Bullseye!

Environmental Scientist Skills

Precision and Accuracy in Sampling

Reliable storm water monitoring depends on two things: **Accuracy** (how close your result is to the "true" value) and **Precision** (how consistent your results are with each other). Test your accuracy and precision skills in this activity by hitting the the pollutant "bullseye" in a sampling target.

1. Record where your clay balls landed on the target below and use the table to reflect on your overall accuracy and precision.

Number of hits in the bullseye	Number of hits clustered together	Number of hits not in the bullseye or near other hits
Does this reflect accuracy, precision, or neither? _____	Does this reflect accuracy, precision, or neither? _____	Does this reflect accuracy, precision, or neither? _____

2. As the Storm Patrol's Environmental Scientist, you are tasked with verifying the reliability of your data. Read following sampling descriptions to determine whether they involve accuracy or precision

- The sampling team collected two samples at Site 1, one regular storm water sample and one duplicate sample. They completed the following log, detailing the sample information and laboratory results:

Monitoring Location	Sample Number	Date Collected	Time Collected	Detected Total Suspended Solids (TSS) Concentration
Site 1	SAMPLE-01	1/5/2025	9:00 AM	101 mg/L
Site 1	SAMPLE-01 DUPLICATE	1/5/2025	9:02 AM	85 mg/L

Duplicate sampling is a way to verify (check one):

- ❏ Accuracy
- ❏ Precision

How can sampling be adjusted to make the results nearly the same?

_____
_____
_____
_____

- The Total Nitrogen (TN) present in storm water at Site 2 is usually 0.54 mg/L. The sampling team collected two consecutive storm water samples from Site 2 and recorded the following sample data:

Monitoring Location	Sample Number	Date Collected	Time Collected	Detected Total Nitrogen (TN) Concentration
Site 2	SAMPLE-01	3/18/2025	11:35 AM	0.54 mg/L
Site 2	SAMPLE-02	3/18/2025	11:27 AM	0.70 mg/L

Comparing results to a known value is a way to verify (check one):

- ❏ Accuracy
- ❏ Precision

Why might one sample to be closer to the known amount than another?

_____
_____
_____
_____

Following Water to the Outfall

Environmental Scientist Skills

Monitoring Design

Your Storm Patrol team has been tasked with determining whether your site's storm water runoff has pollutants that may affect the local stream. Begin designing a monitoring plan by determining "what" you are looking for and "where" might it be.

1. Take a look at the map of the Mock Site. Based on the land use (parking lots, storage, etc.) which suspected parameters, the "what", are most likely to be in the storm water runoff? (Check all that apply)

   ☐ Temperature (Impervious surfaces are a common cause of high temperature)

   ☐ pH (Chemicals or cleaning agents can be a cause of fluctuating pH)

   ☐ Turbidity (Sediment or decaying matter can be a cause of high turbidity)

   ☐ Nutrients (Fertilizers and wildlife waste are common sources)

   ☐ Metals (Urban and vehicle related-particulates are common sources)

   ☐ Other: _____

2. Next, determine the "where", your potential sampling locations.
   - Find confluent flows. Circle 2-3 areas on your map where storm water flow paths come together. These are your high-volume discharge points..
   - Identify 4-5 potential monitoring locations on your map, marking them with a star (★).

3. Select three of the marked potential sites and consider the following to complete the tables on the next page:
   - Drainage Area: Where is the water coming from? (e.g., Roof, Parking Lot, Loading Dock)
   - Surface Cover: What is the water flowing over? (Concrete, Grass, Bare Dirt)
   - Run-on Influences: Could storm water flow from a neighboring property into the sampling point? If so, what is that neighbor's land use ? (e.g., a gas station, a park, a forest)
   - Sampling parameters: Looking at the unique activities at the sampling location, which pollutant(s) from Step 1 is most likely present? Don't forget those from your neighbors!
   - Write a brief note for each site. Why will sampling here best determine if the site contributes pollution to the stream? Consider flow volume and type of structure.

Site #1	
Location	
Approximate Drainage Area	
Contributing Surface Cover	
Run-on Influences	
Sampling Parameters	

Site #2	
Location	
Approximate Drainage Area	
Contributing Surface Cover	
Run-on Influences	
Sampling Parameters	

Site #3	
Location	
Approximate Drainage Area	
Contributing Surface Cover	
Run-on Influences	
Sampling Parameters	

Storm Sampling T-RAIN-ing

Environmental Scientist Skills

Data Analysis and Drawing Conclusions

Oh no, the Waikele Watershed is impaired for Total Suspended Solids (TSS) and Total Nitrogen (TN)! Your team has just received the results for storm water samples taken by the Storm Patrol Environmental Scientist. Take a look at the data to determine if your site contributes the pollutants to Waikele Watershed.

