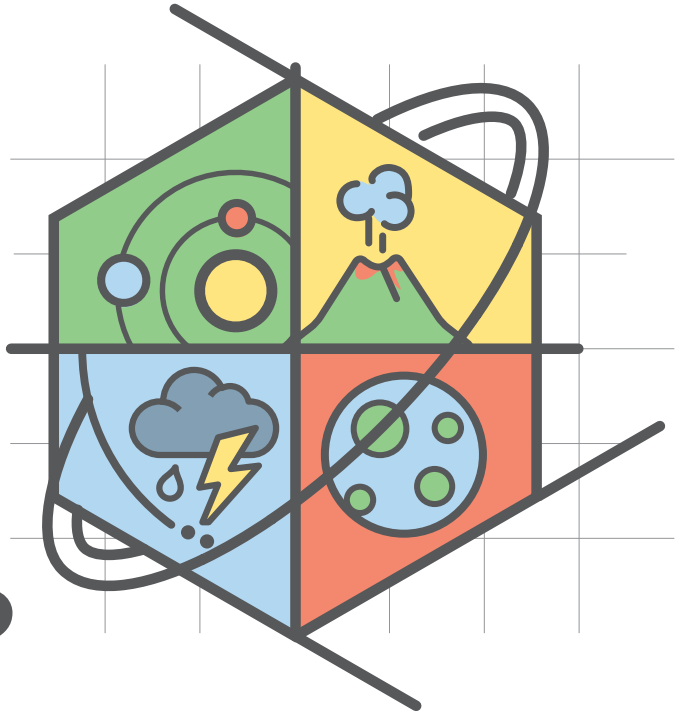
Where Did the Beach Go?



2nd Grade Earth and Space Science Storyline to support the Pebbles, Sand, and Silt kit

STEM

6.24.19

ABOUT THIS UNIT

We are pleased to present this NGSS Storyline Unit to help support educators in our region as we shift towards providing students with NGSS-aligned, phenomenon-based and project-based learning experiences. Our vision is to provide students with high-quality and equitable learning experiences that empower them to develop fluency in STEM and literacy. This unit strives to engage students in the phenomenon of erosion by having students investigate the local phenomenon of rapid beach erosion on Washington's coast.

This unit also contains links to online resources created by other organizations which may use a different license. Please make sure that you understand the terms of use of third-party resources before reusing them. Prior to publishing this unit of study, we have reviewed the content of this unit to ensure that all materials are in accordance with creative commons regulations. If you notice that a part of this unit infringes another's copyright, please contact us.

A digital copy of this document is available on the STEM Materials Center website at:
https://www.stemmaterials.org/wheredidthebeachgo

ATTRIBUTION

This unit is a result of a collaborative effort between Educational Service District 112 and educators and specialists from other school districts and agencies.

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STEM
Science
Technology
Engineering
Math

A program of Educational Service District 112
supporting Next Generation Science Standards

A special thanks to Governor Jay Inslee and the Washington State Legislature who supported the development of this unit through funding the 2018-2019 Climate Science Proviso. We would also like to thank Barbara Soots at OSPI and the Washington OER Project for funding and supporting this work.

OSPI

CLIME TIME
CLIMATE SCIENCE LEARNING

UNIT OVERVIEW

Embark on a journey with your students to answer the driving question: ***How can we design a solution to prevent Washington's coast from eroding?*** This NGSS-aligned integrated storyline unit strives to help students explore the 2nd grade NGSS standards bundle Earth's Systems: Processes that Shape the Earth (2-ESS1-1, 2-ESS2-1, 2-ESS2-2, & 2-ESS2-3). Students explore Earth's processes that cause change slowly and quickly. Students also explore a variety of Earth materials and their resistance to erosion while designing a plan to help the people of Washaway beach with their serious beach erosion problem. The unit culminates in students designing a blockade to help prevent erosion in Washaway Beach (North Cove, WA).

Please note that the sequence of FOSS activities in this storyline unit differs from the way that the FOSS teacher guide presents these investigations. For alignment with NGSS and to create an integrated STEM-based learning experience for your students, it is recommended that you use this storyline unit instead of closely following the sequence of the FOSS guide. The outline below can help in your planning. Please note that each session is intended to take a class period of 30-45 minutes.

For your convenience, all resources have been uploaded to this Google drive folder, Where did the beach go? (Pebbles, Sand, and Silt NGSS Storyline), http://bit.ly/wheredidthebeachgo for easy access. Since curriculum revision during the school year will be limited, any additional resources and changes will be reflected in the live documents on the Google drive. You may also make comments for suggested revisions on these documents. In order to modify the Google resources to make changes, click "file" and "make a copy." This will create a copy in your drive that you can edit to fit your needs.

LESSON 1: Where Did the Beach Go? *pg. 8*

This lesson engages students in the phenomenon of beach erosion that is plaguing and changing Washington's shores. Students will be exposed to the phenomenon of beach erosion and will learn about the causes and impacts of this problem. Students will also create a map of the coast and ocean (2ESS2-3).

Session	Materials Needed		Page
1. Where did the beach go?	• KLEWS Chart • Photos of Washaway Beach • Computer for teacher slides	• Chart paper, markers and crayons for Washaway Bay map	**9**
2-3. Where is water found?	• *Icebergs, Ice Caps and Glaciers* by Adam Fowler • Tables for student research	• Where is Water Found on Earth Worksheet	**10**
4. Analyzing sea level data	• KLEWS Chart	• Teacher slides	**28**
5-6. Mapping the problem	• Chart paper • Markers, Crayons, Pencils	• Computer with Map of North Cove	**29**

UNIT OVERVIEW (cont.)

LESSON 2: What is a Beach? *pg. 33*

In this lesson, students will explore the phenomenon of beach erosion. Through two FOSS investigations where students are experimenting with different materials and connecting to the storyline of Washaway Beach, students will explore how erosion can occur in different ways to change a landscape and affect a community. Students will be exploring different materials, such as rocks, sand, silt, and clay and will connect their investigation with the phenomenon of beach erosion.

Session	Materials Needed		Page
1. So many types of beaches!	• Slides showing beaches around world	• KLEWS chart	**34**
2. FieldSTEM session: Finding erosion outdoors	• Science notebooks to take notes and draw observations	• Chalk • Outdoor space for walking	**52**
3. FOSS Investigation 1: First Rocks	• Materials for FOSS Investigation 1: River Rocks	• Station signs • Observation Templates	**53**
4-5. FOSS Investigation 2: River Rocks Part 2	• Materials for FOSS Investigation 2: River Rocks, Part 1 and 2	• KLEWS chart	**54**
6. Sand castles and erosion	• Basins • Sand	• Water • Water pitcher	**55**
7. FOSS Investigation 2, Part 4: Exploring Clay	• Materials for Investigation 2: River Rocks, Part 4: Exploring Clay		**57**
8. Earth's materials and erosion	• Sentence Frames written on board	• KLEWS chart	**58**

UNIT OVERVIEW (cont.)

LESSON 3: How Does Erosion Happen? *pg. 60*

Students will study the science of beach erosion and how it can happen quickly or slowly. Students will use various media (texts, pictures, videos) to distinguish between erosion that is happening rapidly or over a long period of time. Students will be investigating this phenomenon in the context of beach erosion on the eroding Washington Coast.

Session	Materials Needed		Page
1. Erosion over time and making predictions	• Image of the erosion of Washaway Beach	• Student maps from Lesson 1	**61**
2. Other types of erosion that happen very slowly	• This Bill Nye video about erosion • KLEWS chart	• Erosion Slides Presentation • Erosion Examples and Evidence worksheet	**62**
3. Yikes, storm surge!	• Slides presentation (Slide 9 for session 3)		**65**
4. Other fast Earth events	• Use this slides presentation (Slide 19) • Student handout on fast erosion	• *Ocean Tides and Tsunamis* by Baby Professor • KLEWS chart	**66**
5. Constructing an argument about erosion	• Chart paper • *How Do Wind and Water Change Earth?* by Natalie Hyde	• KLEWS chart • Colored stickers	**69**

UNIT OVERVIEW (cont.)

LESSON 4: Designing a Blockade! *pg. 71*

Students will explore different design solutions that have been used to prevent or reduce the impacts of beach erosion. Through a series of hands-on investigations, students will explore different materials and investigate their abilities to resist erosion. Students will begin to construct an argument for which material they would like to use to create dikes to help the Washaway Beach community in fighting erosion. Please see the outline below to clarify modifications from the original FOSS sequence.

Session	Materials Needed		Page
1. Structures that prevent erosion	• Slides presentation • KLEWS chart	• *Rosie, Revere, Engineer* by Andrea Beaty (optional)	**72**
2-3. FOSS investigation 3, Part 3: Sand Sculptures (modified to Sand "Structures")	• Materials for FOSS Investigation 3, Part 3: Sand Sculptures	• Observation template	**73**
4. FOSS Investigation 3, Part 5: Making Bricks (optional)	• Materials for FOSS Investigation 3 Part 5: Making Bricks	• 1 ice cube tray per group (as block-like as possible)	**75**
5-6. Making brick Barriers (optional)	• Students bricks • Sand matrix mixture • Metal pans	• Water in cup • Observation template	**76**
7. FOSS Investigation 4: Homemade Soil	• Basin • Spoon • Small pebbles • Potting soil • Plastic cups	• Gravel • Paper towels • Sand • KLEWS chart	**78**
8. Field STEM walk: What type of soil is present in our school yard and what is growing in it?	• Schoolyard (where you are ok to dig)	• A shovel • A bucket of water	**79**
9. How can plants prevent erosion?	• Slides presentation	• KLEWS chart	**80**

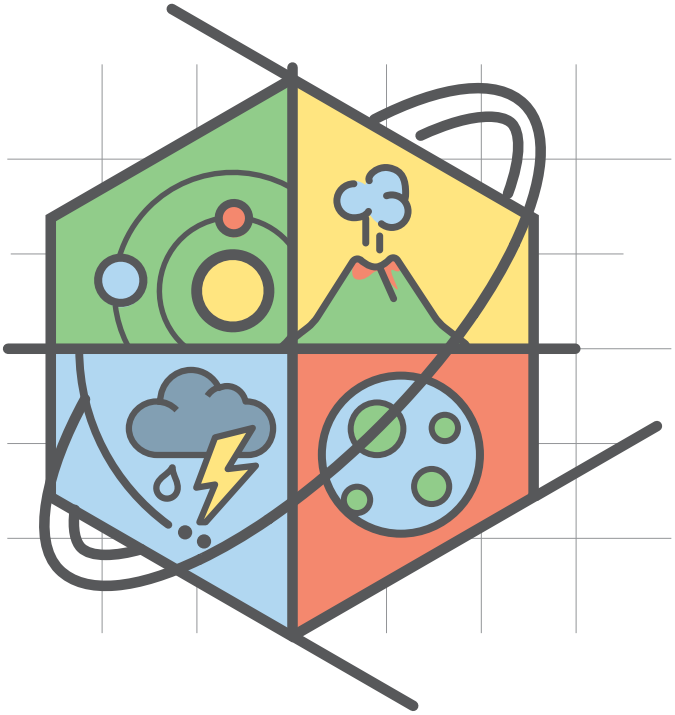
UNIT OVERVIEW (cont.)

