

## Earth Sciences Trek



**Grades:** 3 - 5

**Time:** a pre-visit session of 30-45 minutes and a post visit session of 20-30 minutes (*Note: Time for either session can be adapted. For instance the pre-visit session can consist of a 10 minute preview of the exhibits.*)

### **Rationale and Context:**

This trek is organized around the NGSS crosscutting concept cause and effect. [This video](#) provides an overview of the concept. To help maximize their ECHO experience, students will be introduced to ECHO exhibits that relate to Earth sciences before their classroom visit. They will make predictions about how to produce desired results at several exhibits. At ECHO, students will test out their designs or hypotheses and explore exhibits more deeply with the help of additional challenge questions. After their visit, students will process their learning as a group and draw conclusions about Earth's systems, Earth and human activity, and cause and effect relationships. Teachers may choose to continue to explore these concepts using additional resources provided.

### **Teacher Background Information:**

The primary learning goal of ECHO's Awesome Forces exhibit gallery is to help visitors understand the physical laws that govern the natural phenomena we experience everyday on the Burlington Waterfront. Through hands-on physical science interactive exhibits students will delight in discovering the amazing processes that have shaped the Lake Champlain Basin and our Earth.

### **Learning/Behavioral Objective(s):**

1. Students will engage with ECHO exhibits with a sense of purpose.
2. Students will hypothesize about how to create desired effects with the exhibits.
3. Students will connect the phenomena they observe with Earth science concepts.
4. Students will draw conclusions about Earth science concepts and connect their learning to a broader cross cutting science concept.

**Essential Question:** How can cause and effect relationships help predict or explain future events?

### **Focusing Questions:**

How and why is Earth constantly changing?

How does water shape Earth's surface?

How do the Earth's surface processes and human activities affect each other?

How do communities use science ideas to protect the environment?

How do humans reduce the impact of weather hazards?

## Vermont Standard(s): Next Generation Science Standards

Standard	Description
Crosscutting concept	Cause and Effect; Mechanism and explanation
3 ESS3-1	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
4 ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4 ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
5 ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
5 ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
Science and Engineering Practice	Developing and Using Models Constructing Explanations and Designing Solutions Obtaining, Evaluating and Communicating Information

**Vocabulary:** Students may gain an understanding of certain vocabulary words through active participation and explanation.

Atmosphere  
Environment  
Erosion  
Fog  
Hazard

Hydrosphere  
Resource  
Vegetation  
Weathering  
Watershed

### LEARNING PLAN:

#### Resources/Materials:

1. Optional free admission for teacher walkthrough visit
  - contact [ephillips@echovermont.org](mailto:ephillips@echovermont.org)
2. [Slide presentation of selected exhibits](#)
3. [Museum Map](#)
4. [ECHO Exhibit Preview sheet](#)
5. [ECHO Exhibit Exploration sheet](#)
6. Links to extension activities

## Before your ECHO trip:

### Introduction

1. *When our class visits ECHO, you will have a chance to explore many science exhibits. Today we're going to preview a few of them and start thinking about some of the challenges you might explore when we are there.*
2. *At many of the exhibits, you'll be able to think about cause and effect. If necessary, introduce or review this crosscutting concept.*
3. Hand out the [ECHO Exhibit Preview sheet](#).

### Exhibit Preview

1. Begin [slideshow](#). Show Flowing Streams slide, then discuss:
  - a. *What do you notice in this picture?* Take several responses. If no one comments on the faucet above the cup, call students' attention to it.
  - b. *You will be able to make water flow out of the faucet and it will run out a hole in the cup onto the landscape. But in the real world, water doesn't pour out of a cup the size of a house! Where does it actually come from?* Rainwater, snowmelt
  - c. *How can this model help us investigate the effect flowing water has on the landscape?* It can show the effect more quickly than in real life; you can control the amount of water flowing; You can see what's happening to a large amount of land.
  - d. *How do you think flowing water affects a landscape?*
  - e. Allow students time to record ideas on their worksheet. Share and discuss.
2. Show Steaming Lakes slide, then discuss:
  - a. *What do you notice in this picture?* Take several responses.
  - b. *This is called a steam devil. Why do you think it's called that?* Take several responses.
    - i. *What is it made up of?* Students may say 'steam' but it's actually made of fog pulled into a whirlwind.
    - ii. *What causes fog to form?* Very cold air flowing over very warm water
  - c. *You can put your hand into this exhibit! What is your hypothesis about how your hand will affect the steam devil?*
  - d. Allow students time to record ideas on their worksheet. Share and discuss.
3. Show Shaping Watersheds slide, then discuss:
  - a. *What do you notice?* Take several responses. If no one predicts that this exhibit is hands on, say:
  - b. *The landform is made out of tiny rubber pellets. You can shape and create your own landscape. Afterward you can make it rain!* Show the next slide.
  - c. *When you hold your hand over the landscape, the exhibit will simulate rain falling.*
  - d. *How can changing the landscape change where the water will go?* H
  - e. Allow students time to record ideas on their worksheet. Share and discuss.

