

Developing a Good Monitoring Plan

James Beckley

Virginia Department of Environmental Quality

To Be Or Not To Be Biased

- **Bias-** is a prejudice to predetrmined end result.
- Bias can creep into even the most well intended study.
- To prevent bias, proper planning and execuaction of a project is important

I have the data, but the results are not what I anticipated



Ways To Stop Bias

DON'T

- Assume that the project will generate a result you are expecting
- Point fingers at specific parties
- Ignore data that doesn't seem to fit

DO

- Careful research on the issue before you begin
- Establish a good monitoring plan to investigate ALL potential sources
- Seek professional and unbiased expertise when needed
- Step back and review the project to see if you are going down the wrong path

Monitoring Plans

- Document used to map out a monitoring project
- Four major parts
 - Goals of the project and who is conducting the study
 - The intended audience and how results are shared
 - Parameters and analysis methods
 - Site list and special conditions
- Plan is useful in developing/linking two other documents each monitoring project should use
 - Quality Assurance Project Plan
 - Standard Operating Procedures

Project Goals

- Summarize why a monitoring project is needed
 - State the problem or issue the study will attempt to resolve
 - What kind of data will be generated
 - State the pass/fail conditions the data will be gauged by (e.g. Null hypothesis)

Identifying Data Users

- State who the intended audience is for the collected data both internally and externally of the group
- How will it be communicated to these various users
 - Databases used to store/retrieve results
 - Electronic or other means when sharing results
 - Summary of how results would be manipulated (e.g. flagged) or interpreted when sharing with outside organizations.

Parameters and Methods

- What types of tests are being done in the study
 - Sampling equipment used
 - Laboratory methods used to analyze samples
 - Usually EPA or Standard Methods cited is sufficient
 - Include who (e.g. company) is doing the laboratory analysis and contact information

Site Selection and Schedule

- List monitoring sites the study will cover
- Frequency of sampling for each site
- Geographic location of sampling sites

When to Use a Laboratory

- Laboratories can provide the most accurate data for most parameters
 - DO, pH, temperature and similar 'field' parameters prone to change during transport to the lab
 - Generally more expensive than using field kits but far more accurate
- Transport of samples following established procedures is a must!
- Laboratory should be certified to being capable of running the test (e.g. NELAP)

Recommended Sampling Frequency

- Once a month or more frequently for bacteria, physical and chemical parameters
 - Parameters prone to change due quickly due to time of day or weather conditions
 - Frequent sampling not likely to result to bias results
 - 10 or more samples needed to get a good idea of conditions
- Once every 3 to 6 months for benthic macroinvertebrates, fish tissue, or sediment contaminants
 - Changes usually accumulate over time
 - Oversampling one spot could bias results
 - One or two samples usually enough to know what is happening
- Ideal sampling occurs before, during, and completion of the issue being investigated

Sample Site Selection

- Usually recommended to sample above and below the area of interest
 - Above sampling shows what is coming
 - Below sampling is what is leaving
 - Subtracting the below from the above results can show the study area is being impacted or not
- Sites should be safe to access and representative
- Sites have accurate coordinates and description to allow easy identification

What Makes A Good Sampling Site

- Mid-Channel sampling is idea for nearly every project
 - Majority of water flows through the sampling point
 - Samples are ensured to be well mixed and represent actual conditions
 - Influences from stream banks/shallow water is reduced avoiding sample bias

What Makes A Good Sampling Site

- Bridges are great to get mid channel of large streams
 - Mid channel is the best place to get a well mixed sample
 - Bridge must allow safe access to the sampler, sampler's parked vehicle and traffic
 - Sampler vehicle can pull completely off the road shoulder
 - Traffic is not too fast or coming from sharp curves so drivers can respond to the sampler's presence
 - Bridge has enough room for the sampler to operate in without being in the traffic lane and bridge is not posted against pedestrians or fishing.

What Makes A Good Sampling Site

- Streambanks can be good locations to sample
 - If on private land, landowner permission is given
 - Banks are not steep or hazardous to get in and out quickly
 - Sampler can get a sample without fouling the equipment

What Makes A Good Sampling Site

- Instream sampling is needed for certain methods
 - Macroinvertebrate sampling for example
- Walk upstream a short distance before sampling
 - Washes sediment disturbed by sampler's presence to avoid biasing sampling results
- Water is not too deep or fast flowing
 - Usually knee deep or less is recommended
- Access into and out of the site can be done quickly and safely and landowner permission is granted

Recording Sampling Sites

- Include latitude and longitude of the site
 - Decimal Degrees using the NAD83/84 datum is the standard now
 - GPS units, smart phones, GIS maps can provide this
- An easy to identify, permanent, landmark used as a reference point to the sampling site
 - Do not use turn by turn directions or easy to remove marks like survey flags