LESSON 5: Saving Washaway Beach *pg. 82*

Students will engage in the engineering design process to create a plan for their dike to help the Washaway Beach Community. Students' designs will be backed up with an argument explaining why they materials they used will help prevent against rapid and slow erosion. This version of the engineering design process is created for students in primary grades and it will guide them through the thinking and planning that is necessary to effectively solve a problem!

Session	Materials Needed		Page
1. Wondering about the problem	• Slides presentation • KLEWS chart	• Engineering design template	**91**
2. Imagining the solution	• Slides presentation	• Engineering design template	**92**
3. Planning the solution	• Markers, crayons, colored pencils • Chart paper	• Engineering design template	**93**
4-5. Creating a model	• Pebbles • Rocks • Soil • Sand and sand matrix • Paper house template	• Items to be scavenged for outdoors (small plants, grass, rocks, dry leaves, moss, lichen, sticks and twigs, etc.)	**95**
6. Optimize and explain	• Students design plan diagrams	• Students' models • Sentence frames	**99**
7. Share!	• Slides to show Washaway Beach	• Student projects	**100**

LESSON 1: Where Did the Beach Go?



STRATEGY: ENGAGE

This lesson engages students in the phenomenon of beach erosion that is plaguing and changing Washington's shores. Students will be exposed to the phenomenon of beach erosion and will learn about the causes and impacts of this problem. Students will also create a map of the coast and ocean (2ESS2-3).

STEM

SESSION 1:
Where did the beach go?

Warm-up (5-10 min)

Show students this animation of the eroding coast of Washington. Ask students to watch carefully.

Main activity

What are some things they notice? What are some things they wonder? What are some things they know? Students' "noticings" "wonderings" and "knowings" can be added to a KLEWS chart that will help them in their journey towards making sense of the phenomenon of beach erosion. Show students these series of photos taken of the coast by photographer Erika Langley. What do they think is happening to the coast? Ask students, why is the disappearing beach a problem for us Washingtonians? Why is it a problem for the people living in North Cove, WA?

Present students with the driving question of the unit:
How can we design a solution to protect Washington's coast from erosion?

Wrap-up

Check-in with the KLEWS chart again after presenting the driving question. Ask students: what do you know/think about the problem of the disappearing coast? Is there anything you wonder about it? Do you have any idea what erosion means? What might be causing all this erosion? Allow students to share their thinking without focusing on the correctness of their responses. They will build an understanding of erosion and its causes through the course of the unit.

Materials Needed

- KLEWS chart
- Computer for teacher slides
- Photos of Washaway Beach
- Chart paper, markers and crayons for Washaway Bay Map

SESSIONS 2-3:
Where is water found?

Note: This session is based on a lesson called "Where is Water Found on Earth" openly accessible on BetterLesson.com and written by 2nd grade teacher Jeri Faber. The lesson description below is an abridged version for your reference, but it is recommended that you click the link above and use the detailed lesson with resources for your planning and prepping. A copy of the lesson with master sheets is located in the "teacher's resources" section of this unit (at the end).

Materials Needed

Icebergs, Ice Caps and Glaciers by Adam Fowler

Tables for student research

Where is Water Found on Earth Worksheet

Warm-up

Begin the lesson by asking students if they have ever heard that the Earth is called the "Blue Planet." Ask students:

- Why do you think the Earth is called the "blue planet?"
- What makes Earth different from other planets in the solar system?
- Where on Earth do we find water?

Allow students to share their ideas.

Main activity (20-30 min)

Students will work in teams of 2-3 to explore different websites and resources where they can find information about where water is found. This lesson requires students to have ipads or android tablets in order to access the QR codes. The Where is Water Found on Earth Worksheet can be used as a place to record student ideas. Please see Teacher's Resources packet for master copies of this sheet. After students are done researching, have them partner up with a team and share their findings.

Read *Icebergs, Ice Caps and Glaciers* by Adam Fowler and ask students to continue to take notes on their Where is Water Found on Earth Worksheet.

Wrap-up

Bring students together and display the Where is Water Found on Earth Worksheet. Have students share their responses as a class and ask students to share their thoughts. The work pages in this lesson can be kept in their science notebooks for later reference.

Jeri Faber RINGWOOD SCHOOL PRIMARY Center, RINGWOOD, IL
2nd Grade Science : Unit #6 - Water and Landforms : Lesson #1

Where is Water Found on Earth?

Objective: SWBAT collaborate as a team to locate forms of water on Earth.

Standards: W.2.7 W.2.8 2-ESS2-3 SP8 XC-P-LE-1
Subject(s): Science
60 minutes

Teacher Notes - 0 minutes

Activity Description
Watch the 1 minute video for a brief description of the activity and to preview the resources.
Link (https://goanimate4schools.com/player/embed/0Etgnd8lCIS8)
Partner teams will use QR codes to go on a hunt for where water is located on Earth using electronic devices. They will obtain the information from websites and collect it on a chart. Then partner teams will collaborate with another partner team to supplement their information.

NGSS Connection
In the NGSS standards, the children are expected to be able to obtain information to identify where water is found on Earth, and that it can be a solid or a liquid. In this lesson they will be working collaboratively to find that information using QR codes to direct them to appropriate websites. Once on the websites, they must obtain information using icons and electronic menus, which is a science practice standard. In the Common Core, one of the writing standards is for children to be an integral part of a shared research and writing project. Another standard is to gather information from provided sources to answer a question, which is exactly what the children will be doing in this lesson.
Note: The students will be collecting the information in this lesson, and then writing about it in the next.

Materials
- Where is Water Found on Earth Revised (https://betterlesson.com/lesson/resource/3362242/where-is-water-found-on-earth-revised)--This is a set of **8 DIFFERENT treasure hunt sheets** each with a different QR code, one per team.
  - In advance, I ran 2-3 *Where is Water Found on Earth?* recording sheets per team, depending on the number in that team. I have a class of 20 students, so I have 4 groups of 2 and 4 groups of 3. I assign a number to each of the teams (#1-8). I give each member of that team the exact same *Where is Water Found on Earth?* recording sheet. The number in the upper left-hand corner of the sheet matches the team number.
- ipods/ipads--1 per team
- You will need to have a QR code reader on each device. I would suggest the FREE ***QR Reader*** (ipods/ipads) and ***QR Code Reader*** for Androids. They are simple, easy and quick to install.
- book titled *Icebergs, Ice Caps and Glaciers (https://betterlesson.com/lesson/resource/3199972/icebergs-ice-caps-and-glacier-book)* by Allan Fowler or a similar book
- Forms of Water notetaking organizer (https://betterlesson.com/lesson/resource/3198855/forms-of-water-notetaking-organizer)--1 per student

Note: If you do not want to use ipads/ipods for this lesson, you may also have the students gather their information from books. (See reflection for more info).

Parent Connection

When I begin this unit on Water and Landforms, I send out this parent letter (https://betterlesson.com/lesson/resource/3319149/water-and-landform-parent-letter) to help keep them informed and involved in what we are doing in school. This knowledge helps build a strong communication from school to home.

RESOURCES

DSC_0046.jpg https://betterlesson.com/lesson/resource/3199972/icebergs-ice-caps-and-glacier-book

Forms of Water notetaking organizer.pdf
https://betterlesson.com/lesson/resource/3198855/forms-of-water-notetaking-organizer

Water and Landform parent letter.pdf
https://betterlesson.com/lesson/resource/3319149/water-and-landform-parent-letter

WhereisWaterFoundonEarthRevised2016.pdf
https://betterlesson.com/lesson/resource/3362242/where-is-water-found-on-earth-revised

TECHNOLOGY--FINDING APPROPRIATE RESOURCES: Adjustments to Practice

When planning this lesson, I wanted to have the children use websites to gather their information on water forms exclusively. However, I found that finding appropriate websites for second grade students was very difficult. I thought I had found websites that would work for second grade students.
However, when I implemented the lesson, I found that a few of the websites were a little bit over their heads, or, as a student put it, didn't have enough photos and too much reading. So I ended the lesson a bit early, and tabled it for Monday.
Then over the weekend, I did two things to help alleviate this problem. First, I created my own website in which the children could research different forms of water. I added this QR code to the teacher resource packet. I kept my text and information at a level that I knew they could understand. Plus I added the much loved photo portion to each website page. Then I also added the used of books as a resource in addition to the websites.
Then on Monday, I added these two changes. Things went much more smoothly. I revised the lesson to include both of these changes.

Engage! - 5 minutes

I begin the lesson by first posing a question to the students.

Earth is called the blue planet. Do you know why?
Are any other planets like Earth? What makes it so different? In this unit we are going to be discovering all about Earth and what makes it so unique. Today we are going to be investigating the blue part of Earth. We are going to be finding out about the forms of water.

I try to get the kiddos interested in the topic by introducing a question. It gets their thoughts focused in the right direction and helps guide them.

Explore - 25 minutes

In the next part of the lesson, the children are going to be researching on the internet to find out about forms of water on our Earth. The internet research, however, will be well-managed by the use of QR codes. I love using technology (https://betterlesson.com/lesson/resource/3221273/utilizing-technology-in-the-classroom-info-sheet) in the

classroom! Technology helps the children learn the scientific concepts and arms them with relevant tech skills needed for the future. Plus when I use technology, the children interest level soars!

First I divide the children up into teams of 2 to 3. I make sure that I have 1 academically strong student in each group. I give the team numbers (#1-8) and give each team a different Where is Water Found on Earth (https://betterlesson.com/lesson/resource/3362243/where-is-water-found-on-earth) sheet, matching the number on the sheet with the team number. I make sure that each person in that team has a sheet and the number matches their partner. Keep in mind that each different numbered sheet has a different website that the QR code opens up. Each team has a different QR code and will be directed to a different website. Therefore, the teams will come up with different answers, creating a variety within the class. This is done for the express purpose of generating different answers so they can compare their answers during the last part of this lesson.

> *For this investigation, you are going to be working in partner teams to find out answers. You are going on a hunt to find out where water is located on Earth. You will record the information that you have found on this sheet. You need to list the forms of water that you found on this table. There are 3 categories that you need to sort your information into--fresh water (not frozen), frozen water and saltwater.*

In the NGSS standards, the children are expected to be able to obtain information to identify where water is found on Earth, and that it can be a solid or a liquid. This investigation will help lead them to the answers, but let them have some independence, too.

> *I am going to give you an example to help you figure out what a form of water is to help get us started. We have the Fox River that is a body of water that is in our town. I know that a river is a* **form of water***. Which category would I put river in?*

I like to start with an example of something they know about. Plus this gives them an idea of the type of words that I am looking for.

