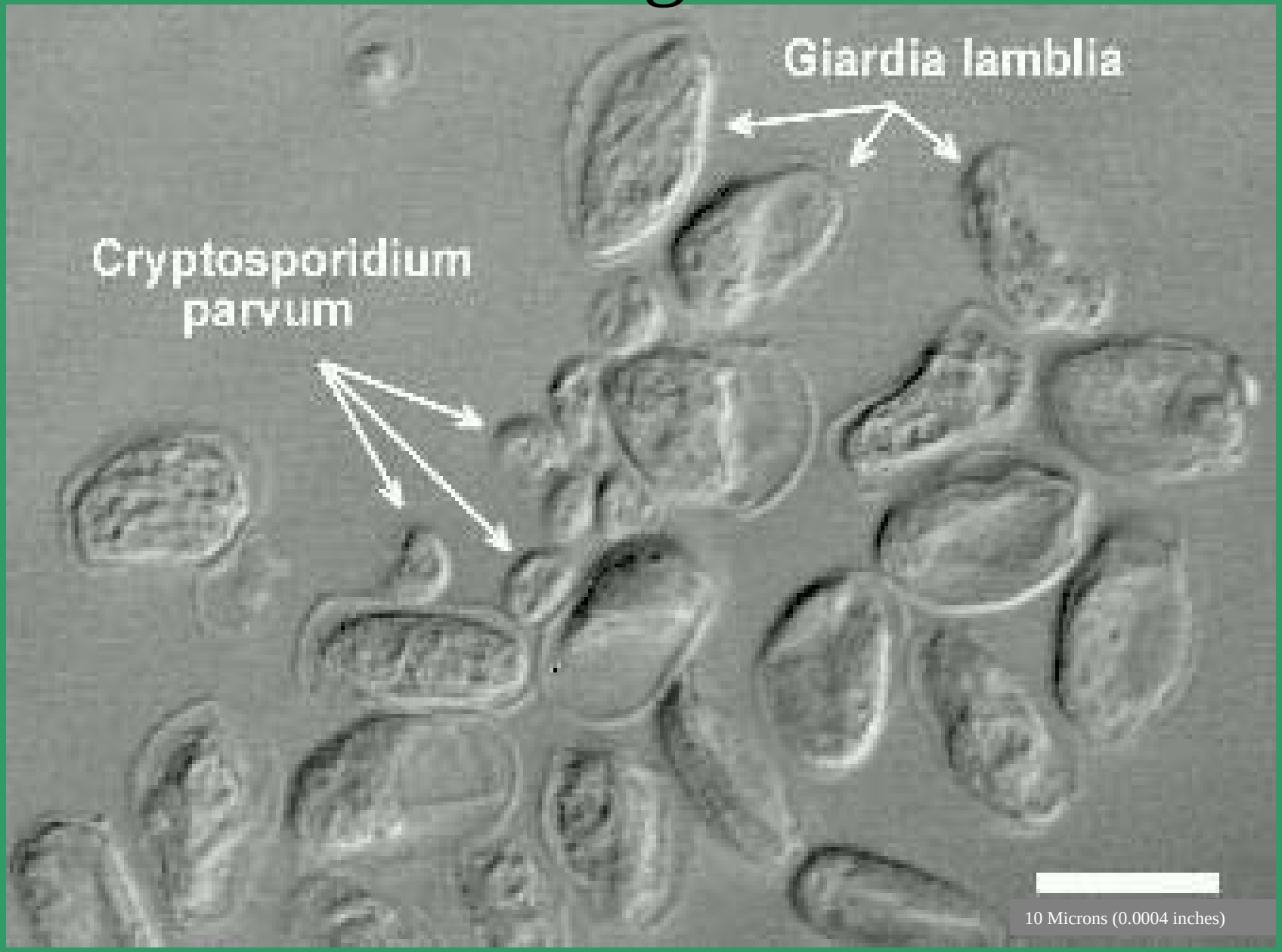
Goodie, it’s time for GWUDI!

What is GWUDI?

