Erosion

Earth & Space Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- Loose gravel and crushed stone scattered across ground (light gray/white colored)
- Flowing water or muddy stream running through the gravel bed
- Dark, wet soil and sediment mixed with the gravel
- Green grass sprouting along the right edge of the disturbed area
- What appears to be a railroad tie or wooden beam visible at the top left corner

Reasonable Inferences

- Water flow + loose gravel: Water is eroding and moving loose materials downhill; the gravel bed is not effectively containing or filtering the water.
- Grass at edges + bare center: Vegetation naturally stabilizes soil, suggesting the bare gravel area lacks natural protection against water movement.
- Muddy water + sediment mix: The soil structure is breaking down under water pressure, indicating a need for material organization or reinforcement.

Engineering Task

K-2 Challenge:

Design a dam or wall using rocks, sticks, and soil to slow down water flowing down a slope. Your wall should stop water from washing away the gravel. Test it by pouring water from a cup and see if your wall holds up!

3-5 Challenge:

Design a sediment filter or retention structure using rocks (minimum 2 sizes), soil, and natural materials that will reduce muddy water runoff by at least 50%. Your structure must fit within a 30 cm × 30 cm area, allow some water to drain through, and prevent gravel from washing away in at least 3 separate water tests. Measure water clarity before and after to determine success.

EDP Phase Targeted

Ask / Define Problem — This photo shows a clear real-world problem: erosion and water runoff carrying sediment. Students should first investigate why the current slope fails to manage water (observation), then define what a better system needs to do before designing solutions.

Suggested Materials

- Various sizes of gravel and small rocks
- Soil or potting mix
- Sticks or twigs
- Cups or containers for water testing
- Cheesecloth or coffee filters (for older grades)

- Clear containers to observe water clarity

Estimated Time

K-2: 30–45 minutes (design + one or two water tests)
3-5: Two 40-minute sessions (design session 1, construction and testing session 2, with measurement and iteration)

Why This Works for Teachers

This task directly addresses NGSS ETS1.B (Developing Possible Solutions) by requiring students to design a system that manages Earth materials and water flow, connecting engineering to observable environmental challenges.