Guidelines for Landowners Collecting Water Samples for Fecal Coliform Analysis

Background

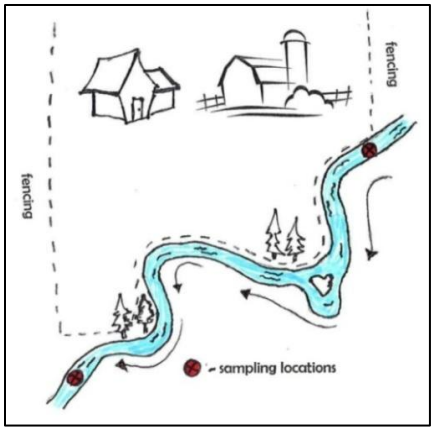
Fecal coliform bacteria are found in human and animal feces. While usually not harmful themselves, their presence in creeks suggests that disease-causing microorganisms might also be present and pose a health risk. People can be exposed to these pathogens through direct water contact, such as swimming, wading, or eating shellfish from waters with high bacteria levels.

The goal of water quality sampling for fecal coliform bacteria is to identify where elevated bacteria levels occur along a creek. Many landowners have expressed an interest in collecting their own water samples for fecal coliform analysis. These guidelines provide an overview of equipment, techniques, and labs for collecting and analyzing samples. The following sections are included:

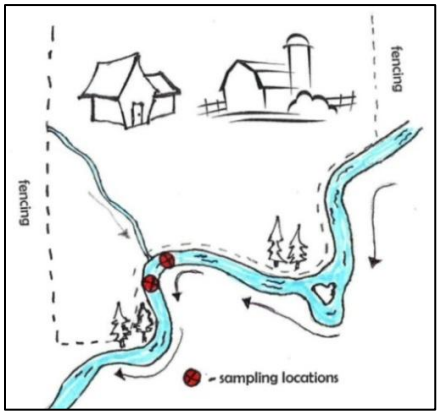
- Determining Sampling Location
- Selecting a Laboratory
- Preparing Sampling Equipment
- Sample Collection
- Sample Storage and Delivery
- Understanding Your Results

Determining Sampling Location

There are two primary strategies for landowners collecting water quality samples for bacteria analysis. These are 1) measuring bacteria levels upstream and downstream of your property or 2) measuring bacteria levels from a specific pipe, ditch, or other channel entering the creek. If high bacteria levels are found using the first strategy, following up with the second strategy helps determine the source of the bacteria. The two diagrams below illustrate how to select sampling locations for these strategies.



Sampling Strategy 1: Property Characterization. The first sampling strategy helps characterize bacterial contributions from your overall property. For this strategy, collect a sample at the upstream end where the creek enters your property and a sample at the downstream end where the creek exits your property.



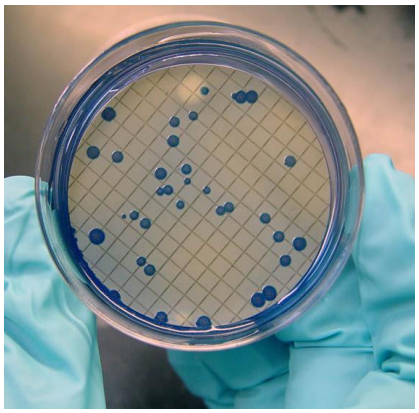
Sampling Strategy 2: Characterizing a Pipe, Ditch, or Other Channel. The second sampling strategy helps characterize bacterial contributions from a specific pipe, ditch, or other channel. For this strategy, collect a sample directly from the end of the channel, if feasible. If a sample cannot be collected directly from the channel without potential contamination, collect one sample from the creek above the point the channel enters the creek and one sample below that point where the water is well-mixed.

Selecting Sample Collection Point

In addition to selecting your sampling sites, it is important to collect your sample from a portion of the waterbody that represents the general character of the creek at that point. A representative site will have adequate flow, be well-mixed, and deep enough that you will not disturb the bottom of the creek while collecting the sample. Do not collect a sample from a back eddy, stagnant water, or a site that is less than about three inches deep.

Selecting a Laboratory

Prior to conducting sampling, you will need to select and contact a laboratory. There are three local, commercial labs certified by the Washington State Department of Ecology for fecal coliform analysis using the membrane filtration method (SM9222D). Each of these labs will provide sample bottles and a chain of custody form. Prices range from approximately $20-35 per sample based upon the laboratory and number of samples you submit.



- Avocet Environmental Testing (360) 734-9033
- Edge Analytical Labs (360) 715-1212
- Exact Scientific Services (360) 733-1205

Preparing Sampling Equipment

Collecting a water sample for fecal coliform analysis can be completed with fairly limited equipment. The following lists are required and optional equipment to ensure that representative and defensible samples are collected and that personal safety is addressed.

Required Sampling Equipment:

- Sterile sample bottles (provided by the selected laboratory).
- Chain of custody form (provided by the selected laboratory).
- Cooler with ice or ice packs.