The federal rule (40 CFR 141) defines Groundwater Under the Direct Influence of Surface Water as:

"Any water beneath the surface of the ground with significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium*, or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions (40 CFR 141 definition)".

Pathogens


Giardia lamblia
Cryptosporidium parvum
10 Microns (0.0004 inches)

GWUDI History

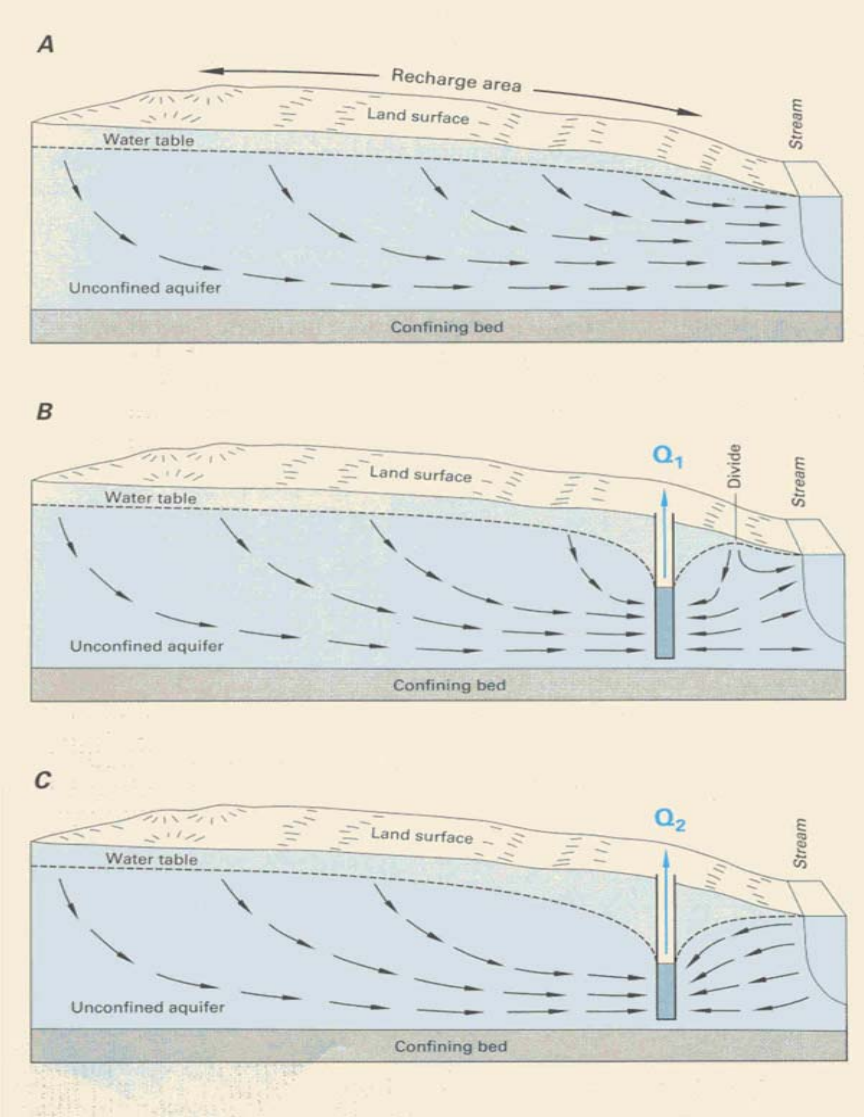
- Surface Water Treatment Rule (1986)
  - Concern: *Giardia* and *Cryptosporidium*
  - Surface Water <u>and</u> Groundwater under the direct influence
- EPA Region 10 States define criteria for identifying GWUDI systems (1993)
  - If within 1000 ft and either TC in source or inadequate well construction, then evaluate
  - Hydraulic connection with surface water (proximity, covariation of T, Cond, pH, etc. and if necessary
  - Microscopic Particulate Analysis (MPA): presence and abundance of surface water indicators

