Pollution Arroyo Walk

Pollution in the Arroyo Unit, Lesson 1

Lesson Summary: Students will look for evidence of pollution in the arroyo and attempt to identify the source(s) of the pollution.

Suggested Timing: 1 hour, including time to walk to and from the arroyo

New Mexico State Standards

Performance Expectation(s): MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Constructing Explanations and Designing Solutions: Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific principles to design an object, tool, process or system.	ESS3.C: Human Impacts on Earth Systems: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	Cause and Effect: Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Evidence Statements:

- MS-ESS3-3 Evidence Statements

ELA CCSS Connections:

- WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3)
- WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS3-3)

Content Objectives and Daily Learning Targets	**Objectives**: • I can define what pollution is. • I can identify different types of pollution in the natural environment. • I can differentiate between point source pollutants and nonpoint source pollutants.
Focus Question	Where do I see evidence of pollution?

Language Objectives	● Students will use vocabulary in a real world context. ● Students will express their thinking in writing and diagrams.
Vocabulary	● **Arroyo** - a dry creek, stream bed, or gulch that temporarily or seasonally fills and flows after sufficient rain. ● **Invisible pollutants** - pollutants that are too small to see, but could be mixed in with the water or air. ● **Nonpoint source** - pollution from multiple sources. ● **Point source** - pollution from a single source. ● **Pollution** - the introduction of harmful materials into the natural environment that will have negative effects. ● **Soluble** - the ability to dissolve. ● **Visible pollutants** - pollutants that are visible to the human eye.
Materials	● Clipboards ● Lab notebooks or lab sheets ● Pencils ● Optional: Buckets to carry materials and sit on
Preparation before class	● Optional: make copies of lab sheets
Assessments (Formative/ Summative), Rubrics, Success criteria	● Science Journals ● Success criteria: ○ Students are able to identify types of pollution in the arroyo and where it could be coming from in order to make connections to the impacts of pollution.
EL Supports	● Provide key vocabulary in both languages ● Encourage students to use diagrams and labeling ● Think-pair-share
Culturally Relevant Strategies	● Students investigate an issue that is in their local environment. ● Students work with classmates to identify challenges. ● Students practice social and academic skills they will need.
Special Education Modifications	● Students are given different ways of expressing and recording their thinking, including writing, drawing, and speaking. ● Students who are unable to climb into the arroyo should be partnered with a student who is, and they can divide the tasks to look at the banks and the valley of the arroyo.

Lesson Plan Details

ENGAGE (~10 min):	● Show students the slide deck of different kinds of pollution in arroyos and rivers (provided). ● Ask students where they think the pollution comes from in each picture. This activity engages students in thinking about what is pollution,

	different kinds of pollution, and where it might come from. They don't need to know exactly where the pollution is coming from at this point. ● In the pictures with the dry arroyo beds, remind students that water will flow after a storm. ● Ask students, do they think each example comes from one source or multiple sources?
EXPLORE (~15 min):	● Review rules about being outside and then walk to the arroyo. ● As you walk, ask students to start looking for sources of pollution. ● At the arroyo, give students time to look for evidence of pollution. ● Ask them to record what they find in their journals using maps, diagrams, and notes.
EXPLAIN (~10 min):	● Pair-share, ask students to share what they noticed with a partner and then the whole group. ● Define key terminology: ○ Pollution ○ Point source pollution: from a single source ○ Nonpoint source pollution: from multiple sources ○ Visible pollutants are visible to the human eye ○ Invisible pollutants are too small to see, but could be mixed in with the water or air. These could include diseases, soluble chemicals, or similar. ○ Soluble: ability to dissolve ● Ask students how they might be able to identify invisible pollutants. ○ E.g. If there is a road above the arroyo, it is likely that the water will carry salts and other soluble pollutants that would be visible on the road, but maybe not visible in the arroyo. ● A few specific pollutants, potential origins, and associated concerns to share with students: ○ Sediment ■ Naturally occurring clays in sediment are very small and carry a negative charge which means that they attract positively charged heavy metals (see below). The clays can settle in water bodies (e.g. rivers and lakes) where the metals become soluble. ■ Too much sediment can ultimately fill in reservoirs and thus stored water capacity and hydro-power is diminished. ■ Sediment can bury cobble in river bottoms where fish lay eggs and benthic macroinvertebrates live….leading to death of those organisms. ○ Heavy metals ■ Zinc, copper, lead and other metals from the wear and tear on tires and brakes or from natural sources are soluble in water and can be ingested by small

	organisms, are passed up the food chain, and can ultimately accumulate in our bodies leading to sickness. ○ Temperature ■ Warmer water from hot surfaces (e.g. pavement) holds less dissolved oxygen and can lead to suffocation in less tolerant fish (e.g. trout) or other aquatic organisms. ○ Salt ■ De-icing salts used to melt snow on roads can ultimately end up in soils where it makes it harder for plants to absorb soil moisture into their roots, potentially leading to the death of roadside vegetation. ○ E. coli ■ This type of bacteria can end up in arroyos from broken sewer lines, septic systems, and animal feces (usually dogs in urban areas). This bacteria is easy to test for and often associated with other pathogenic (i.e. harmful) bacteria and viruses that make people and animals sick if ingested.
ELABORATE (~10 min):	● Send students back to the arroyo. This time they should record evidence of invisible pollution as well as any sources of pollution. They should use the key vocabulary as they label their findings.
EVALUATE (~15 min):	● Students should share what else they notice with the whole class. ● They should make a list of unanswered questions. ● Walk back to school.

Additional Sources:

- 5 Es of Science Instruction
- 5E Model of Instruction
- ISEC model of lesson sequence