> *To do this each team will have a different research sheet. On each sheet is this little code called a QR code. You will need to use this code to direct you to a website with information that I would like you to research.*

I am using QR codes to guide them to appropriate websites, since they are too young to just surf the web without any guidance. The QR codes led them to where I want them to go and it also adds an element of FUN!

> *To use the QR code, you have to open the app called QR Reader. Then you hold the ipad over the code and it will detect its information. It will automatically bring your ipad's screen to the website. Once the website is on your screen, you can navigate to find the answers that you are looking for.*

Most children have not the experience of using QR codes, so they need some directions on how to use them. It is pretty cool!

> *Make sure to share the screen with your partner so you both can see it. You might want to consider having one person read the information softly aloud. Since you are working as a partner team, once you have found an answer, make sure to share it with your teammate. You should both have the same answers written on your papers.*

I have the partner teams work together for about 15 minutes (see video clip (https://betterlesson.com/lesson/resource/3210969/using-website-video-clip)). They are recording the information on their sheets as I walk around to answer any questions and to make sure they understand the task. Working collaboratively is an essential part of life, so this is a great task to help them practice the skill.

To supplement our information, I also had the children look in books to fill out additional ideas of the chart (see video clip (https://betterlesson.com/lesson/resource/3212203/where-is-water-found-on-earth-finding-info-from-books-video-clip)).

After time is up, I then have the students combine with another team to share their answers. I call this Think and Link (https://betterlesson.com/lesson/resource/3198535/think-and-link-strategy-information-sheet) (click for further information). The teams are now comprised of four to five students. I let them share their ideas for 5-10 more minutes. Again, I am trying to get them lots of experience working with others. They got their feet wet by starting with one or two teammates, now they have the experience of working with an even larger team (see Think and Link Groups video clip (https://betterlesson.com/lesson/resource/3212201/think-and-link-groups-video-clip)).

So you can see how my students filled out the chart, click here (https://betterlesson.com/lesson/resource/3212188/where-is-water-found-on-earth-student-sample) and here (https://betterlesson.com/lesson/resource/3212190/where-is-water-found-on-earth-student-sample-b).

RESOURCES

strategy-utilizing technology.pdf
https://betterlesson.com/lesson/resource/3221273/utilizing-technology-in-the-classroom-info-sheet

Where is Water Found on Earth? using websites.mp4
https://betterlesson.com/lesson/resource/3210969/using-website-video-clip

Where is Water Found on Earth? finding info from books.mp4
https://betterlesson.com/lesson/resource/3212203/where-is-water-found-on-earth-finding-info-from-books-video-clip

Strategies Think and Link.pdf
https://betterlesson.com/lesson/resource/3198535/think-and-link-strategy-information-sheet

Where is water found on Earth? Think and Link Groups.mp4
https://betterlesson.com/lesson/resource/3212201/think-and-link-groups-video-clip

Where is Water Found on Earth student sample.pdf
https://betterlesson.com/lesson/resource/3212188/where-is-water-found-on-earth-student-sample

Where is Water Found on Earth student sample B.pdf
https://betterlesson.com/lesson/resource/3212190/where-is-water-found-on-earth-student-sample-b

WhereisWaterFoundonEarthRevised2016.pdf
https://betterlesson.com/lesson/resource/3362243/where-is-water-found-on-earth

MY THOUGHTS ON THINK AND LINK: Journaling

Using the strategy "Think and Link" worked very well. Two student groups were combined to make one group. Thus they were able to share exclusive information with the other team. The children loved the idea of sharing with others. It gave them a feeling of empowerment that they had knowledge that needed to be shared with others.
It was interesting to see how differently each new team handled the task. Some teams went round the table and had each team member give an answer. Other teams seem to have one person that took the position of the leader and asked questions of the others, such as "What did you write under the heading of saltwater?" Then the team members would state their answer. I think the beauty of this is that the children are learning to be more responsible for their own learning and can chose to do that in a way that is appropriate for them.
I also was very pleased to see that my students worked very well in these larger teams. This shows huge growth from the beginning of the year when some of my students were struggling to even be in a partner group.

Explanation - 10 minutes

First we watch the 2 minute video (https://www.youtube.com/watch?v=MhMWIpLuPDI) on the Earth's hydrosphere. It gives a super easy to understand overview.
When doing the hunt for information, most children know about the typical places where water is found, such as rivers, oceans, and streams. But many of them do not think of Earth's frozen water. So I choose to read *Icebergs, Ice Caps and Glaciers* by Adam Fowler to enlighten them on this subject.
As I am reading, I ask the students to take notes on the Forms of Water note taking organizer (https://betterlesson.com/lesson/resource/3198856/forms-of-water-notetaking-organizer). They write the name of the form of water in the box (iceberg, ice cap, glacier) where designated and then write a short definition under it (see student sample (https://betterlesson.com/lesson/resource/3212571/student-sample-of-definitions)).
Here are the definitions we use:

- iceberg--a large piece of floating ice that has broken off from a glacier

- ice cap--a thick covering of ice over an area
- glacier--a large river of ice that moves slowly down a valley

I do not have them take notes on the other water forms since they were just collecting information as to where it is found. I do not want to put too much on their plate at once. In the next lesson (https://betterlesson.com/lesson/635823/forms-of-water-booklet?from=owner_view), they will take notes on the other forms of water.

RESOURCES

Forms of Water notetaking organizer.pdf
https://betterlesson.com/lesson/resource/3198856/forms-of-water-notetaking-organizer

Where is Water Found on Earth? sample day 1.JPG
https://betterlesson.com/lesson/resource/3212571/student-sample-of-definitions

Wrap-Up - 10 minutes

I pull up a copy of the Where is Water Found on Earth? recording page (https://betterlesson.com/lesson/resource/3198566/where-is-water-found-on-earth-recording-page) on the Smartboard.

> *I would like our new teams to come up and share their findings. When each group is sharing, it is going to be your responsibility to listen to what they are saying. If they tell us about a form of water that you do not have down on your paper, you need to add it. Since everyone is listening closely, I do not want to hear any repeats of something that we have heard before. Use your best listening ears, just like Buddy did.*

We read a story called Listen, Buddy! (by Helen Lester) at the beginning of the year. I like to refer to it when I need them to listen carefully.
Then the new teams share their ideas of where water is found on Earth by writing it on our chart and telling a little bit about what they have found out. Other teams need to listen intently and then add to their chart if new knowledge was learned.
We glue their charts in their science notebook. I collect the notebooks and check to see if the children have filled out what we have gone over on the chart.

RESOURCES

Slide1.jpg https://betterlesson.com/lesson/resource/3198566/where-is-water-found-on-earth-recording-page

Name _____

Form of water:_____	Form of water:_____	Form of water:_____
Definition: _____ _____ _____	Definition: _____ _____ _____	Definition: _____ _____ _____
Form of water:_____	Form of water:_____	Form of water:_____
Definition: _____ _____ _____	Definition: _____ _____ _____	Definition: _____ _____ _____

Created by Jeri Faber

QR Code Water Treasure Hunt

Where is water found on Earth?

Teacher Copy of the QR Codes

All groups:
Mrs. Faber's Wix Website
Forms of Water

Team 1
Science Kids Earth Images
(kids need to click on images to view)
http://www.sciencekids.co.nz/pictures/earth.html

Team 2
Science Kids Water Facts
http://www.sciencekids.co.nz/sciencefacts/water.html

Team 3
NASA safeyoutube video
https://www.youtube.com/watch?v=4HSFKwho7MQ

Team 4
USGS Where is Earth's Water Located?
https://water.usgs.gov/edu/earthwherewater.html

Team 5
Kids Geo Surface Water
http://www.kidsgeo.com/geography-for-kids/0148-surface-water.php

Team 6
Safeyoutube video
http://safeYouTube.net/w/nYW

Team 7
Safeyoutube video
http://safeYouTube.net/w/jYW

Team 8
One Geology Kids
http://www.onegeology.org/extra/kids/water.html

Name_____

Answer Key

Where is water found on Earth?

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater
Rivers Streams Brooks Marshes Swamps Lakes ponds	Icebergs Glaciers Icecaps	Oceans Salt Lake Bay Harbor Cove

created by Jeri Faber

Team 1

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 2

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 3

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 4

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 5

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 6

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 7

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

Team 8

Name_____

Where is water found on Earth?

Mrs. Faber's website

Directions: With a team, try to find as many types of water as you can in each category by using the QR code to research.

Fresh water (not frozen)	Frozen water	saltwater

SESSION 4:
Analyzing sea level data

Warm-up

Engage students by reconnecting to the phenomenon of the eroding coast at North cove by using the animation in the slides presentation. Ask students:

- What do they notice?
- What is happening to the amount of water vs the amount of land?
- Why might the water be taking over?
- Allow students to share their thinking.

Materials Needed

Teacher slides
KLEWS chart

Main activity

Analyzing Sea Level Data: Ask students to look at the graph on slide 3. A graph is a way for us to look at information. This graph shows how the size of water in the ocean (also called the sea level) has changed over time. Ask students what they notice about the lines shown. Students will notice lots of things about the colors and shapes they see in the data. Validate their responses. If students have trouble identifying the trend in the graph, ask them, "What do you notice about the direction the line is going? What do you think that means?" have students turn and talk to a partner and then ask students to share.

Show students the animation of the trend of what might happen to Miami in upcoming years. Ask students to talk with a partner about this question: "Why is the ocean taking over?"

Wrap-up

Check back with the KLEWS chart. What have we learned about the problem in North Cove? What patterns do we see happening around the world about how the coast is changing? What can we add to the KLEWS chart?

SESSIONS 5-6:
Mapping the problem

Warm-up

Engage students by asking them what they remember about North Cove (Washaway Beach). Ask students if they remember the driving question: How can we design a solution to protect Washington's Coast from erosion? Tell students that before we can try to help solve the problem, we would like to understand what the area looks like and why erosion is becoming a problem.