Optional Sampling Equipment:

- Disposable latex gloves or hand sanitizer (highly recommended for bacteria sampling).
- Field data sheet or notebook and pencil to record observations.
- High-visibility safety vest (highly recommended if sampling by the roadway).
- Rubber boots or a sampling pole for sampling wider stretches of a creek.
- Camera for photo references of the monitoring site.

Sample Collection

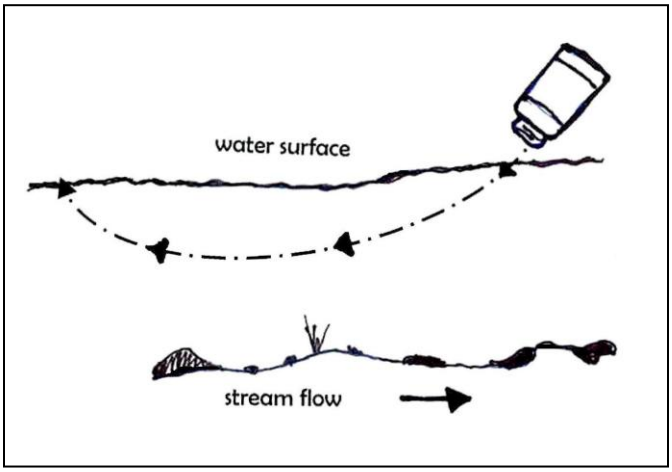
This section describes the steps for collecting a water sample for fecal coliform analysis. Standard collection methods are described, as well as variations that can be used for sampling at shallow sites, sites at wider stretches of the creek, or directly from a pipe.

General Considerations

Bacteria sampling requires careful attention to sampling methods to avoid contamination of the water sample and to ensure that a representative sample is collected. The following guidelines should be consistently followed:

- Do not contaminate the inside of the bottle cap and mouth. These should not be touched by hands or any other surface that may have bacteria exposure.
- Do not rinse the bottle or pour water into it from a container that has not been sterilized.
- Do not disturb the sediment upstream of the sample location, particularly in slow moving waters, as bacteria attach to sediment particles.
- Do not collect samples from the surface layer (top inch of water column), as bacteria can accumulate there. If a surface sample is unavoidable due to shallow depth of the creek (less than about three inches), make note of the conditions on your field data sheet.
- Collect samples from the active part of the stream where there is sufficient mixing to ensure the sample is representative. Do not collect samples from stagnant waters or back eddies.
- If contamination is suspected, dump out the bottle and repeat sample collection with a new bottle.
- Disposable latex gloves or hand sanitizer are recommended for sampling surface water for bacteria.

Step-by-Step Methods



- Label the bottle with the site ID, date, and time prior to collecting the sample.
- Choose a collection point, such as the deepest part of the active channel, where a representative sample may be collected. It is best to collect the sample from the creek bank, if feasible. However, if you are wading in the creek, approach the collection point from downstream so the sample is not contaminated by stirred up sediment.
- Hold the base of the sample bottle with one hand and remove the bottle cap. Hold the bottle cap in one hand and with the other, invert the bottle, submerge it into the water about 6 inches, and then tip the bottle mouth upstream and sweep it toward the water surface.
- Allow the bottle to fill to approximately the shoulder and take it out of the water. If the bottle is overfilled, immediately pour some water from the bottle. Air space is necessary so that the sample can be shaken and mixed prior to analysis.
- Replace the cap securely, avoiding touching the inside of the bottle or cap.
- Immediately place the sample into a cooler with ice.

Sample Collection from a Shallow Site

- In shallow surface water, ensure that the sample bottle does not touch or disturb the creek bed, potentially contaminating the sample with sediment.
- Submerge the bottle to about the midpoint of the water column and tip upwards toward the direction of the flow.
- Samples should be collected far enough below the surface to avoid contamination from surface film and detritus. If a surface sample is unavoidable due to the shallow depth of the sample location, note this on the field data sheet.

For Sample Collection from Wider Creek Sections

- At sites where the creek is wider and a well-mixed location cannot be reached from the bank, use a sample pole or wade in the creek from downstream of the collection point.
- Follow the same steps described above using the sample pole or reaching upstream of where you are standing in the creek. Make sure to submerge the bottle to a depth of about six inches and sweep it in an upstream fashion into the current.

For Sample Collection from a Pipe

- At sites where a sample is being collected from a pipe, fill the sample bottle directly from the flow of the pipe. Hold the bottle under the discharge with its opening positioned into the flow of water so that water enters directly into the bottle without flowing over the bottle or hands during sampling to prevent contaminating the sample.
- Allow the bottle to fill to approximately the shoulder and take it out of the water. If the bottle is overfilled, immediately pour some water from the bottle.
- Replace the cap securely, avoiding contamination to the inside of the bottle or cap.
- Immediately place the sample in a cooler with ice.