4. Show Foggy Harbor slide, then discuss:
  - a. *What do you notice in this picture?* Take several responses. If no one comments on the fog or the lighthouse in the background, ask:
    - i. *Where do you find lighthouses?* In coastal areas
    - ii. *What purpose do they serve?* They warn boaters of hazards like reefs and rocks.
    - iii. *What do you call low clouds of moisture over water?* Fog
    - iv. *Why is fog a problem on a lake?* Reduces visibility/makes it hard to see into the distance
  - b. *At this exhibit you'll be able to learn more about lighthouses and do a fun challenge to send a light beam through the fog. I want you to think about how well lighthouses do at their job of making it safer for people traveling on the water. What would be an important design element for a lighthouse?*
  - c. Allow students time to record ideas on their worksheet. Share and discuss.
5. Show the State of the Lake slide.
  - a. *Did you know scientists keep track of how healthy Lake Champlain is? This exhibit has a lot of information about some of the problems the lake faces. What might some of those problems be?* Responses will vary.
  - b. *The Lake Champlain Basin Program works to protect the lake's water, animals and surrounding environment. They have a resource room at ECHO. Show picture of the Lake Champlain Basin Program Resource Room.*
  - c. *While we're at ECHO, I'd like you to use the State of the Lake exhibit and the LCBP resource room and find out about one problem facing the lake and one way people are working to solve it.*
  - d. Allow students time to record their ideas of possible problems on the worksheet. Share and discuss.

### Closure and Connections

1. *What are you most excited about seeing, doing or learning on our ECHO field trip?*
2. *During our visit, you will get to discover many other exhibits. Some relate to physical sciences and lots of them include animals. If you are looking for more exhibits that explore Earth systems and cause/effect relationships, you can look for these exhibits.*  
Show slides of additional exhibits.

### **During your ECHO trip:**

1. It may be helpful to have students identify which of the previewed exhibits they are most excited about. They can be split up into small chaperoned groups by their interest. We will help direct your groups to different areas of the museum to begin your ECHO explore time.

2. Give each student or partner group a copy of the [ECHO Exhibit Exploration sheet](#) to guide them as they interact with the exhibits.

**After your ECHO trip:**

1. *Now that everyone has explored the exhibits at ECHO, let's hear what you thought.*  
Allow a quick share where everyone can share one favorite exhibit/experience/etc.
2. *Let's discuss what you've learned about Earth's systems, Earth and human activity, and cause and effect relationships.*
  - a. *At Flowing Streams:*
    - i. *What effect did the water have on the landscape?* Encourage discussion of the rate of erosion by water.
    - ii. *Where would you recommend putting buildings to reduce the impacts of water flow?* If possible, generate and compare multiple solutions.
    - iii. *What other actions could people take to reduce the impact of water flow?*
    - iv. *What human activities might cause increased runoff?* If time allows, discuss the effect of paved roads and lots on rainwater runoff.
  - b. *At Steaming Lakes, what did you notice about how the funnel formed?*  
Encourage discussion about the interaction between the hydrosphere and the atmosphere.
  - c. *At Shaping Watersheds, how did changing the landscape change where the water went?* Encourage observations that provide evidence of the rate of erosion by water.
  - d. *After visiting Foggy Harbor, what are your thoughts about the pluses and minuses about the way lighthouses work?* Encourage discussion about necessary design elements for a lighthouse (tall, sends a bright signal into the distance and in multiple directions, needs to be accessible for maintenance, etc.) Then discuss the merits of the design solution. Students may also want to discuss whether lighthouses are necessary now that there are technologies like GPS and radar beacons which are less expensive than staffing and maintaining a lighthouse.
  - e. *What problems are facing the lake and what solutions did you learn about by visiting the Lake Champlain Basin Program resource room?* Focus discussion on ways to use science ideas to protect the Earth's resources and environment.
3. *What connections can you make between the exhibits?* Possible answers include: following the path of water in Flowing Water and Shaping Landscapes; seeing the effects of erosion and LCBP efforts to reduce/mitigate the effects of runoff.

4. *How can understanding cause and effect relationships help us reduce the impacts of natural Earth processes on humans?* Example: If we understand how water moves, we can avoid building homes in places that are likely to get flooded.
  - a. This may also be a logical place to make connections with the current science unit under study.

## **Extensions**

### Flowing Streams and Shaping Watersheds:

- Change the shape of land with these [video directions](#).
- Watch this [video demonstration](#) of ways to slow soil erosion.
- Investigate how different riparian ground covers affect river flooding with this [hands on activity](#).
- Watch [this video](#) that includes visualizations of how river flows shift and change path over time.
- [This video](#) shows a virtual tool similar to ECHO's Shaping Watersheds display.
- Watch a [dramatic mudslide caught on video](#).

### Steaming Lakes:

- Enjoy this 2016 [slideshow](#) of steam devils on Lake Champlain.
- Watch these steam devils on Lake Ontario caught on [video](#).
- This [short video](#) explains how the interaction of the hydrosphere and the atmosphere cause thunderstorms to form.

### Foggy Harbor/Building Design:

- Learn the [history of the Colchester lighthouse](#): from design to its retirement at Shelburne Museum
- Watch a [short video](#) that shows a housing solution for flood-prone areas.

### State of the Lake:

- Explore [lake and watershed data](#).
- Learn about [featured projects](#) at the Lake Champlain Basin Program.