Materials Needed

- Map of the North Cove, WA
- Chart paper
- Pencils
- Markers/crayons

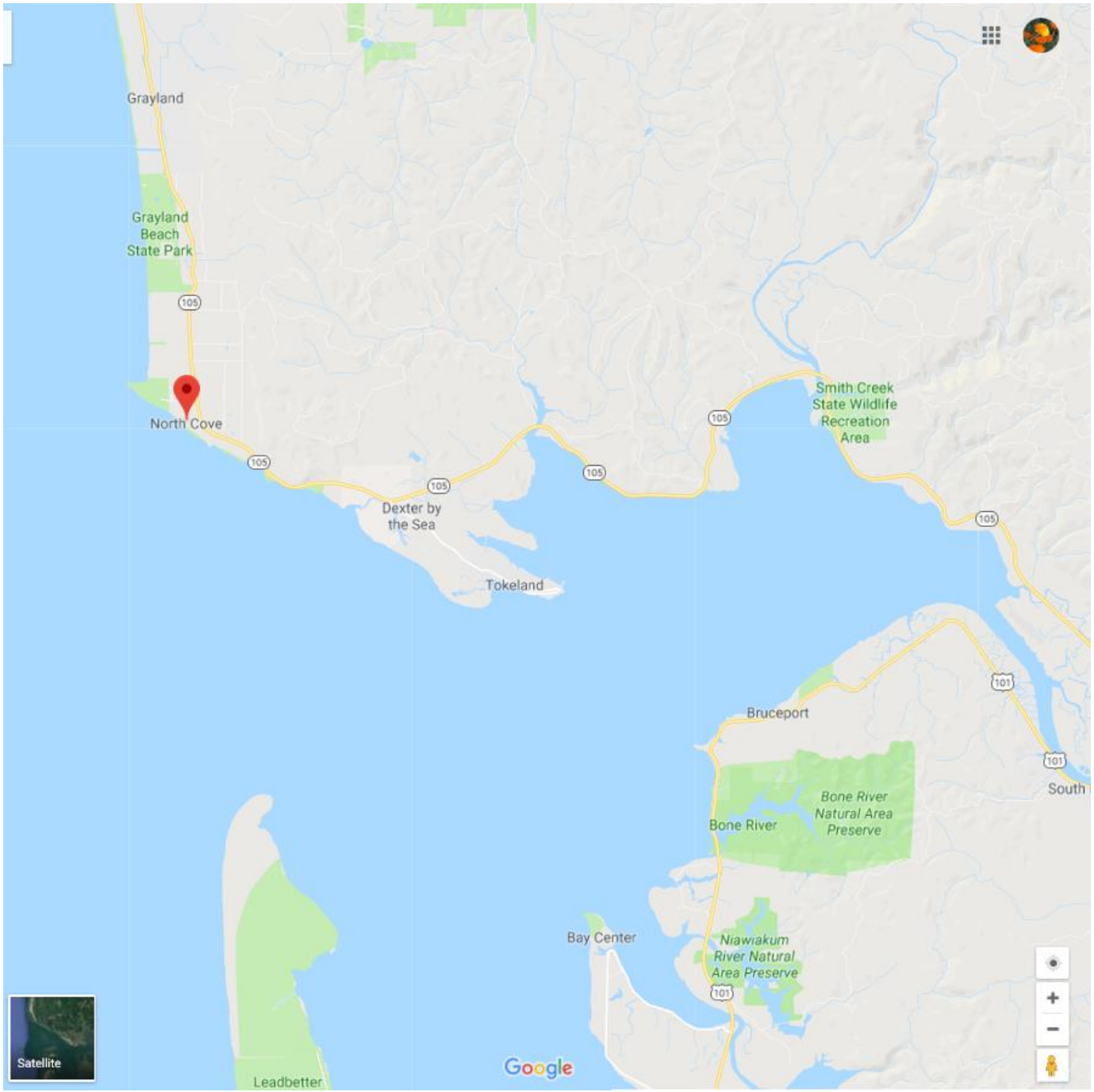
Main activity

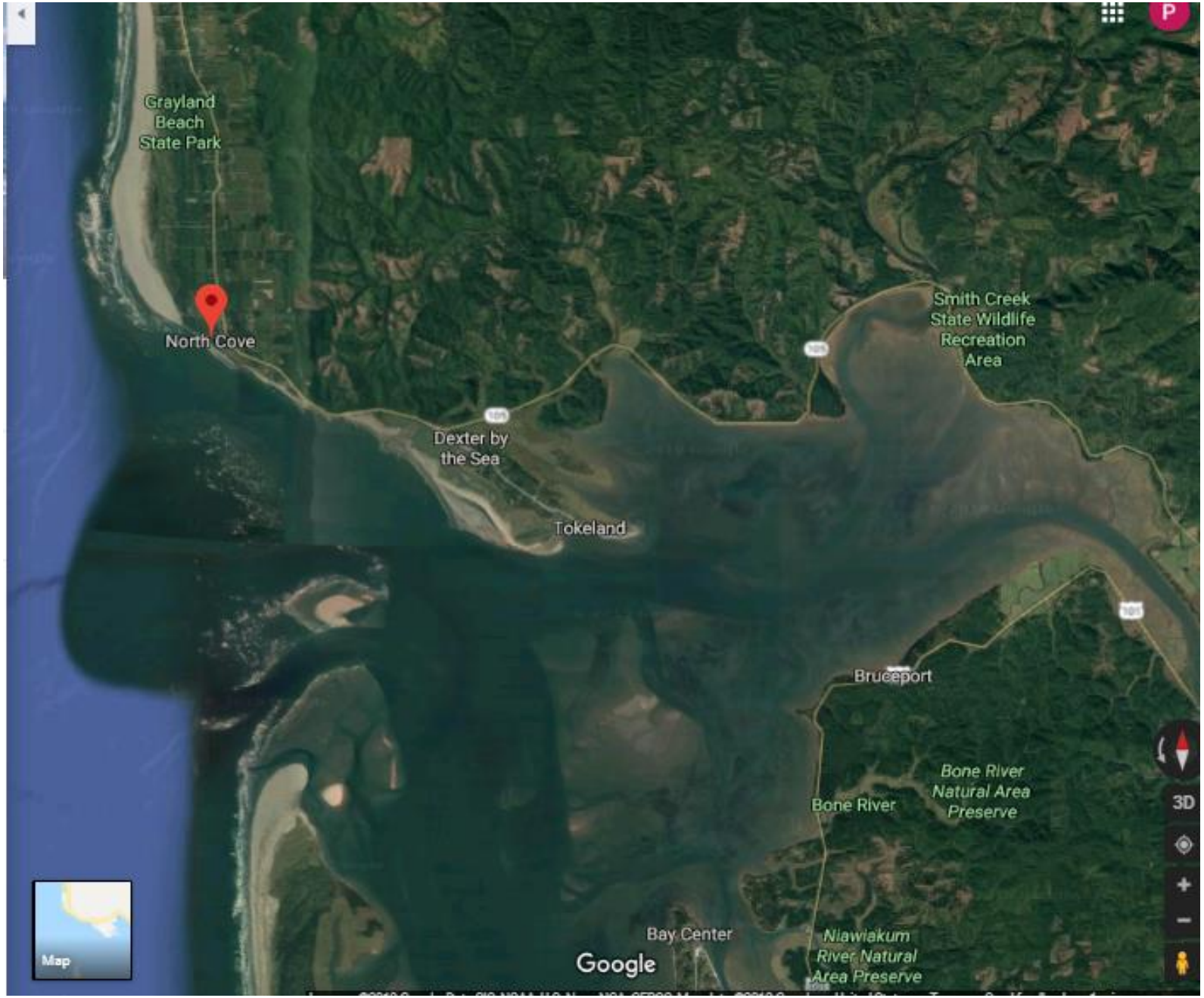
Tell students that we will be creating a map to show where Washaway bay is and how the coast is changing. Pull up this map of the North Cove, WA on the large screen. You may want to switch out of "satellite" mode to make boundaries look more clear to students. Ask students what they see: Where is there land on the map? Where is there water? Which body of water do we see (Pacific ocean)? You may want to zoom in/out based on students' requests. You may also want to switch into satellite mode (small box at bottom left corner of map) so students can analyze the terrain. Ask students about other bodies of water or land that stand out to them (ex. Willapa Bay, nearby parks or forests). Where do people live? Is anyone living close to where the ocean is taking over? Is that an important part of our map based on the problem we are trying to solve?

Provide students with large pieces of chart paper. Ask students to work in teams of 2-3 to recreate a map of the Washaway Beach and the area around it. Tell students that their maps will be important in helping them plan a solution for the community. Ask students to first sketch the boundaries between water and land before coloring in with marker or crayon. Ask students to label 1) The bodies of water in their map (Pacific ocean, Willapa Bay) and 2) some important parts of the land that people should know about (do people have houses near the coast? Are there parks nearby?). Allow students to have at least a few sessions to work on their maps. Their maps will be helpful when they are planning their design solution.

Wrap-up

Do a quick gallery walk, where students have a chance to look at each others' maps.


Grayland
Grayland Beach State Park
105
North Cove
105
105
Dexter by the Sea
105
Tokeland
105
Smith Creek State Wildlife Recreation Area
105
101
Bruceport
101
South
Bone River Natural Area Preserve
Bone River
Bay Center
Niawiakum River Natural Area Preserve
101
Satellite
Leadbetter
Google


Grayland
Beach
State Park
North Cove
Smith Creek
State Wildlife
Recreation
Area
Dexter by
the Sea
Tokeland
Bruceport
Bone River
Natural Area
Preserve
Bone River
3D
Map
Bay Center
Niawiakum
River Natural
Area Preserve
Google

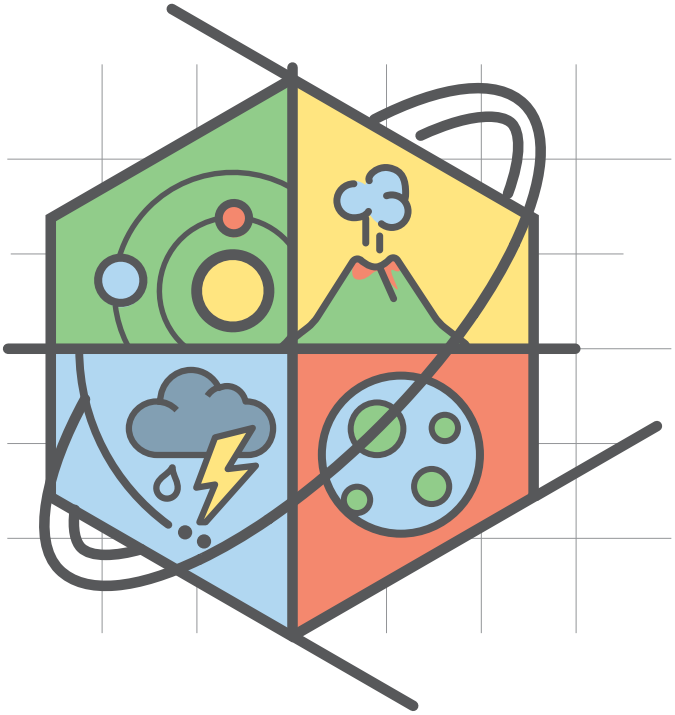
How Lesson 1 Supports Next Generation Science Standards

Earth's Systems: Processes that Shape the Earth

Performance Expectation	**Connections to Classroom Activity,** *Students:*
2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area. 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.	• Research various media using technology to find different places on Earth that water exists. • Research various media to find different forms of water that are existing in Earth's hydrosphere. • Read about frozen water and where it is located on different parts of the Earth. • Create a map of Washaway Beach that includes the location of major bodies of water and specific landmarks.
SCIENCE & ENGINEERING PRACTICES	
Obtaining, Evaluating and Communicating Information Developing and Using Models Asking Questions and Defining Problems Analyze and Interpret Data	• Obtain information from a variety of resources and use this to explain where water is located in different parts of the Earth and the forms that it takes. • Create a model (map) to show the North Cove (Washaway Beach) area and the different bodies of water and land masses that comprise the area. • Ask questions about the problem being faced by the community that lives in Washaway Beach and what the causes and potential solutions for their problem are. • Analyze and interpret data that is presented in graphical form to identify trends in sea level rise. • Analyze pictures of changes in North Cove over a period of time to identify patterns coastal erosion.
DISCIPLINARY CORE IDEAS	
ESS2.C: The Roles of Water in Earth's Surface Processes ESS2.B Plate Tectonics and Large-Scale System Interactions	• Obtain information that water is found in the oceans, rivers, lakes and ponds. • Obtain information that water can be salty or fresh • Obtain information that water can be found in solid or liquid form. • Create a map that resembles North Cove, WA and shows where land and water is located.
CROSSCUTTING CONCEPTS	
Patterns	• Analyze and interpret various forms of data to find patterns in the way the coast is changing in North Cove, WA.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/2Earth%E2%80%99s-systems-processes-shape-Earth



LESSON 2: What is a Beach?