Hydraulic Connection

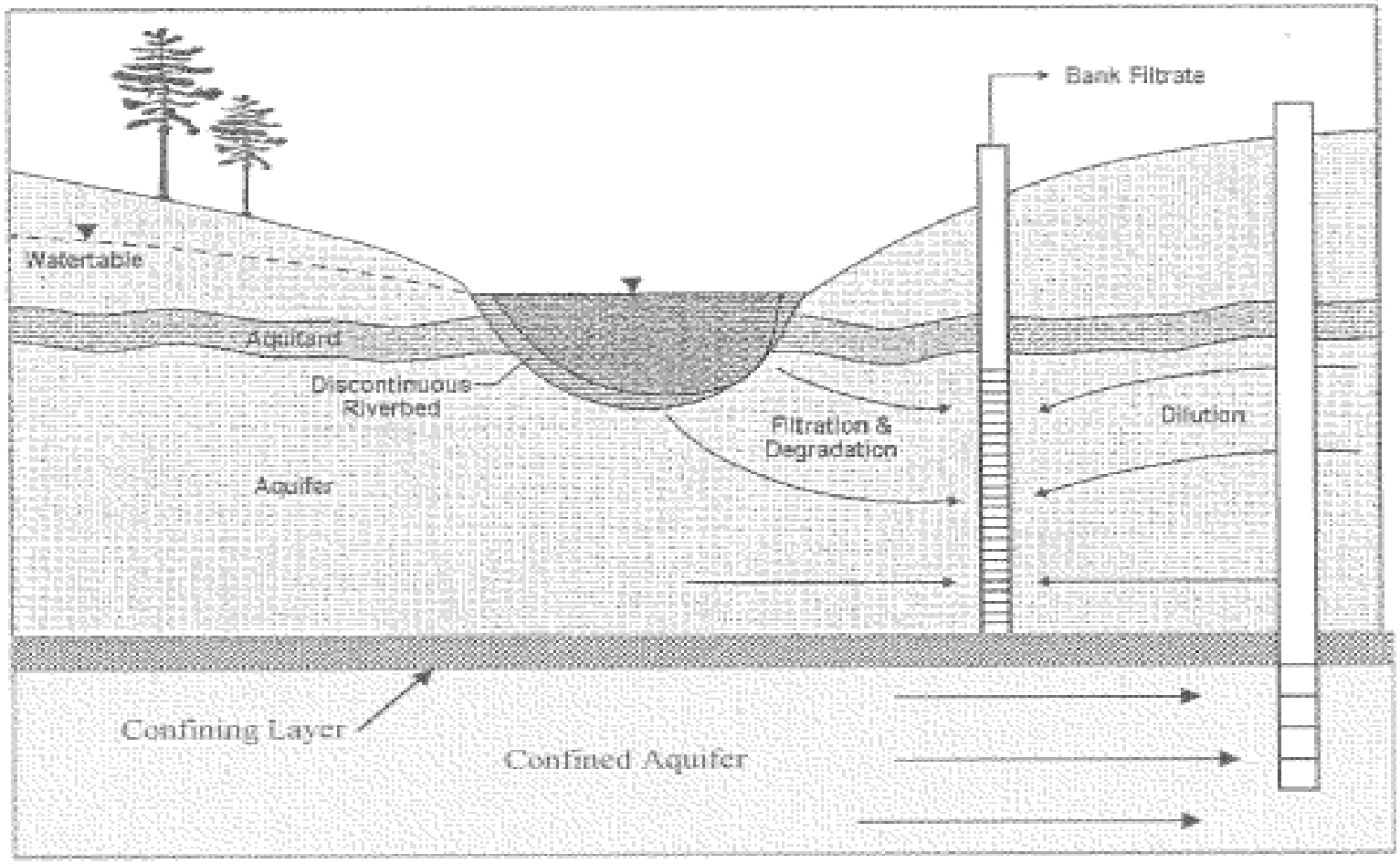
Pumping wells Close to Streams

Drawing in surface Water?