Field Duplicates

Collection of a second sample at the same site, immediately following the first sample is referred to as a field duplicate. Field duplicates help determine the level of confidence in your sampling techniques. If results from your field duplicates are very different, your sampling methods may need to be adjusted to reduce the potential for contamination of your sample.

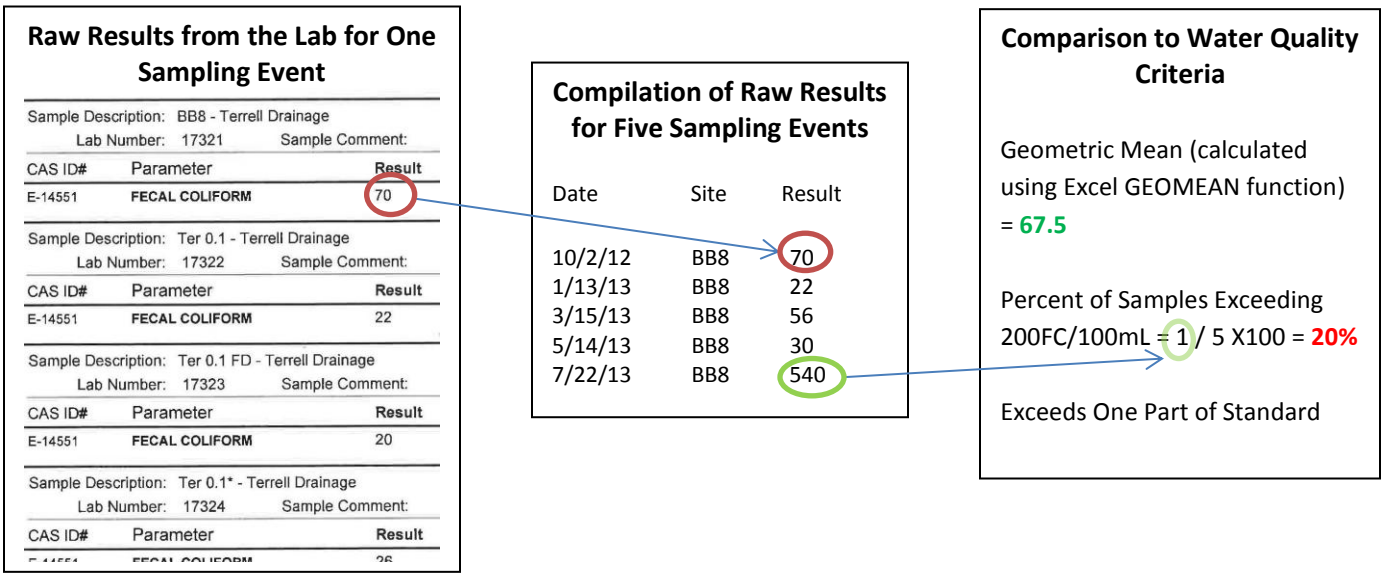
Sample Storage and Delivery

- Record the sample site ID, date, and time of sample collection on the field data sheet and chain of custody form. Record notes about site conditions, adjacent land activities, presence or evidence of pets and wildlife, or sample collection methods on the field data sheet.
- Place samples in a dark cooler with ice immediately after they are collected.
- Deliver samples to the lab within 6 hours of collection and sign the chain of custody form.

Understanding your Results

Fecal coliform bacteria are living organisms, thus, natural variation in bacteria levels is frequently seen in water quality sampling. In conditions that encourage bacteria growth, you will naturally see higher levels. In unfavorable conditions, bacteria will die off rapidly and lower levels will be observed. Due to this natural variation, it is important to collect multiple samples from a site to best characterize its overall contributions to bacteria in a creek.

There are two criteria within the water quality standard for fecal coliform (FC) in the Lower Dakota Creek drainages. The first criterion is a geometric mean less than **100 FC/100mL**. The second criterion is less than **10%** of the samples exceed **200 FC/mL**. In order to compare your results to the water quality criteria, it is best to have at least 5 samples for a specific site. The best characterization will be provided by collecting samples during a variety of environmental conditions (e.g. dry weather, rain event, warm day, cold day, etc.). For each site, compile your results and 1) calculate the geometric mean (using the GEOMEAN function in Microsoft Excel) and 2) determine the percent of samples that exceed 200FC/mL.



Fecal coliform bacteria are living organisms, thus, you will see natural variation in the levels of bacteria observed at your sampling sites. Due to this natural variation, it is important to collect as many samples as possible in order to best characterize the bacteria contribution at your sites. For example, with Whatcom County's routine monitoring program we compare monthly samples for one year (~12 samples) and three years (~36 samples) to the water quality criteria.

For more information: *A Citizen's Guide to Understanding and Monitoring Lakes and Streams* on the Washington State Department of Ecology website provides a comprehensive overview of citizen monitoring. www.ecy.wa.gov

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