STRATEGY: EXPLORE

In this lesson, students will explore the phenomenon of beach erosion. Through two FOSS investigations where students are experimenting with different materials and connecting to the storyline of Washaway Beach, students will explore how erosion can occur in different ways to change a landscape and affect a community. Students will be exploring different materials, such as rocks, sand, silt, and clay and will connect their investigation with the phenomenon of beach erosion.

STEM

SESSION 1:
So many types of beaches!

Warm-up

Start by asking students: "Have any of you ever been to a beach, whether it's the ocean or a river bank? Think about what that experience was like and share with a partner what you remember about being at the beach or river bank." Have students share their ideas with the whole group.

Main activity

Show students these slides showing different beaches from around the world. At each slide, allow students to share what they see. Have students think about the question: What was different about the beaches and what was the same? Ask them to turn-and-talk to a partner, then ask students to share as a whole group.

Wrap-up

Connect back to the storyline and ask students: "In this unit, we are learning about what erosion is: what type of beach do you think would erode (or wash away) more easily? Have students share their responses. They will further develop their ideas throughout the lesson and are expected to just start thinking about this concept. This might also be an appropriate time to check in with the KLEWS chart and see if students "Learned" anything from this investigation (ex. that there are different types of beaches).

Materials Needed

Teacher slides
KLEWS chart

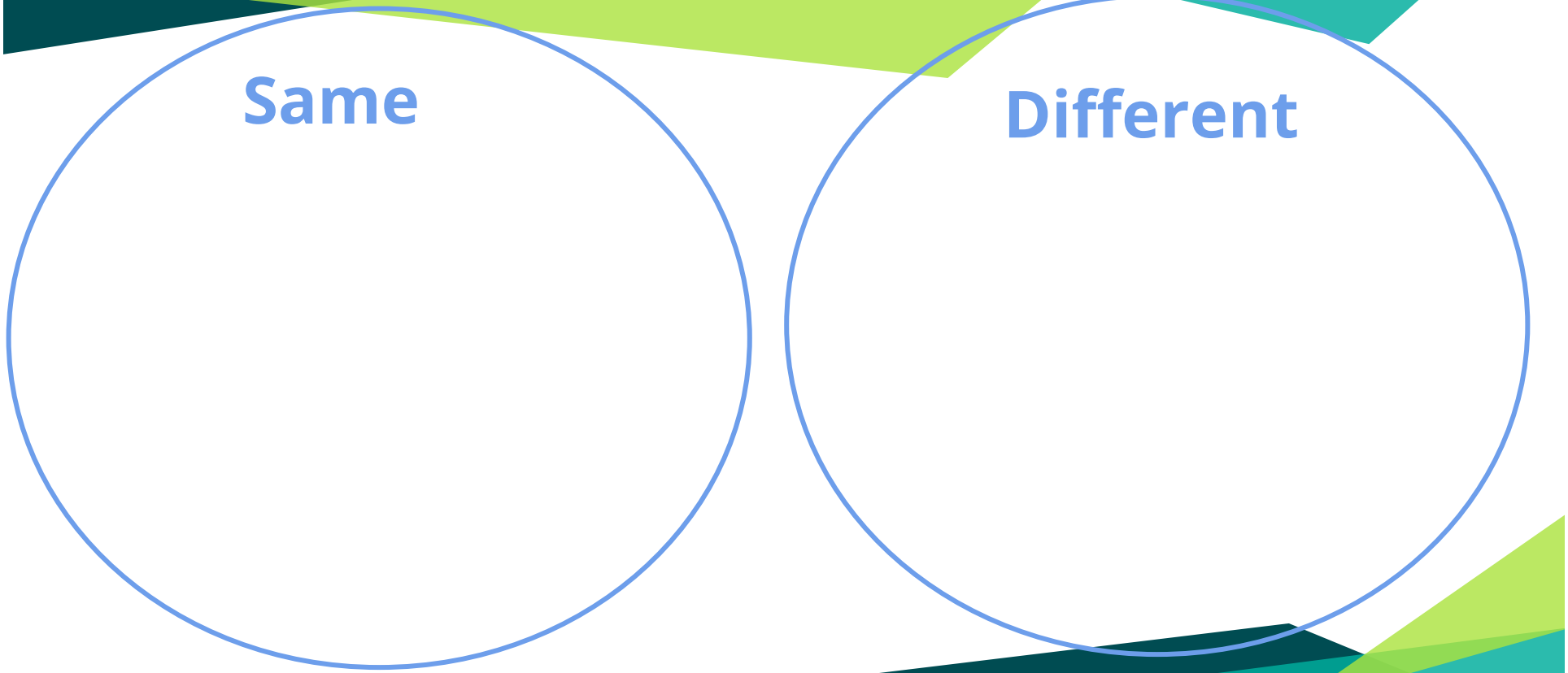
Lesson 2 Session 2 Station Signs

Please print signs for stations. There are signs for 6 stations total.

Station 1

1. Explore the rocks.
2. Talk with your team about how they are same and different.
3. Write some words in the circles to show how they are same and different.
4. Rub them together on white and black paper.
5. Talk about what happens.
6. Add to your same and different chart.

Station 1: Same and Different



Station 2

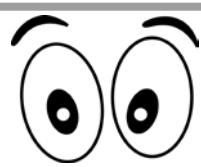
1. Explore the rocks.
2. Talk with your team about how they are same and different.
3. Write some words in the circles to show how they are same and different.
4. Rub them together on white and black paper.
5. Talk about what happens.
6. Add to your same and different chart.

Station 2: Same and Different

Station 3: Washing the Rocks

1. Observe the rock before, write down ideas.
2. Put one rock in water at a time.
3. Observe rock in water.
4. Remove rock and put on paper towel.
5. Observe and write down ideas of wet rock.
6. Repeat with other rocks.

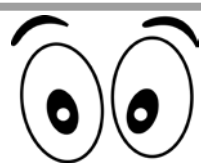
Station 4: Washing Rock Observations

Before washing 	After washing 

Station 4: Washing the Rocks

1. Observe the rock before, write down ideas.
2. Put one rock in water at a time.
3. Observer rock in water.
4. Remove rock and put on paper towel.
5. Observe and write down ideas.
6. Repeat with other rocks.

Station 4: Washing Rock Observations

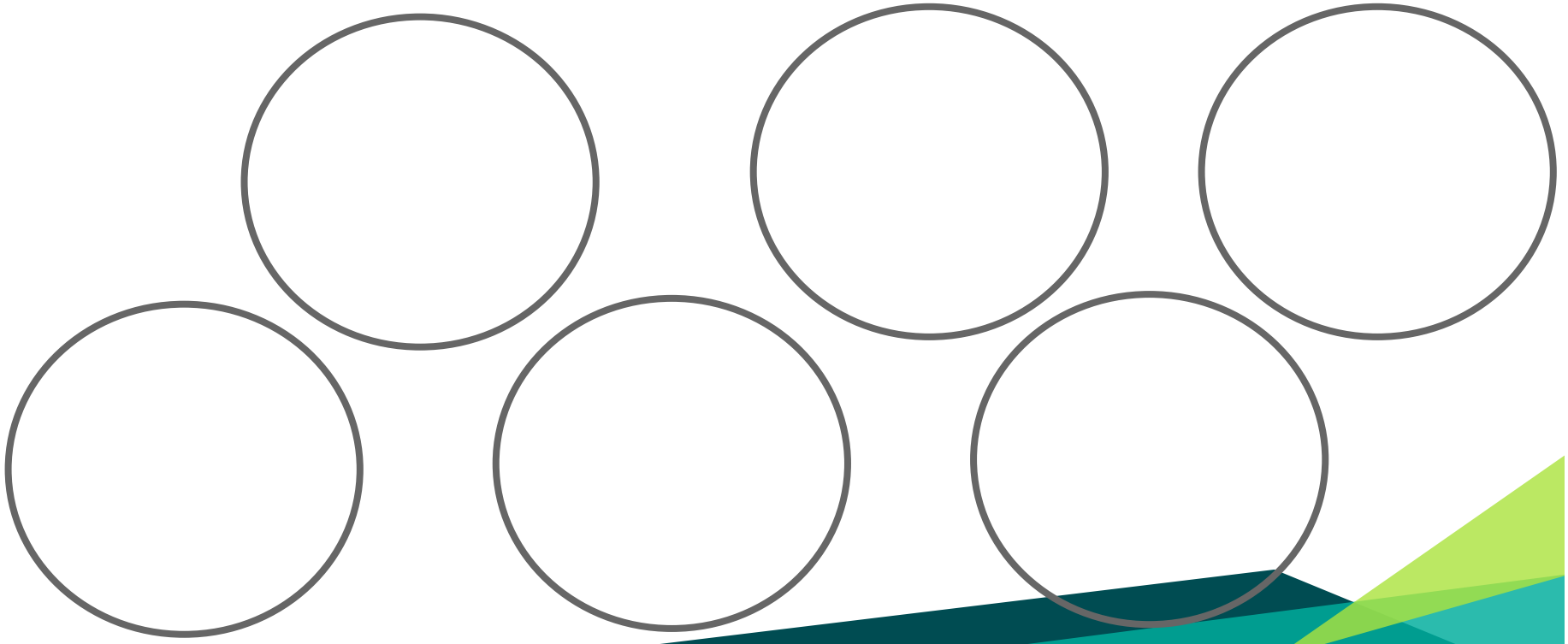
Before washing 	After washing 

Station 5: Rock Sorting!

1. Share the rocks and sort them. Talk to your group about how you want to sort them.
2. Draw a picture of how you sorted.

