



## Environmental Stewardship

### Lesson 4: Testing and Evaluating Water Quality – Part Two

**Grade Level** 9-12

**Time Required** 55 minutes

#### Summary

Clean water is not an unlimited resource. Understanding the impact of human activity on the water supply is a critical aspect of helping them to learn to be better stewards. Helping them to understand that prevention of water quality degradation is the best approach to management is one of the primary goals of this unit. After they have a basic understanding of some of the key indicators of pollution, they can discuss sources of those pollutants and propose possible strategies to reduce the pollutants.

#### Objectives

The purpose of this lesson is to help students begin to recognize some of the chemical indicators of pollution. They will gain an understanding of what might cause a change in the level of a certain indicator and they will identify sources for that contaminant. They will then work together to propose solutions to water quality challenges.

#### Engineering Connections: Environmental Engineering, Chemical Engineering, Civil Engineering

Chemical, Civil, and Environmental Engineers are all involved in the quest for solutions to global water challenges. Identifying strategies for mitigation and building treatment facilities are important aspects that will be critical in guaranteeing that clean water will be available to all in the coming years.

#### I Can:

- o Describe how human choices and activities can impact the environment and the quality of our water supply.
- o Identify the chemical and physical characteristics that are used to monitor water quality.
- o Perform basic analytic tests to determine the presence or absence of specific parameters that are used to measure water quality.

#### Standards

##### [HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics](#)

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.\*

##### [HS-ESS3-4 Earth and Human Activity](#)

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.\*

##### [HS-ETS1-1 Engineering Design](#)

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

#### Keywords

Water quality, water chemistry, pH, Dissolved oxygen, conductivity, Biological Oxygen Demand (BOD), phosphates, nitrates

#### Prior activity: Part 1 Lab – What’s in that Water?

#### Time required:

- 50 minutes of class time for Part 2

**Class activities:**

1. Students will combine their data as a class on a whiteboard or on large pieces of newsprint for each water quality indicator. As a class, identify mean values for measurements of indicators and identify data ‘outliers’.
2. Present the class with the desired values for the indicators measured. Students will discuss how each water sample compares to this:

Standard	Color/Odor	pH	Nitrate (ppm)	Phosphate (ppm)	Dissolved Oxygen (ppm)
Reference value	Clear, colorless, odorless	6.0-8.2	<4.4 ppm (clean) >4.4 ppm (unsafe)	<0.03 ppm (clean) >0.1 ppm (unsafe)	>5ppm

3. Students will work in groups to hypothesize the identity and source of each water sample. When all predictions are recorded, the teacher will reveal the origin of the sample.

**Assessment:** Students will choose one of the following categories of groundwater contamination and write a short summary of solutions to reducing contamination. Student must address what activities might be responsible for specific contaminants. Also, assess the risk level of that category. Summary must be a complete paragraph, no fewer than 6 complete sentences.

- Industrial
- Agricultural
- Residential
- Commercial

**Contributors**

Kim McVicar, NDSU RET, North Dakota State University, Fargo, ND  
Mike Dobberstein, NDSU RET, North Dakota State University, Fargo, ND

**Acknowledgements**

This curriculum was developed under National Science Foundation RET grant # 1953102. However, these contents do not necessarily represent the policies of the National Science Foundation, and you should not assume endorsement by the federal government.