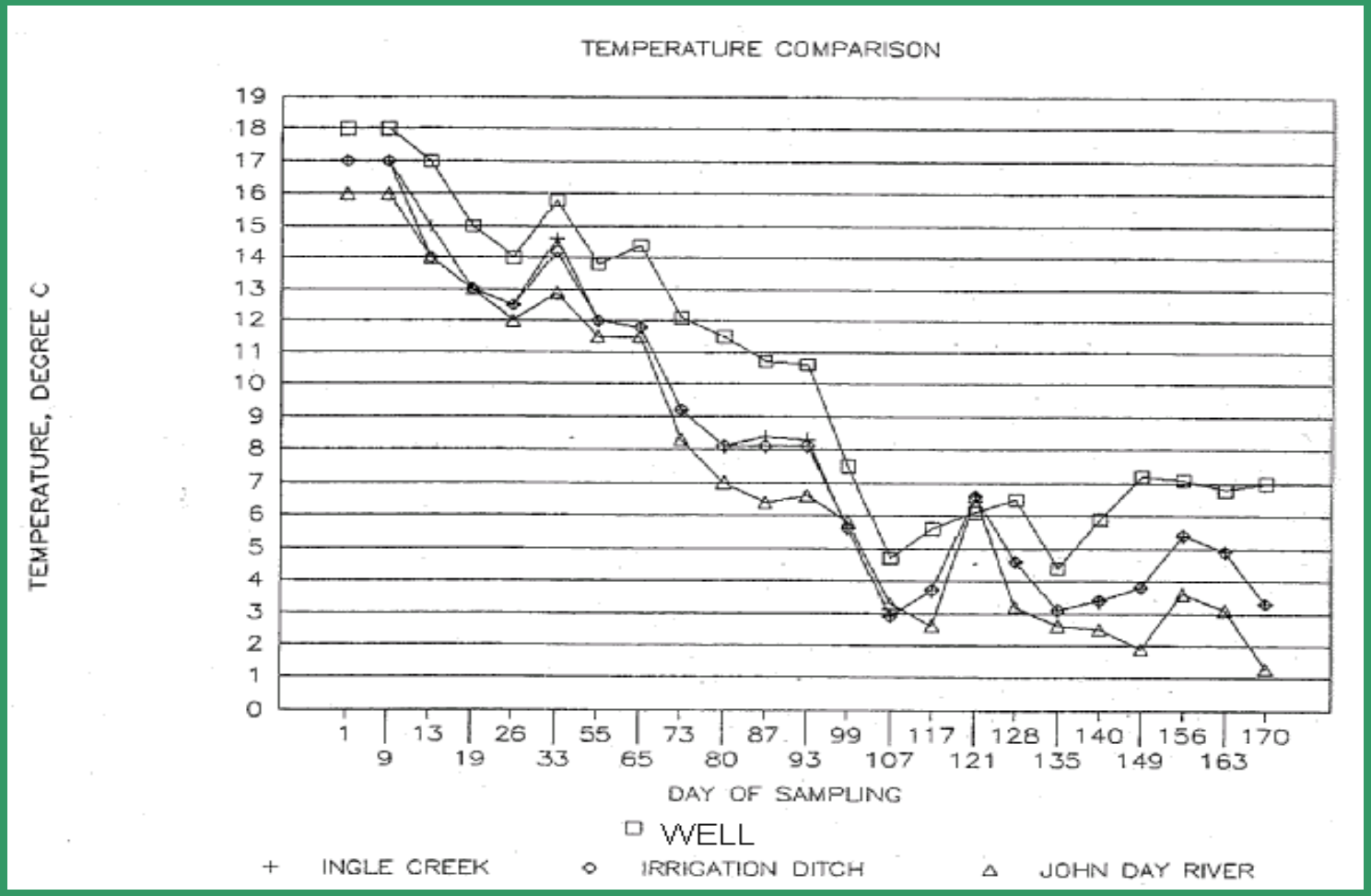
- **How much pumped**
- **How long pumped**



Hydraulic Connection and Aquifer Types



Example of Covariation of Temperature



Community Water Systems

- State/County staff reviewed proximity, coliform history and well construction
- Completed, although new systems
- 53 systems in hydraulic connection
- 13 systems GWUDI

What did we learn?