Station 5: Rock Sorting

This is how we sorted our rocks:

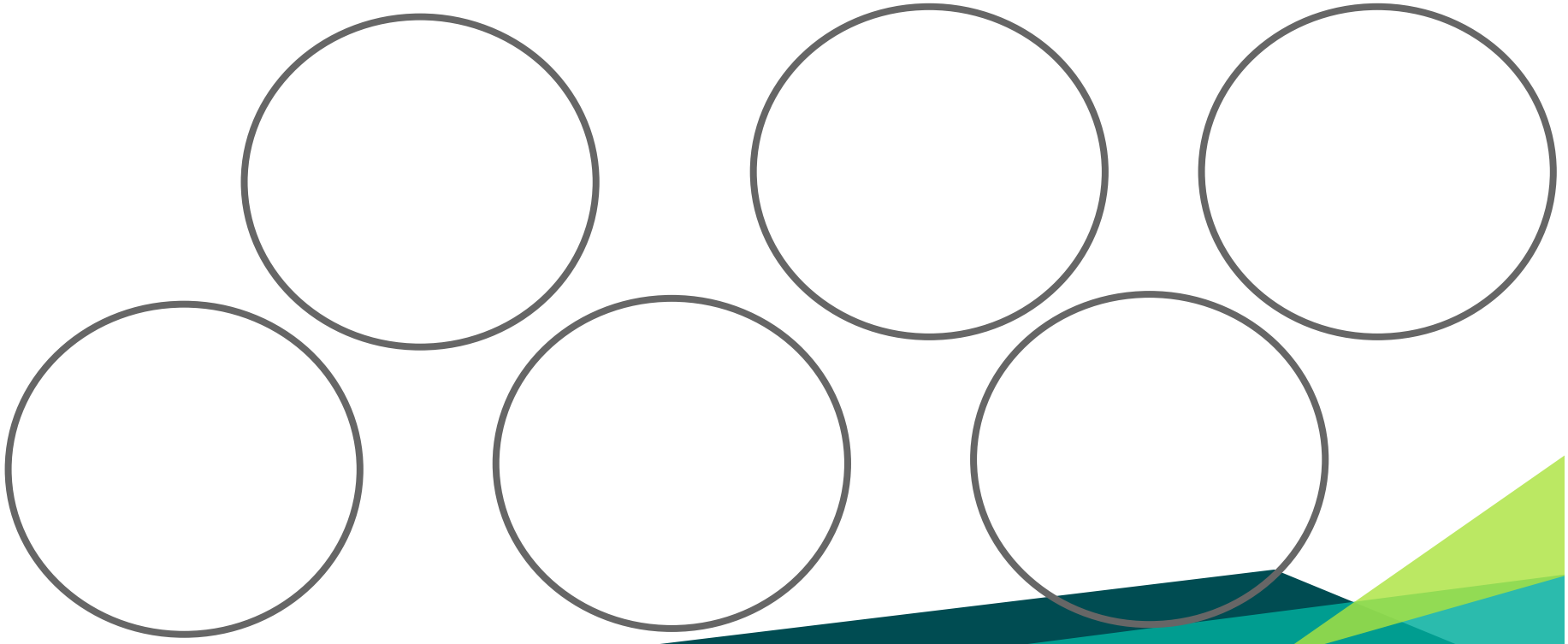


Station 6: Rock Sorting!

1. Share the rocks and sort them. Talk to your group about how you want to sort them.
2. Draw a picture of how you sorted.

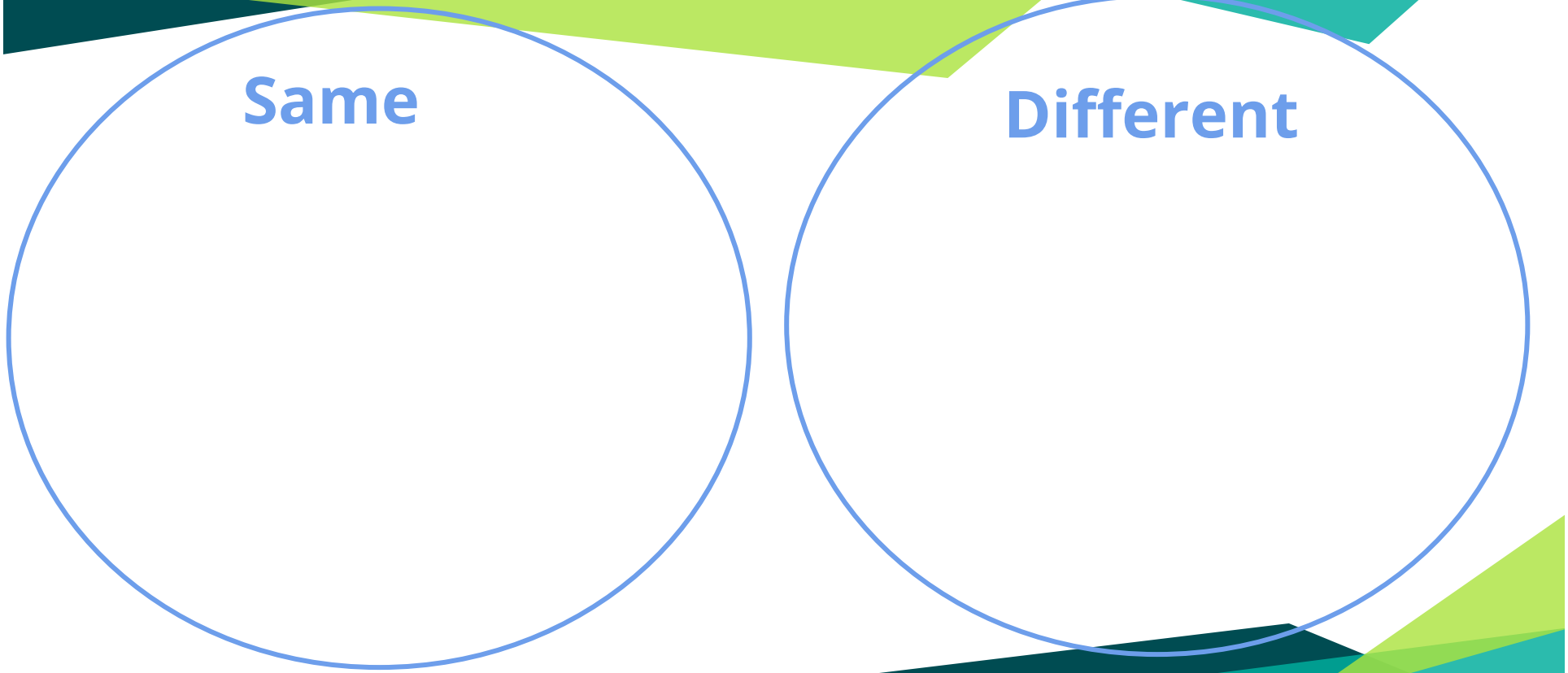
Station 6: Rock Sorting

This is how we sorted our rocks:

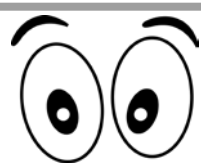


First Rocks Station Worksheets

Station 1: Same and Different

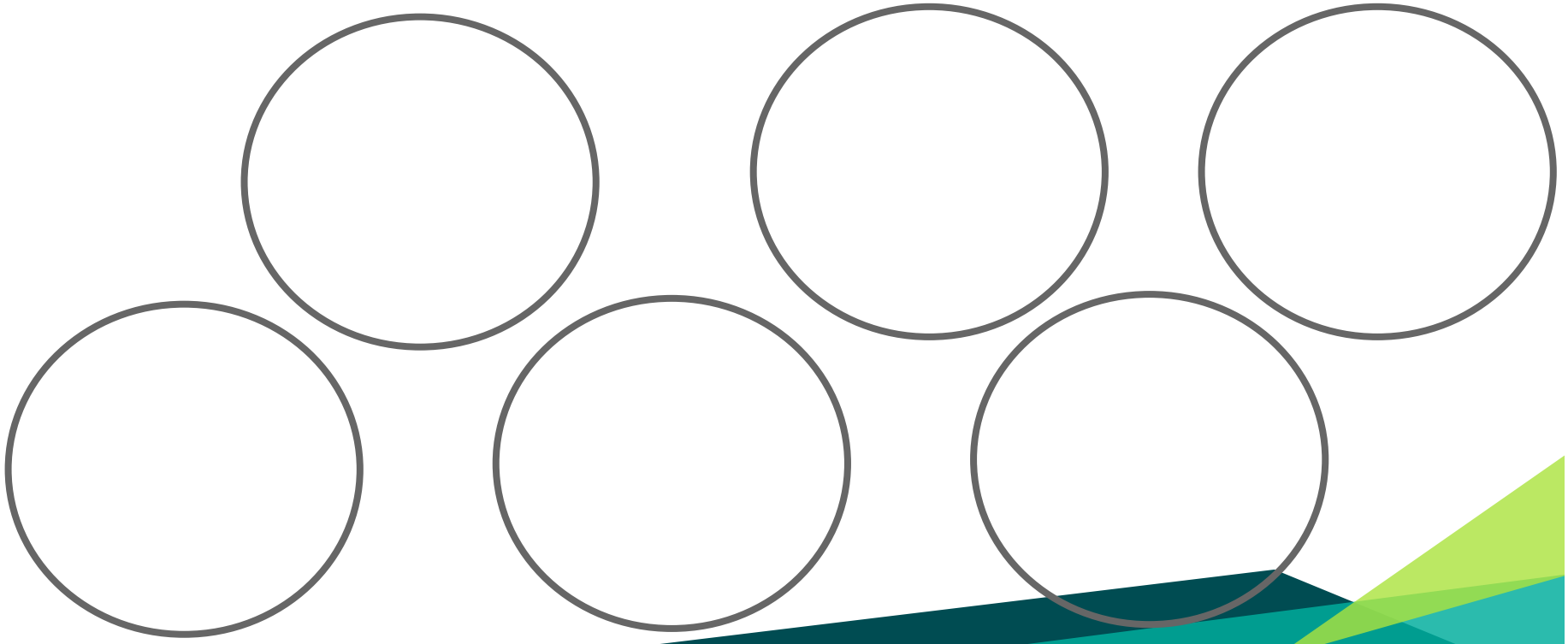


Station 4: Washing Rock Observations

Before washing 	After washing 

Station 5: Rock Sorting

This is how we sorted our rocks:



SESSION 2: FieldSTEM session: Finding erosion outdoors

Warm-up

"I used sidewalk chalk to write my name on the sidewalk at my house, but after it rained my name was gone. Where did it go?" Discuss the idea of "washing away." Model this in the classroom with chalk/sand on a surface, and demo how the sediment moves/washes away with the MOVING water.

Main activity (15 min)

"Let's go on a walk around the schoolyard, looking for evidence of erosion, or movement of stuff caused by water or wind." Lead class around campus, by downspouts and sidewalk gutters, looking for evidence of erosion. "Where did this dirt/soil come from? Where is headed?" Coming from uphill, going downhill. Water travels downhill, and it brings sediment with it sometimes. All of the water that hits our playground will end up in the Pacific Ocean!

