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## High School Activities Outline

Discover Mojave: Forever Earth

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# High School Activities Outline

## BACKGROUND

During the past two years, high school teachers who have scheduled Forever Earth field trips have fallen into one of two categories:

1. Science resource teachers who request the Grade 5 curriculum (Finicky Fish Finish Last!) or the Grade 6 curriculum (Alien Invaders!) to match the science learning levels of their students; or
2. Science teachers who have already established their own field trip objectives and have clear ideas of what will be accomplished on Forever Earth. Note: Teachers wishing to use their own curriculum are asked to submit a description of their proposed program that includes an itinerary with specific destinations for pre-approval.

Forever Earth facilitators take leadership roles for groups fitting the first category description. For groups in the second category, the science teacher takes the lead in facilitating activities with the assistance of a Forever Earth facilitator.

To meet the needs of high school science teachers who may not fit into one of the two categories described above, the following activity outline provides a protocol for conducting water quality monitoring. The outline also includes educational goals and objectives and shows how Nevada State Standards and Clark County District Objectives are addressed. The protocol can be adapted to meet the needs of the group, as well as its time and equipment constraints.

## OVERVIEW

Snowmelt in the Rocky Mountains flows through a series of tributaries into the Colorado River, which winds its way south for 1,400 miles and empties into the Gulf of California. Along the way, dams trap the water in a series of reservoirs, of which Lake Mead is the largest. All of Southern Nevada's drinking water comes from the Colorado River via Lake Mead. Thus, protecting Lake Mead's water quality is of paramount importance. Potential sources of contamination include urban chemicals such as fertilizers and pesticides, industrial activities, and hydrocarbon discharge from recreational boats and other watercraft.

The following activity outline is excerpted from *Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools*. This field manual compiles a series of tests and protocols for calculating a standard measurement of water quality, used by a number of schools and universities across the country. Drawing upon this field manual, Michael Brundage, a high school science teacher in the Clark County School District, developed a standardized protocol for measuring Lake Mead's water quality, and used it with his students for a number of years. For more detailed information about the tests and protocols described below, teachers should obtain the field manual or borrow a copy from the Forever Earth Project Manager.

## THEME

Millions of people depend on the maintenance of high water quality in Lake Mead.

## KEY QUESTIONS

What is the quality of Lake Mead's water? How do humans impact water quality in Lake Mead and within the Colorado River watershed? What can be done to protect Lake Mead's water quality?

## GOAL

Students will use a standardized protocol for testing the water quality of Lake Mead and will demonstrate an understanding of the importance of Lake Mead's water quality and the lake's role within the Colorado River watershed.

## OBJECTIVES

Students will:

- develop a Water Quality Index by conducting water quality measurement tests;
- contribute new data to a central data base;
- synthesize and interpret collected data.

## NEVADA STATE STANDARDS CORRELATIONS

N.12.A.1. Students know tables, charts, illustrations, and graphs can be used in making arguments and claims in oral and written presentation.

N.12.A.2. Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations.

N.12.B.1. Students know science, technology, and society influenced one another in both positive and negative ways.

N.12.B.4. Students know scientific knowledge builds on previous information.

E.12.C.4. Students know processes of obtaining, using, and recycling of renewable and nonrenewable resources.

## CLARK COUNTY SCHOOL DISTRICT OBJECTIVES

(Correlations to specific high school courses will be completed.)

## SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site high school activities support the following guiding theme developed by Clark County-based educators:

*Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.*

- Sub-theme 1. Human activity profoundly alters the ecosystems of southern Nevada. We and our partners care about protection and preservation of these sensitive lands.

## PREREQUISITE CLASSROOM EXPERIENCES

A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and their upcoming field trip. Students learn and agree to the “conduct rules” of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

## VOCABULARY

- biological oxygen demand
- dissolved oxygen
- fecal coliform
- nitrates
- pH
- temperature
- total phosphate
- total solids
- turbidity
- water quality
- water quality index (WQI)
- watershed

## ON-SITE ACTIVITIES: Forever Earth

Materials: Hach water quality testing kit or other water chemistry kit

Time: 4 hours

Reference:

Mitchell, Mark K. and William B. Stapp. Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools. Dubuque, IA: Kendall/Hunt Publishing Company, 2000.

In order to compare rivers, lakes, and other waterways in various parts of the country, the National Sanitation Foundation created and designed a standard index, called the Water Quality Index (WQI). The WQI, one of the most widely used of all existing water quality indices, is a unitless number ranging from 1 to 100. A higher number is indicative of better water quality. The table below gives a general qualitative description for a WQI range.

<b>WQI</b>	<b>Water Quality</b>
0-25	Poor
25-50	Fair
50-70	Medium
70-90	Good
90-100	Excellent

To determine the WQI, nine tests are performed:

- dissolved oxygen
- fecal coliform
- pH
- biochemical oxygen demand (5-day)
- temperature
- total phosphate
- nitrates
- turbidity
- total solids

The field manual, referenced above, provides an overview of these tests, including what they mean and how to do them (e.g., proper sampling techniques). The instructions accompanying the Hach kit are used to perform the actual tests. The full range of tests is conducted at two sites: the first is near Swallow Cove and the other is in Las Vegas Bay. GPS coordinates will be determined for these sites. It is suggested that samples be taken at depths of 5 meters, 10 meters, and 20 meters. This is done so that data collected over a period of time can be compared.

The next step is calculating the results and arriving at the WQI. The majority, if not all, of these calculations will be completed in the classroom with the raw data collected during the field trip. Chapter 4 of the field manual provides the procedure for calculating the overall WQI for each sample site. There is a strong possibility that students may not be able to complete all nine tests. For example, the fecal coliform test requires an incubator and other special equipment. The amount of time aboard Forever Earth may be another limiting factor that determines which tests are actually conducted. There is a process outlined on page 11, Chapter 1, for estimating the WQI if the students are unable to conduct all nine water quality tests.

As a way to synthesize and share their results, students can create a PowerPoint presentation or other visual presentation that highlights their findings and conclusions about Lake Mead's water quality. This final product, as well as the raw data, should be shared with the Forever Earth Project Manager.

## EXTENSIONS

- Students contact the Forever Earth Project Manager for data collected by other Clark County School District students. Test results are compared and similarities and differences discussed.
- Further discussion of the students' findings can lead to investigating questions such as:
  - What did you learn about your drinking water source?
  - What actions are taken to protect Lake Mead water quality?
  - Are there any actions that need to be taken to improve water quality, and thereby the lives of people that depend upon Lake Mead?