- Temp and Conductivity most useful WQ parameters to indicate groundwater and surface water undergoing similar trends
- High river stage is time of greatest susceptibility
- Most systems determined to be GWUDI were Ranney wells, infiltration galleries and high volume wellfields
- Intermittent streams and drainage ditches appear to be lower risk
- Particle count data indicates that makeup of aquifer most important followed by pumping rate
- Risk from fractured rock > coarse sand/gravel > sand/gravel > sand > silt

What did we learn?

- Eliminated many of the hand pump systems (e.g. campgrounds) due to low pumping rate
- Ultimately, we learned enough to revise our criteria for determining a GWUDI system

Revised Criteria for GWUDI Evaluation: Data from SWAs and SDWIS

- Well Proximity to perennial or intermittent surface water body
  - 500 ft for fractured rock or layered volcanics
  - 200 ft for coarse sand and gravel
  - 100 ft for sand and gravel
  - 75 ft for sand
- Source has a confirmed or suspected history of coliform bacteria
- Aquifer character: unconfined
- Well construction inadequate: facilitates movement of surface water to the aquifer

Where are we at this point?

- 157 Non-Community Systems evaluated since October 2006
- March 2007 – Letters sent out to water systems releasing them from monitoring requirements or notifying them of their failure to collect samples
- As of May 2007, 116 NC systems on list that are required to conduct TC source water monitoring or MPAs
- New CWS will be assessed using the same criteria used for NC systems
- Depend on the counties to tell us about new systems

Initial GWUDI Monitoring Requirements

- Monthly monitoring of the source/raw water for coliform, unless they choose to move directly to MPA
- If E.coli positive, then 5 confirmation samples within 24 hrs (consistent with Groundwater Rule)
- If any of the five samples are E.coli+ then MPA
- Total Coliform not a direct trigger, but Dept may require additional monitoring if consistently TC+
- If MPA required, coliform monitoring ends
- Rules are being revised to reflect changes

Coliform Sampling and Results

- Follow standard coliform sampling protocol for source water samples
- Samples should be marked as “Special”
- Results should be sent to Springfield not Portland
- Does not replace or otherwise affect routine monitoring
- Seasonal sources sampled only when operational
- If surface water source is intermittent, monitor only when surface water is present
- Data not entered into SDWIS

MPA Monitoring Requirements

- MPAs conducted according to EPA's Consensus Method (no certification required for labs)
- Two required in winter/spring, during high stream stage and separated by 30 days
- Systems may choose to do both in 2007, or one in 2007 and one in 2008
- Analysis costs $250 – 475
- Labs supply sampling device

