Runoff Redesign

Use test results to evaluate a creek protection design.

HS-ENV5-3 "Design, evaluate and refine a technological solution that reduces impacts of human activities on natural systems. [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the creek impact, circle design features that address sediment or flooding, and number the table's average sediment readings from lowest to highest so you can compare solutions.

A Drain That Protects the Creek

1. After storms, a school parking lot sends muddy water through a curb drain into Willow Creek. Fine sediment can cloud the water and cover gravel where fish lay eggs. A student engineering team wants to lower sediment leaving the drain without making street flooding worse. They build inserts that can be removed for cleaning.

2. The team runs three trials per setup, using the same volume of muddy water each time. The table reports average sediment concentration in water leaving the drain and estimated installation cost. The original basket traps grit but sometimes clogs with leaves. A redesigned basket adds a deeper settling pocket and a wide overflow opening.

DRAIN INSERT TEST RESULTS

Setup	Average sediment leaving drain (mg/L)	Estimated installation cost
No insert	120	$0
Original basket	72	$450
Redesigned basket	36	$750
Fabric cartridge	48	$600

3. A third insert uses a replaceable fabric cartridge. The team has only $650 for one installation, and its target is an average sediment concentration of 50 milligrams per liter or less. An overflow opening may limit flooding, but water that bypasses the insert could still carry sediment. The team plans to test the devices after leaves accumulate.

2 ANSWER WITH EVIDENCE

Use the passage

1. How much lower is the original basket's average sediment concentration than the no-insert average? What creek impact might that help reduce?

2. Compared with the original basket, how does the redesign change the average sediment concentration and installation cost?

3. Which setup meets both the team's cost limit and sediment target? Use the table to support your choice.

4. After leaves accumulate, what should the team check to decide whether the redesigned basket protects the creek without increasing flood risk?

3 YOUR TURN

Your own words

After a school fair, wind blows snack wrappers from an outdoor trash area into a pond. Propose a technological solution, name one measurement for testing it, and explain one possible drawback and a refinement that could address it.

ANSWER KEY

Runoff Redesign

HIGH SCHOOL · HS-ENV5-3

PART 1 · READ AND MARK

Underline the creek impact, circle design features that address sediment or flooding, and number the table's average sediment readings from lowest to highest so you can compare solutions. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How much lower is the original basket's average sediment concentration than the no-insert average? What creek impact might that help reduce?	**The average is 48 mg/L lower. Less sediment may mean less cloudy water or less gravel covered where fish lay eggs.**
2	Compared with the original basket, how does the redesign change the average sediment concentration and installation cost?	**The redesigned basket's average is 36 mg/L lower, and its estimated installation cost is $300 higher.**
3	Which setup meets both the team's cost limit and sediment target? Use the table to support your choice.	**The fabric cartridge meets both limits. It costs $600 and has an average sediment concentration of 48 mg/L.**
4	After leaves accumulate, what should the team check to decide whether the redesigned basket protects the creek without increasing flood risk?	**Check sediment concentration in water leaving the drain and whether water backs up or floods. Leaves could block the basket, while overflow could carry sediment past it.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Install a covered trash bin with a weighted, self-closing flap near the fair. Count wrappers along the pond shore after similar fair days before and after installation. A heavy flap might keep younger students from using the bin, so replace it with a lighter flap that still closes in wind, then repeat the shore counts.

Accept other feasible technologies if the response includes a measurable test, a plausible drawback, and a refinement that addresses it. For the table questions, reductions refer to differences between averages across three trials, not results from individual trials.