Examples of Station Information

- Lewis Creek- 300 feet downstream of Route 275 (Woodrow Wilson Parkway):
Lat 38.16465 Long -79.00442
- Lewis Creek- downstream of Woodrow Wilson Parkway: Lat 38° 09' 53 Lon: 79° 00' 16
- Bob's Creek- Go down to the creek from the 3rd haybale on Steve's second pasture to the right of the road and go up stream 300 feet to where the orange flag is tied to the tree. Lat: N/A Long: N/A

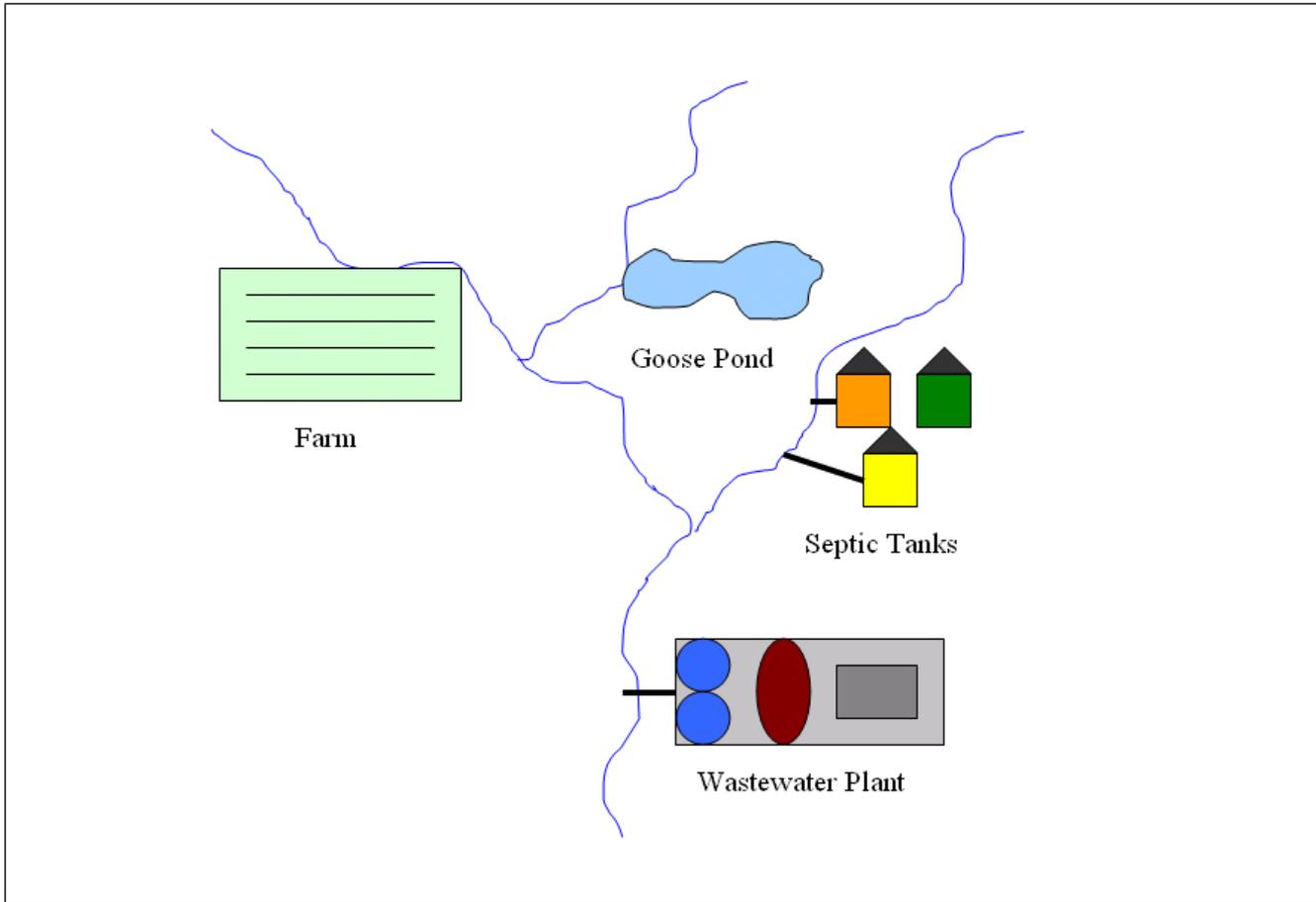




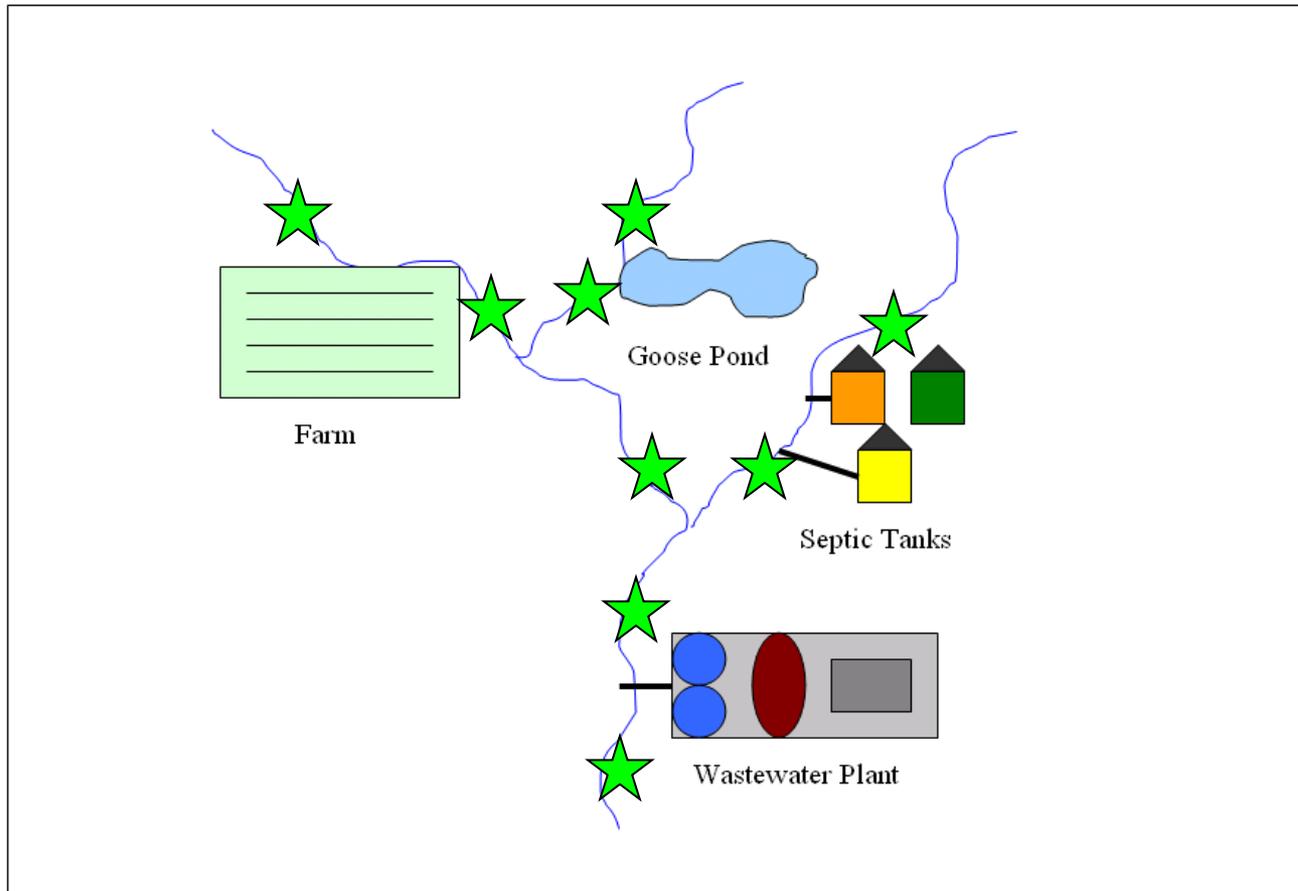
Exercise Time

A Potty Problem On Bob's Creek

- Bob's creek is suspected of having a fecal bacteria (E. coli) problem
 - Suspected sources include a wastewater plant, a subdivision, local farm, or a local pond with lots of geese