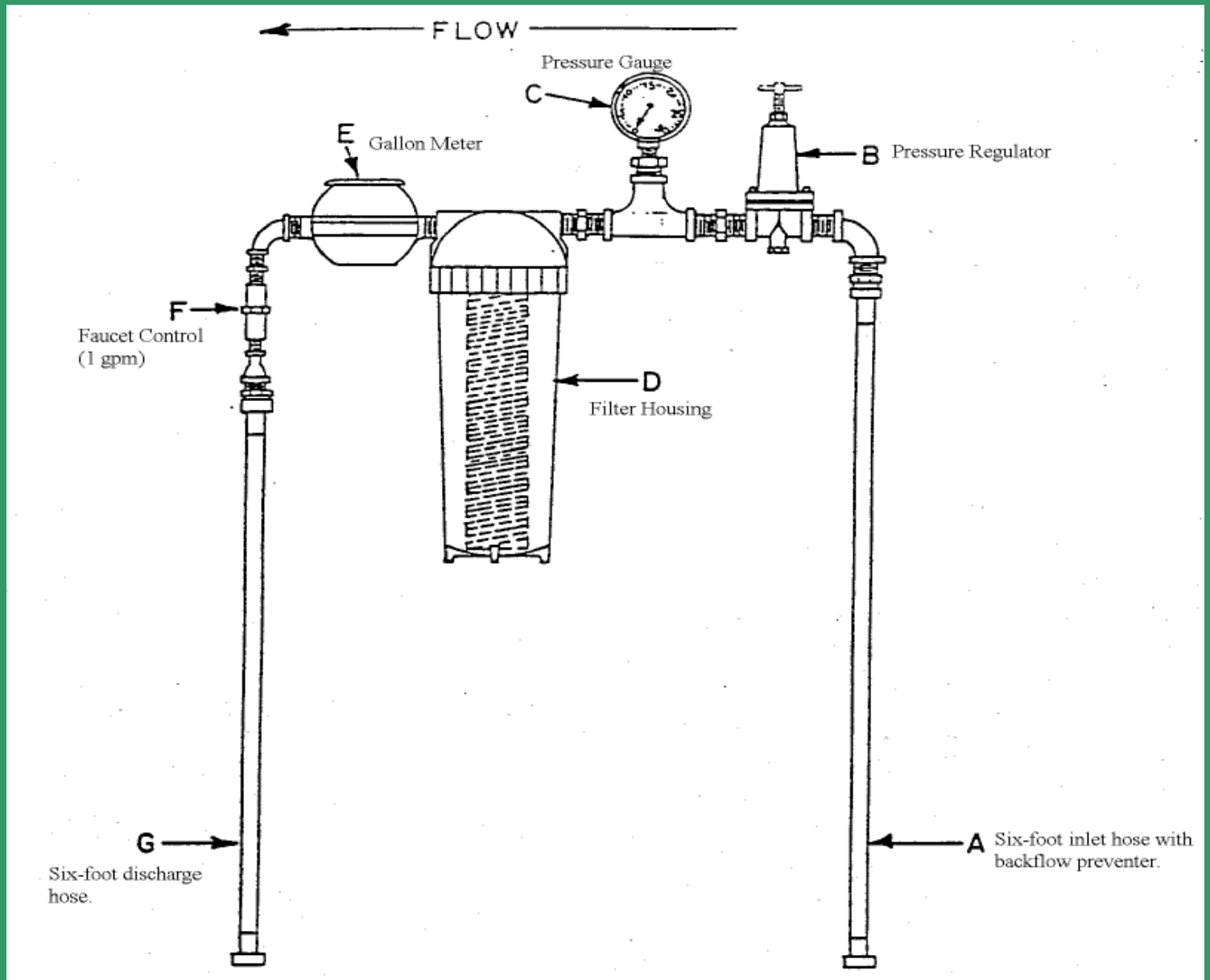
MPA Sampling

- Not a simple grab sample like Total Coliform
- Minimum 500 gallons at 1 gpm through filter over an 8 hr period
- Sample flow rate held at 10 psi
- Sample should be collected directly from the source prior to any treatment and not from the distribution

MPA Sampling Equipment

- Inlet hose with backflow preventor
- Pressure regulator and gauge
- 1 micron filter and housing
- Water meter
- Flow control valve
- Discharge hose
- Sample pump and source of power

Water Sampling Device



Sampling for Microscopic Particulate Analysis (MPA) - Potable Water (Wells and Filtered Surface Waters):

1. All water distribution lines should be purged before a sampling device is connected.
2. The sampling device should be as close to the source as possible.
3. Assemble the sampling apparatus and other equipment without the filter in place. Connect sampling unit to pressure source or pump in the direction of flow indicated on filter holder. Connect a new piece of hose to the inlet end of the sampler. Connect a hose to the outlet side to the sampler to direct the effluent water to waste.
4. Since most source water pressure exceeds 30 psi, the EPA requires the pressure to be reduced to 10 psi with the MPA sampling units. The pressure regulator should be set at 10 psi to begin sampling. DO NOT ADJUST AFTER START.
5. Using only the water to be tested, purge the sampling device for 3 - 5 minutes without a sample filter in place. Check all connections for leaks.

   While purging, check the water meter against the actual flow through the sampler using a bucket with volume markings and stop watch (it should be approximately 1 gpm). Bleed the air out of sampler by inverting in all directions. It is important not to have any air trapped in the water meter as this can give inaccurate volume measurements.

