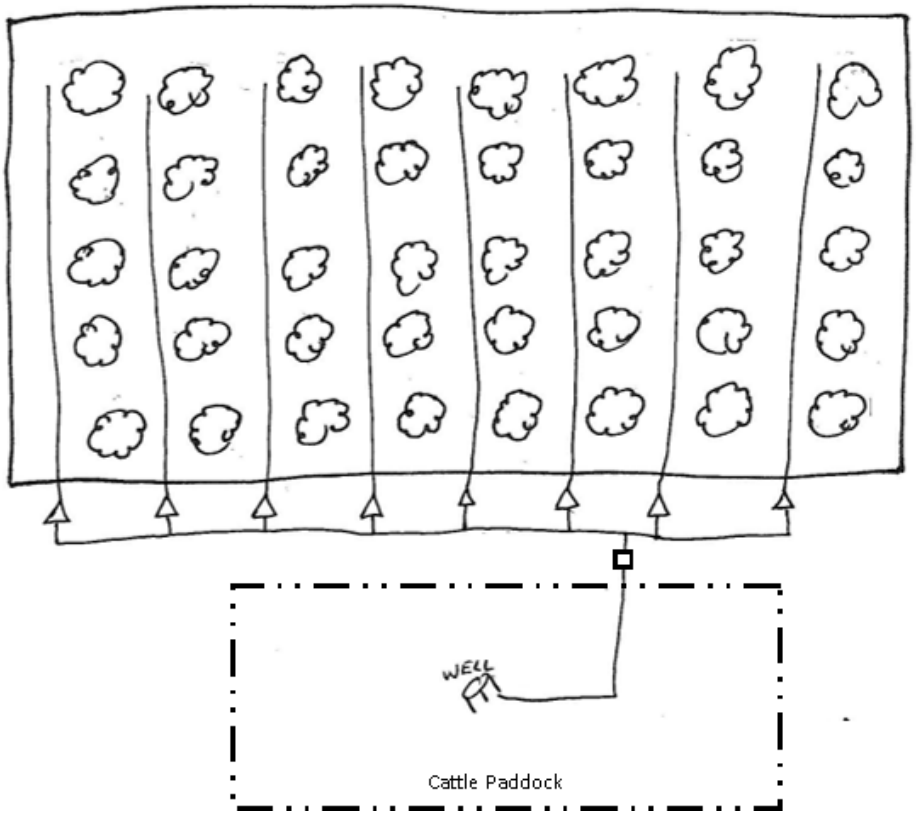
- What might the depth of the well indicate?



# Scenario 4

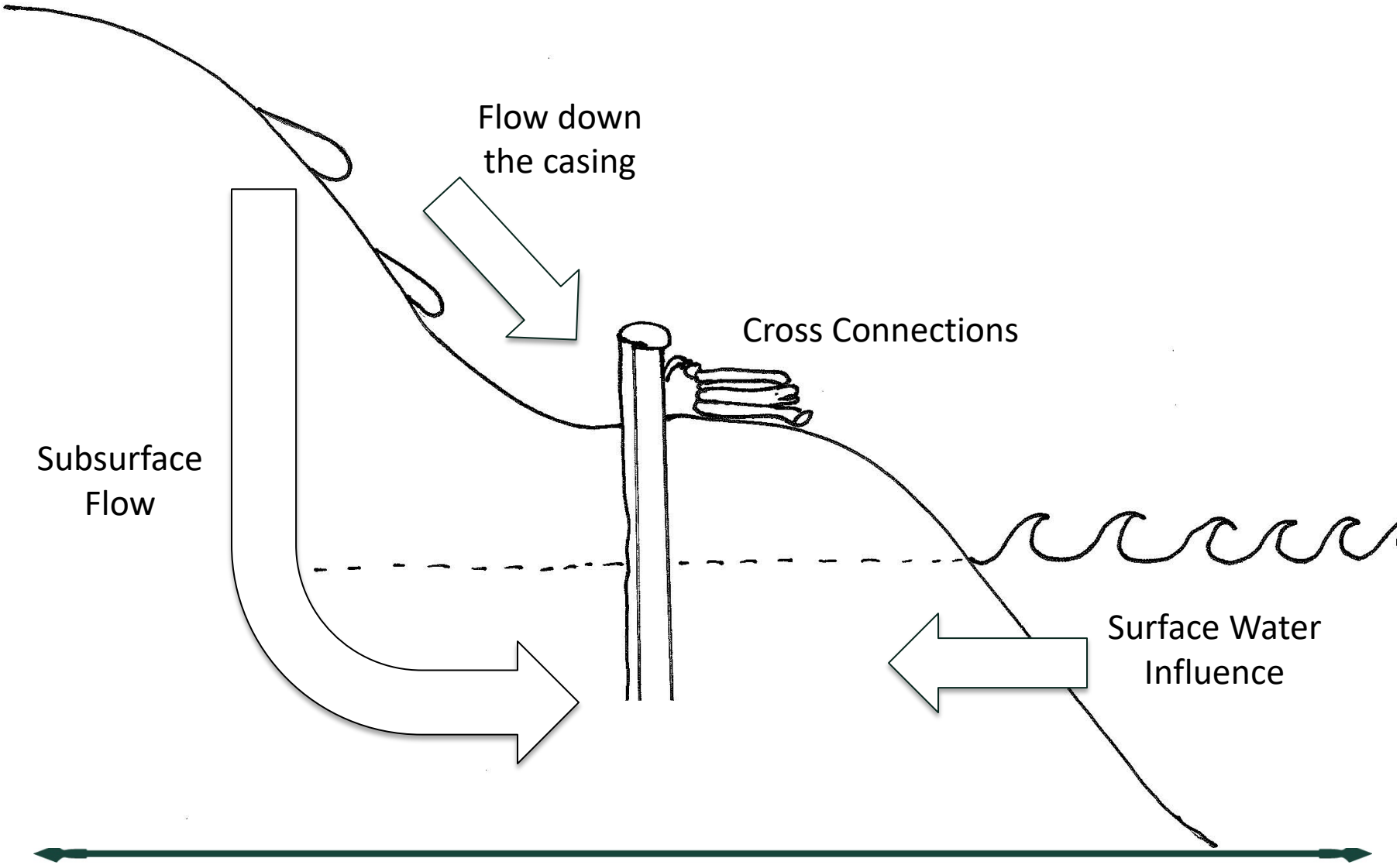
- 125 ft deep
- Mostly no detectable generic *E. coli*/100 ml

- Might the well placement affect the long-term suitability of the water source?



# Key Considerations when Evaluating Wells

- Protection of the delivery system (cross connections)
- Wellhead proximity to surface water (Surface water influence)
- Depth of the well (Surface water influence and casing integrity)
- Proximity of wellhead to contamination sources (Casing integrity and subsurface flow)


Flow down
the casing
Cross Connections
Subsurface
Flow
Surface Water
Influence

# What are Mitigation Options for Rogue Wells?

- Change how you use the water.
- Change the structure of the well
  - Deeper
  - New with solid casing
  - Berms to prevent pooling
  - Well housing/fencing
- …..or treat the water


Like most postharvest water students, Doreen breezes though chapter 9

Cartoon c/o Keith Schneider

# A Good Well

- Is above grade
- Has securely connected conduit
- Is securely locked
- Has a screened vent hole
- Has a backflow preventer.

# A BETTER Well

- Is inside an enclosed structure or fenced
- Has intact concrete
- Has a solid, sealed casing until the well meets the water bearing layer
- Is not near a surface water source that can influence it

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