Subject/course: Science **Grade level(s):** 7

Unit title: Freshwater Analysis

Freshwater Analysis

UNIT/LESSON SUMMARY

Water is an essential compound for all life on Earth and keeping our water free of pollutants is of utmost importance. In this unit, students will learn how water becomes polluted from point source and non-point source sources and they will learn the methods to assess the health of a body of water through both chemical and biological analysis. Lastly, students will be introduced to the inter relationships between forest and aquatic ecosystems.

Stage 1 - Desired Results

Established Goal(s) :

NY State Standards addressed by the lesson (Include minimum of two state frameworks goals for this subject and grade level that this lesson aligns to):

Math, Science and Technology, Elementary , Core Curr: Standard 4 Process Skills, Physical Setting, (Living Environment)

General Skills

- Follow safety procedures in the classroom, laboratory, and field
- Safely and accurately use the following tools:
  - hand lens
  - ruler (metric)
  - balance
  - gram weights
  - spring scale
  - thermometer (C°, F°)
  - measuring cups
  - graduated cylinder
  - timepiece(s)
- Develop an appreciation of and respect for all learning environments (classroom, laboratory, field, etc.)
- Manipulate materials through teacher direction and free discovery
- Use information systems appropriately
- Select appropriate standard and nonstandard measurement tools for measurement activities
- Estimate, find, and communicate measurements, using standard and nonstandard units
- Use and record appropriate units for measured or calculated values
- Classify objects according to an established scheme
- Observe, analyze, and report observations of objects and events
- Observe, identify, and communicate patterns
- Observe, identify, and communicate cause-and-effect relationships
- Generate appropriate questions (teacher and student based) in response to observations, events, and other experiences
- Observe, collect, organize, and appropriately record data, then accurately interpret results
- Collect and organize data, choosing the appropriate representation:
  - journal entries
  - graphic representations
  - drawings/pictorial representations
- Make predictions based on prior experiences and/or information
- Compare and contrast organisms/objects/events in the living and physical environments
- Identify and control variables/factors
- Plan, design, and implement a short-term and long-term investigation based on a student- or teacher-posed problem
- Communicate procedures and conclusions through oral and written presentations

Math, Science and Technology, Intermediate , Core Curr: Standard 1 Analysis, Inquiry & Design

STANDARD 1—Analysis, Inquiry, and Design

Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

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Mathematical Analysis

Key Idea 1: Abstraction and symbolic representation are used to communicate mathematically.

- Major Understanding M1.1a identify independent and dependent variables

Scientific Inquiry

Key Idea 1: The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

- Major Understanding S1.1a formulate questions about natural phenomena
- Performance Indicator S1.2 Construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.
- Major Understanding S1.2a independently formulate a hypothesis
- Major Understanding S1.2c differentiate among observations, inferences, predictions, and explanations

Key Idea 2: Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

- Major Understanding S2.3b conduct a scientific investigation

Key Idea 3: The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.

- Major Understanding S3.2c evaluate the original hypothesis in light of the data
- Major Understanding S3.2f make predictions based on experimental data
- Major Understanding S3.2h use and interpret graphs and data tables

Math, Science and Technology, Intermediate , Core Curr: Standard 4 Process Skills, Physical Setting, (Living Environment)
Key Idea 4: Energy exists in many forms, and when these forms change energy is conserved.

- Major Understanding 4.2e Temperature affects the solubility of some substances in water.

Key Idea 6: Plants and animals depend on each other and their physical environment.

- Major Understanding 6.2c Green plants are the producers of food which is used directly or indirectly by consumers.

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment.

- Performance Indicator 7.1 Describe how living things, including humans, depend upon the living and nonliving environment for their survival.
- Major Understanding 7.1a A population consists of all individuals of a species that are found together at a given place and time. Populations living in one place form a community. The community and the physical factors with which it interacts compose an ecosystem.
- Major Understanding 7.1c In all environments, organisms interact with one another in many ways. Relationships among organisms may be competitive, harmful, or beneficial. Some species have adapted to be dependent upon each other with the result that neither could survive without the other.
- Major Understanding 7.1e The environment may contain dangerous levels of substances (pollutants) that are harmful to organisms. Therefore, the good health of environments and individuals requires the monitoring of soil, air, and water, and taking steps to keep them safe.
- Performance Indicator 7.2 Describe the effects of environmental changes on humans and other populations.
- Major Understanding 7.2a In ecosystems, balance is the result of interactions between community members and their environment.
- Major Understanding 7.2b The environment may be altered through the activities of organisms. Alterations are sometimes abrupt. Some species may replace others over time, resulting in long-term gradual changes (ecological succession).