1. Take a look your Sampling Results Card for information about your storm water sample. Use the Sample Identification (Sample ID) field on your Sampling Results Card to fill in the following:

Sampling location: _____	Sampling date: _____
The letters indicate the sampling location: CH stands for channel, SD stands for storm drain, and IF stands for inlet filter.	The numbers indicate when the sample was collected. In this Sample ID, the date is written (Year)(Month)(Day).

2. Locate the results for your sampling event. Reflect on what the results might indicate about your sampling location and answer the following questions:

   - What does this individual set of sampling results tell you about the composition of storm water present on the mock site?

     _____

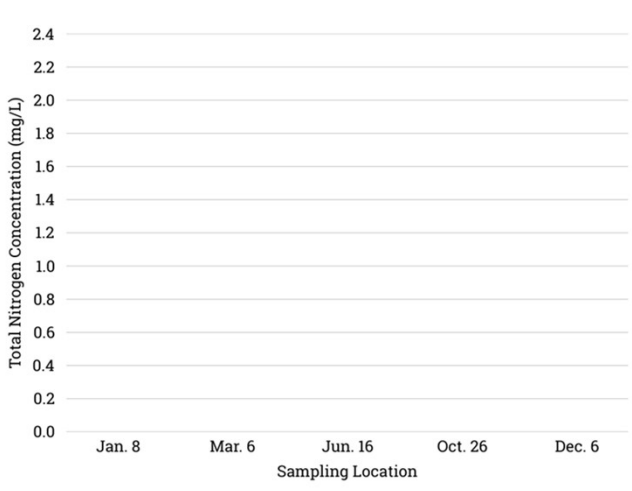
     _____

   - What other information might you need to gain a better understanding of the site's storm water discharge and potential impact on nearby waterways?

     _____

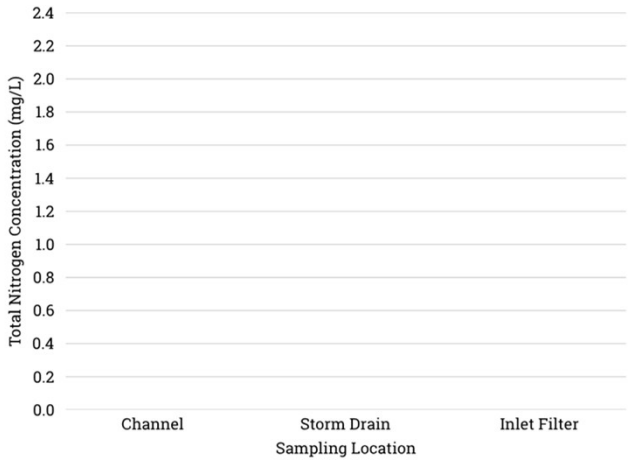
     _____

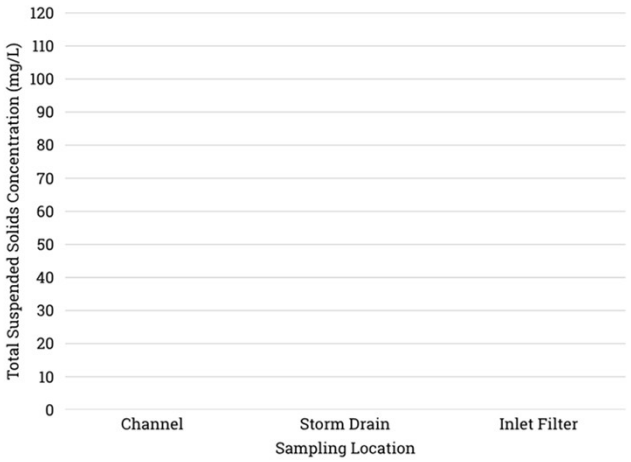
3. Find other students with the same sampling location and work together to graph your results for TN and TSS. Analyze your graphs to compare your site's wet weather and dry weather results.



- When combining your individual dataset with others to create a more comprehensive set of sampling results, what do you notice about the seasonal variances in the level of pollutants or characteristics measured? What factors do you believe influence these trends?

4. Find other students with the same sampling date and work together to graph your results for TN and TSS. Analyze your graphs to compare the pollutant concentrations at the 3 .





- How do the results from the three sampling sites compare to one another? What factors might be impacting the storm water runoff at each site to produce these differences?

5. Based on what you have learned about the different sampling locations, the levels of pollutants across the Mock Site, and storm water treatment approaches from previous lessons, brainstorm the types of treatments that could be implemented throughout the site to combat storm water pollution within Waikele watershed and where they might be installed.