   The flow meter should be horizontal (dial facing up) while sampling.
6. Shut off the water to the sampler, and put a clean filter cartridge into the filter holder. Wash hands and put on gloves before handling or use the bag it comes in to handle the cartridge.
7. Record the start time, meter reading, pressure and flow on the data sheet provided for the sample using a water-resistant marking pen. Again purge all air from unit. When sampling, check the flow manually because the flow meter may not register accurately.
8. The sampling unit should be allowed to run for an 8 - 24 hour period. Volumes sampled over this protracted time may vary from 500 - 1000 gallons. Sample volumes filtered will usually be dictated by the time available for sampling, turbidity and particulate content of the source water being tested.
9. If the water being sampled is very turbid, it is possible to plug the filter and burn out the pump. IF THE FILTER PLUGS, STOP PUMPING IMMEDIATELY. Record the appropriate information.
10. At the end of the sampling period, record the flow meter reading, time, etc. on the data sheet.
11. Disconnect the filter housing and pour the water into a zip-lock bag. Carefully remove the filter cartridge from the housing and place it in the bag with the water. Seal this bag (try to evacuate all of the air) and place it in a second zip-lock bag with a label. **Make sure neither bag leaks!** Write the sample location and identifying information from the data sheet on the label with a waterproof pen. Pack cartridges in container provided by the lab with cold packs and seal the top. Do not place ice in direct contact with filters; filter may freeze. Frozen fibers cannot be analyzed for MPA.
12. Ship the sample to the laboratory IMMEDIATELY. MAKE SURE THERE IS NO LEAKAGE. Samples should be shipped by overnight delivery (UPS, Federal Express or Bus). Use enclosed label.

MPA Sample Holding Time, Preservation, & Shipping

- Wrap sample in bubble wrap and place in an insulated cooler
- Place blue ice packs around but not in direct contact with the sample
- Avoid ice and do not use dry ice
- Stored and shipped at 3° C (do not freeze)
- Maximum transit /holding time should not exceed 48 hrs
- Multiple Samples should be clearly labeled using water proof pen

MPA Analytical Procedure

- Filter processed as outlined in EPA manual, “Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA)”.
  - Unwind or cut filters into halves
  - Wash filters (hand or mechanical)
  - Collect sediment (pooling and centrifuge)
  - Examine

MPA Results

- Interpretation as outlined in our rules
- Rely on surrogate organisms (e.g. diatoms, algae, insect parts, spores?)
- Relative risk score – function of surrogate abundance
- Interpretation
  - both MPA relative risk scores <10 = GW
  - If one or more ≥ 20, or if both ≥15 = GWUDI
  - If one of first two > 10, then two additional MPAs (Tot. = 4)
  - If two or more ≥ 15 = GWUDI
  - If all four <15 = GW

GWUDI Compliance Options

- Eliminate surface water source
  - Correct well construction deficiencies (e.g. seal)
- Develop an alternate source of water
  - Abandon old well and construct a new well away from surface water or into confined aquifer
  - Purchase water from a nearby approved system
- Filtration and disinfection (see Surface Water Treatment Rule and the Long Term Enhanced Surface Water Treatment Rule (LT1 and LT2).

Treatment Options: Removal/Inactivation

- Filtration
  - Cartridge (see list of approved filters)
  - Bag Filtration
  - Slow Sand
  - Membrane
  - Riverbank
- Disinfection
  - UV
  - Chlorine Dioxide
  - Ozone

Riverbank Filtration (RBF)

- Current rules permit “natural filtration” credit if all MPA scores are <20
- Natural filtration credit must be based on site – specific study
- State protocol for RBF study criteria under consideration

RBF – AWWA Web Cast

- RBF as a possible Alternative Filtration Technology (AFT)
- A pre-filtration credit of up to 1 log removal (followed by engineered filtration)
- Treatment credit for unfiltered systems >1 log removal (possibly up to 2 log removal)
- Potential benefit for RBF would that system may only need to add 1.0 log inactivation for a combined total of 3.0 log removal and inactivation
- Federal guidance for use of RBF as a pre-treatment process under the LT2ESWTR is forthcoming in 2007/2008

Expectation of Counties

- If during sanitary survey of new system, discover that system's well(s) meet criteria, inform notify the Springfield office
- Minimum technical assistance on:
  - Procedures
  - Treatment
  - Alerts: Samples incorrectly marked as routine

Questions to

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