Wrap-up (5-10 min)

Discussion back in the classroom about erosion on campus around questions, "What kinds of places do we see erosion happening? (moving water, downhill), "Why do some things move when water washes over them, and not others? (the moving water is strong enough to pick up some smaller things, but not bigger things) "Why might the sandy beach at North Cove be washing away?" Check in with KLEWS chart and catalog students' ideas.

Materials Needed

- Science notebooks to take notes and draw observations
- Chalk
- Outdoor space for walking

SESSION 3:
FOSS Investigation 1: First Rocks

Teacher Note: This is a modified version of Part 1-3 of the "First Rocks" Investigation from the FOSS kit: Pebbles, Sand, and Silt. Since activities are simple, it is suggested that you do Parts 1-3 in the same class session. Students will essentially be comparing, washing and sorting rocks. It is recommended that you skip Parts 4-5 of the Investigation as they do not align strongly to standards or the storyline.

Main activity

Use the FOSS guide in your binder to set up and implement these investigations. It may be helpful to set up stations for each part so students can investigate and rotate to 3 stations. These station signs can be used to give students directions on what to complete at each location. These pages can be printed to have students write their observations individually. Students can also just work in teams to fill out their observation templates per station.

Wrap-up

After students have explored the three stations, connect to the storyline by facilitating a discussion: What did you learn about rocks that can help you understand how rocks on the beach might be affected by water and waves? Show students the pictures of the different beaches from the previous slideshow. Ask students to make a prediction, "In which beach do you think the rocks would be washed away quicker, a beach with small rocks or bigger rocks? Why? Ask students to share their ideas.

Materials Needed

Station Signs

Observation Templates

FOSS Investigation 2: River Rocks, Part 1:

Station 1-2 Materials:

1 set of rocks (Basalt, reddish scoria, and light-colored tuff for each station.

Zip bags

Half-sheet of black paper

Half sheet of white paper

Hand lens

Paper plate

Vial with cap (for rubbed rock dust)

Station 3-4 Materials:

backs of rocks

Plastic cup

Hand lenses

Paper towels*

Basin

Pitcher or soda bottle*

Water*

Station 5-6 Materials:

Set of 20 large pebbles

Zip bag

Hand lenses

Plastic cup

Peter and the Rocks

Basin

Pitcher

Paper towels

Water

**not included in kit*

SESSIONS 4-5:
FOSS Investigation 2: River Rocks, Part 2

Teacher note: This is a modified version of Part 2 of FOSS Investigation 2: River Rocks. It is suggested that you skip FOSS Investigation 2, Part 1: Screening River Rocks. In order to better connect to the storyline and to help add relevance to learning, a small activity to have students study the movement of different sizes of rocks and pebbles in water is suggested before students start separating the rock mixture. Then, the FOSS guide for Part 1 can be followed to guide students through the sorting of rocks (not necessary for hitting standards).

Warm-up

Ask students, what is the problem that the people living near Washaway Beach are facing? Why is it a problem? What is happening to all the sand? What pattern has been seen in the way the coast is changing? Why do you think this is happening to the coast?

Main activity

1. Pre-FOSS tinkering. Prepare the rock mixture using sand, gravel, small pebbles and large pebbles. Instead of having students start FOSS to sort the mixture, provide students with the mixture and a pitcher filled with water. Ask students: "we will be investigating how the different particles (pieces) you see move differently when water is added. We are trying to see how different rocks might act differently at the beach when waves are crashing."

2. Allow groups to add water to the mixture and ask students to look carefully at the particles. What do they notice? How did the small rocks move when the water was added? How did the large rocks move when the water was added? Allow students to share their ideas first with their team and then as a class. Create an "observations chart" where you write down students' noticings. These observations can be added to the KLEWS chart at the end of the lesson, since this is "Evidence" that the students have found that will help them in designing a solution for their problem.

3. Add enough water so that the level is a few centimeters above the level of the rock mixture. Either as a teacher demo or with supervision, allow students to shake the tub, or to create small waves by moving the tub up-and-down to see how the particles move differently based on size. What do students observe? Write observations on the observations chart.

Wrap-up

Connect with the KLEWS chart and ask students: What did you observe about the way that the different size rocks or sand were moving when they were in the water and we shook them? Add students observations to the "Evidence" column of the KLEWS chart. Students ideas can also be added to the "Learned" column of the chart. How do you think a rocky beach will be affected by water than a beach that is made of sand?

Materials Needed

KLEWS chart

FOSS Investigation 2: River Rocks, Part 2:

Vial of sand with cap
Paper plate
Plastic spoon
Hand lens
Sticky note
Unwashed sand
Powdered clay
Plastic cup
¼ L containers
Basin
Bottle brush
Pitcher or 2-L soda bottle
Water
Paper towels
Transparent tape

SESSION 6:
Sand castles and erosion (OPTIONAL)

Warm-up

Ask students if they have ever built a sand castle. (some may have and some might not have). What do they remember about that experience? Tell students that today we will be building small sand castles and will see what happens when they encounter water (like you would at a beach or a riverbank).

Main activity

Have students use some sand to build a sand castle in the bins. Provide them with some water so they can create a mixture to build a small structure. 2-4 students can build small structures in each bin. Once students have built their mini sand castles, take a bucket of water and pour slowly into tub. The teacher might want to model this activity first so the students are prepared for what will happen (the sand castle being destroyed may make some 2nd graders very sad). Pour enough water and pour slowly so that students can see the process of their sand castle breaking apart.

Wrap-up

Ask students, what happened to your sand castles? Can you use the word erosion or eroded to describe what happened? Allow students the opportunity to share with a partner before sharing with the whole group. Formative assessment opportunity: have students draw a picture of their sand castle and to use the word erosion to describe what happened to it. This template with sentence frames can be used as a scaffold for students.

Materials Needed

- Basins
- Sand
- Water
- Water pitcher

Sand Castles and Erosion

Drawing of what happened to my sand castle

Erosion is when _____

_____.

I can say that my sand castle eroded because _____

_____

_____.

SESSION 7:
FOSS Investigation 2, Part 4: Exploring Clay

Warm-up

Ask students, so far, we've explored sand, gravel, and silt. Do you think there is anything that has even smaller particles than silt?

Main activity

Use FOSS guide pages 24-29 to guide students through an investigation where they explore the properties of clay.

Wrap-up

After the FOSS investigation is complete, facilitate a discussion by asking the following questions:

- How was the clay different from the gravel, sand or silt?
- How was the clay similar?
- What do you think would happen to a beach if it were made out of clay?
- Is clay a material you would consider to help the Washaway Beach community?

Bring students back to the KLEWS chart. Ask, did we find any evidence that will help us in creating a solution for people of Washaway beach? What did we find out about clay and how it might erode if a beach is made of it?

Materials Needed

FOSS Investigation 2: River Rocks, Part 4:

Cube of clay
Vial with cap
Sticky notes
Basin
Bottle brush
Pitcher or 2-L Soda bottle
Sponges
Paper towels
Water
Knife

SESSION 8:
Earth's materials and erosion

Learning target

Students can construct an argument for which Earth materials were more resistant to erosion by water.

Materials Needed

- KLEWS chart
- Sentence frames written on board

Warm-up

Start at the KLEWS chart and have students look at all the data that was collected. How did the rocks and pebbles behave when interacting with water? Which materials were more easily moved by the water? Which materials were harder to move?

Main activity

Have students work in teams to come up with an argument about which materials were more resistant to being moved by the water. Students can use this sentence frame to construct their argument:

- The _____ were hardest for the water to move. We think this happened because_____. The _____ was the easiest for the water to move. We think this happened because_____.
- Example: The big rocks were hardest for the water to move. We think this happened because the big rocks were heavier and were harder to move. The clay was the easiest for the water to move. We think this happened because the clay melted in the water too easily.

Wrap-up

Ask each group to share their sentences. Ask students if it seems like there is some kind of a consensus amongst the arguments that students wrote. Are there things we learned that we can agree on? The ideas that the class has in common can be added to the KLEWS chart under the what we "Learned" column.

How Lesson 2 Supports Next Generation Science Standards

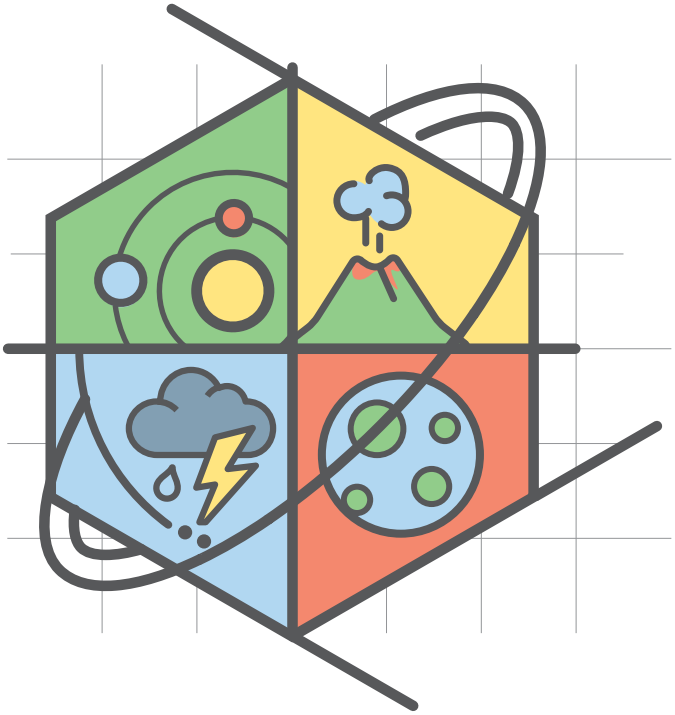
Earth's Systems: Processes that Shape the Earth

Performance Expectation	**Connections to Classroom Activity,** *Students:*
2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	• Students investigate different Earth materials and construct explanations for how different Earth materials are affected by the flow of water. • Students connect back to the storyline problem: How can we design a solution to protect Washington's Coast from erosion?
SCIENCE & ENGINEERING PRACTICES	
Constructing Explanations and Designing Solutions Planning and Carrying our investigations Engaging in Argument from Evidence	• Plan and conduct investigations to collect evidence for how different Earth materials are affected by erosion by water. • Collect evidence that helps them answer their driving question: How can we design a solution to protect Washington's Coast from erosion? • Construct explanations for which Earth material was the most resistant to being flown away by water. • Construct an argument for which materials were more easily moved by the water vs which materials were more resistant to being moved.
DISCIPLINARY CORE IDEAS	
ESS2.A: Earth Materials and Systems. Wind and Water can change the shape of the land. ETS1.C: Optimizing the Design Solution. Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	• Students explore how different Earth materials can be affected by the flow of water and which materials are more easily eroded. • Students begin to plan which materials would be more effective in preventing erosion for the residents of Washaway Beach (North Cove).
CROSSCUTTING CONCEPTS	
Stability and change Patterns Influence of Engineering, Technology, and Science on Society and the Natural World	• Students explore how certain Earth materials are changed when they interact with water. • Students observe patterns in the ways that some materials are more easily moved and some are less easily moved by water. • Students begin to think about their design solution to help the residents of Washaway Beach from having their beach eroded.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/2Earth%E2%80%99s-systems-processes-shape-Earth

LESSON 3: How Does Erosion Happen?