National Education for Sustainability Standards addressed by the lesson (Include minimum of two EfS standards that this lesson aligns to)**:**

1. 2.2 Ecological Systems

2. 3.2 Collective Action

Unit Goals: Students will be able to show connections between the biotic and abiotic parts of their school ecosystem. Students will also be able to collect and analyze samples of an ecosystem to determine its health.

Outcomes (How can sustainability education help your students learn this?)	
Enduring Understandings: (what understandings are desired) *Students will understand that…* • An ecosystem is made up of living and non living components • The age of an forested ecosystem can be determined by the types of vegetation contained in it. • Correct levels of DO, pH, nitrates, phosphates and temperature are needed for life to exist in a body of water.	**Essential Questions:** (what essential questions will be considered?) • What are biotic and abiotic components of a healthy ecosystem? • What types of vegetation are found in our school ecosystem? • What chemical conditions are needed for life in a body of water? • How can organisms adapt to their changing ecosystem? • How can scientists predict cyclic changes in an ecosystem?
Students will know… • How forest ecology effects the health of a body of water • The impact of excessive use of pesticides and fertilizers on fresh water • The difference between point vs. nonpoint sources of pollution	*Students will be able to…* • Evaluate, compare, and contrast the water quality of water systems. • Identify macroinvertebrates in a fresh water system and create a water quality index to determine the health of a body of water. • Determine the source of pollution in a simulated real world situation

Stage 2 – Assessment Evidence	
Performance Task(s): (what evidence will show that students understand?): I. Collecting, testing and analysis of water from 3 different sources II. Using dichotomous keys to identify macroinvertebrates III. Using dichotomous keys to identify vegetation	**Other evidence:** (quizzes, tests, prompts, observations, dialogues, work samples): 1.Parts per Million Lab report 2. Tapwater Tour Lab report 3. Stream/reservoir water testing lab report 4. Woods Walk Activity handout 5. Dichotomous Key Activity handout 6. IMRAD report 7. Test on Water Analysis

Stage 3 – Learning Plan

Learning Activities: (what will students do and what will you, the teacher do, to prepare the students to achieve the desired outcomes)?

I. Students will conduct a lab called **"Parts per Million"** where they will take a sample of water containing food coloring and systematically dilute the sample to a level of 1 part per million. This lab shows that contaminants in a body of water are usually not detected by the naked eye and water testing equipment is needed to detect small traces of materials found in water or soil.

II. Students will conduct a lab called **"The Tap Water Tour"** where they will take samples of water from around the school (water fountains, sinks etc.) and test the water for traces of copper, chlorine, iron, hardness as well as the pH. Discussions will ensue on where these compounds come from and are they safe in our water.

III. Students will conduct a lab called **"Stream Water Testing"** where students will learn how to collect a water sample of their own and test the water for common health indicators such as dissolved oxygen, pH, nitrates, phosphates and temperature.

IV. Students will conduct a lab called **"Water Canaries"** where they will evaluate the health of a stream based on the aquatic creatures they find in their sample. This along with their results of their water testing will enable them to calculate a biotic index of the stream, thus giving them an indication of the health of that body of water.

V. Students will conduct a lab called **"Woods Walk"** where students will use a contour map of the school's forest area to identify where particular types of vegetation exist, to determine the drainage basin of the land and to predict how abiotic factors can effect the health of a body of water.

Resources: What **community** resources can be used in planning and teaching (websites, individual speakers, organizations, resources)? Please hyperlink all websites to the appropriate URL.

Speaker from The Department of Environmental Protection (Watersheds)
Speaker Richard Pope – Malcom Pirney (Waste Water System)

Stage 4 – Addendum
Please list the file names for all elements of your Unit/Lesson. (Eg. include all new handouts, worksheets, assignments, tests, and rubrics, and hyperlinked web resources and supplemental reading documents. 1.Parts per Million Lab report 2. Tap Water Tour Lab report 3. Stream/Reservoir water testing lab report 4. Woods Walk Activity handout 5. Dichotomous Key Activity handout 6.IMRAD report