- Using what we learned, what is the recommended sampling frequency and sampling locations and if a laboratory should be used



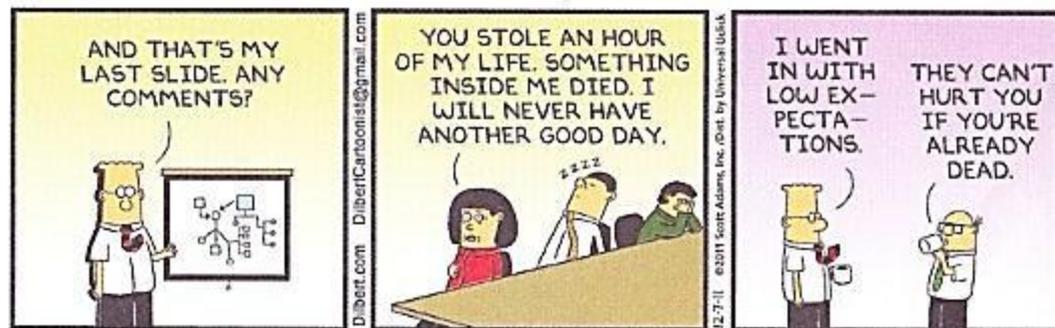
Recommended Sample Sites



Suggested Monitoring Plan

- Monitor upstream and downstream locations of each suspected source
- Include some sites in areas away from potential sources to get a ‘background’ reading on E. coli
- Monitor at least 10 times during the course of an entire year to several years to cover different seasons.
- Monitor on a set schedule (first Tuesday of each month) to avoid ‘stacking’ data based on rainfall or other variables.
- Laboratory is recommended to get the most accurate results.

Questions



Contact

James Beckley

DEQ Quality Assurance Coordinator

804-698-4025

James.beckley@deq.virginia.gov