STRATEGY: EXPLAIN

Students will study the science of beach erosion and how it can happen quickly or slowly. Students will use various media (texts, pictures, videos) to distinguish between erosion that is happening rapidly or over a long period of time. Students will be investigating this phenomenon in the context of beach erosion on the eroding Washington Coast.

STEM

SESSION 1:
Erosion over time and making predictions

Warm-up

Show students this image of the erosion of Washaway Beach over the span of several decades. Ask students what the numbers in the corner mean and facilitate a conversation where they can talk about how this image shows how the beach has changed over the span of many many years. What patterns do they see?

Main activity

Have students revisit the maps they created of Washaway Beach in the first lesson. Based on the image of slow erosion that they have observed, how do they predict that the coast will change over the span of several more years? Ask students work in teams and to first use pencil to sketch out a line of how the coast might look in 10 years. It may be helpful to have the image from the warm-up projected on a large screen so students can study the pattern of change and make predictions accordingly. Circulate the class during this time to ask prompting or clarifying questions to groups who are either stuck or making unreasonable predictions (too much or no erosion). Once students are done sketching their prediction in pencil, allow them to go over it in marker/crayon and have them label the line (10 years from now or "projected coastline in year _____).

Wrap-up

Have student groups share their map and their projected coastline. Ask them to share how they came up with their prediction, what strategies did they use to figure out how the coast might look? What patterns have they seen? Check in with the KLEWS chart and ask students what they have learned about the word erosion. What does the work erosion mean?

Materials Needed

- Image of the erosion of Washaway Beach
- Maps from previous lessons

SESSION 2: Other types of erosion that happen very slowly

Warm-up

Ask students to think about erosion at Washaway beach and the maps that they've created to predict what will happen in the future. Is this type of erosion that happened instantly or over a longer period of time? Tell students that we will be looking at some examples of erosion that happens slowly. A Bill Nye video about erosion gives several examples of erosion that happens as a result of wind or water. It can be used to help review the idea of erosion for students.

Main Activity

Show students the images presented in this slides presentation (look at slides for Session 2). Use this Erosion Examples and Evidence worksheet after each video to have students collect their observations and evidence. After each image, have students talk to a partner about how erosion will be happening in this situation. Since the erosion is gradual and won't be directly seen in the image, have students discuss the elements acting to cause the erosion (ex. water flowing or wind). What do they think caused these shapes? Does it seem like it was caused by wind, water or ice? Could it be more than one?

Wrap-up

Check in with the KLEWS chart. What evidence did they collect from the different examples of erosion? Was erosion happening slowly or quickly in these cases?

Materials Needed

- Bill Nye video about erosion
- Erosion Slides Presentation
- Erosion Examples and Evidence worksheet
- KLEWS chart

Slow Erosion Data

Title of image or place	Draw what you see	What was causing the erosion? Circle one
Cape Horn Cliffs in Columbia River Gorge		Wind Water Ice
Delicate Arch in Arches National Park, Utah, United States		Wind Water Ice

Stream next to trees		Wind Water Ice
The Grand Canyon, Arizona		Wind Water Ice

SESSION 3:
Yikes, storm surge!

Warm-up

Use this slides presentation (find slides for Session 3) to show a video of a storm surge in Ocean Park, WA, near Washaway Beach. Ask students to make observations about what is happening. How is this storm surge different from the regular waves that are usually at the beach? How is the water affecting that community? Is the event happening quickly or slowly? What do you think will happen once the waves go back to the ocean? How could this be a problem for people who are walking outside in the area?

Materials Needed

Slides presentation (Slide 9 for session 3)

Main activity

Show students the images on slides 12-14. Ask students to look closely. Has the coastline changed at all after a storm surge? What do students notice? Ask students to partner up and discuss each image with a partner. After students have discussed each image with a partner and you have discussed as a class, present them with the task of constructing an explanation about how the storm surge can affect people and the coast. Ask them to think about the question: Does a storm surge affect people and the shoreline? Yes or No, a storm surge_____affect people and the shoreline. I know this because _____ _____.

Wrap-up

Have students share their responses. Check-in with the KLEWS chart, students ideas can be added to the "evidence" or what we "learned columns." The word storm surge can also be added to the last column for "science concepts."

SESSION 4:
Other fast Earth events

Warm-up

Tell students that today we will be collecting evidence to answer the question: Can Earth's events happen quickly? Ask students if they can think of some event in nature that happens really suddenly. Students can think back about the storm surge video from Ocean park.

Main activity

Use this slides presentation (Slide 19) to show students a series of videos of Earth's events happening rapidly. Note that some of the events may be stressful to watch so gauge student's emotions and facilitate discussion to help students process what they are seeing. Students can use this template to take notes and collect their data from the videos.

Wrap-up

Check-in with the KLEWS chart. What evidence did they find that events can happen fast and cause erosion? Ask students to talk with a partner and describe how erosion occurred in some of these events (they can use the last column of their worksheet to remind themselves about the data they collected). As a class, decide if there is anything that should be added to the "evidence" or "learned" columns of the KLEWS chart.

Materials Needed

Use this slides presentation (Slide 19)

Student handout on fast erosion

KLEWS chart

Fast Erosion Data

	Draw a picture of what you saw	How did erosion happen? Did it happen fast or slow?
Mudslide in forest		
Riverbank erosion in Bangladesh		

Mt Saint Helens eruption and landslide		
Glacier crashing		

SESSION 5:
Constructing an argument about erosion

Warm-up

Present students with the question: "Does erosion happen quickly or slowly?" Ask students to think about the question, first to themselves, and then to turn and talk with a partner. Have students share their ideas with the whole group (students are just sharing ideas, we are not assessing their understanding at this point)? You can make a tally chart for the answer to the question (ex. how many students think erosion happens quickly, slowly, or both quickly and slowly).

Materials Needed
KLEWS chart
Chart paper
Colored stickers

Main activity

Have students continue to work with their partner and to look at the evidence column on the KLEWS chart. Ask students to think about their answer to the question. What evidence in the "evidence" column supports the answer to their question?

Give student teams small colored sticker dots (or other stickers). Have students go up and put a sticker next to at least 2 pieces of evidence that supports their claim (their answer to the question).

Ask each team to share their thinking using the following sentence frames:

Erosion happens (quickly or slowly, or both). The evidence we found to support our claim is _____ and _____. Have students first practice how they will present to their teams and then come up and present their thinking. Emphasize the point that there is evidence that supports the idea that erosion happens slowly and quickly.

After each student team has presented. Facilitate a discussion using the following prompts: Do we agree on the answer to the question: Does erosion happen quickly or slowly? What do we agree about? What do we disagree about? Can we write a claim as a class that we can all agree on? Use a new piece of chart paper and write the question on the top. Have students help you construct a claim that states that erosion can happen quickly and slowly. Write claim on paper under the question. Then list pieces of evidence below. Explain to students that when you make a claim when answering a question, it is important to back up your claim with evidence.

Wrap-up

Check in with the "learned" column of the KLEWS chart and write the class' claim in this column.

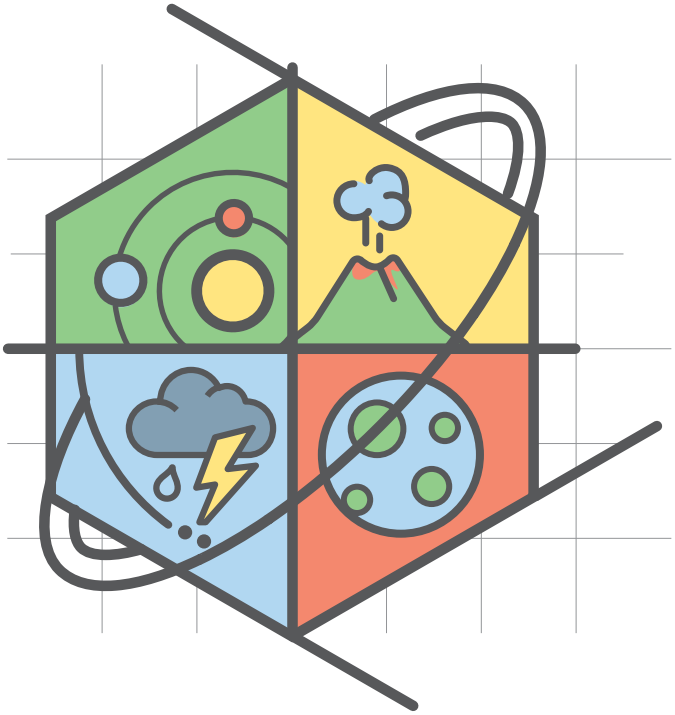
How Lesson 3 Supports Next Generation Science Standards

Earth's Systems: Processes that Shape the Earth

Performance Expectation	Connections to Classroom Activity, *Students:*
2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	• Analyze trends showing the erosion of a coast over time and include this information in their maps in the form of a prediction. • Obtain information from various examples of how erosion can happen slowly over time and cannot be observed. • Explain how storm surges affect people and the coastline. • Obtain information to describe how Earth's events can occur quickly.
SCIENCE & ENGINEERING PRACTICES	
Constructing Explanations Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information Analyzing and Interpreting Data Using Mathematics and Computational Thinking	• Engage in an argument based on evidence to argue if erosion happens quickly, slowly, or both. • Analyze and interpret data from various images, videos and graphs to obtain evidence about how erosion can happen both slowly and quickly. • Use computational thinking and mathematics to make comparisons of how the coastline has reduced over the span of years and after catastrophic events.
DISCIPLINARY CORE IDEAS	
ESS1.C: The History of Planet Earth Some events happen very quickly, others occur very slowly over a time period much longer than one can observe.	• Study various examples of earth's events happening slowly or fast. • Write down and draw observations that describe evidence for how earth's events are happening.
CROSSCUTTING CONCEPTS	
Stability and change Patterns	• Make observations of change caused by earth's rapid or slow events • Find patterns that show earth's events happening slowly or quickly. • Make predictions based on patterns identified.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/2Earth%E2%80%99s-systems-processes-shape-Earth



LESSON 4: Designing a Blockade!

STRATEGY: ELABORATE

Students will explore different design solutions that have been used to prevent or reduce the impacts of beach erosion. Through a series of hands-on investigations, students will explore different materials and investigate their abilities to resist erosion. Students will begin to construct an argument for which material they would like to use to create dikes to help the Washaway Beach community in fighting erosion. Please see the outline below to clarify modifications from the original FOSS sequence.

FOSS ADAPTION GUIDE	
FOSS Investigation 3 Part 1: Rocks in Use	**SKIP** and follow Session 1 guide instead.
FOSS investigation 3 Part 2: Looking at Sandpaper	**SKIP**, does not align with storyline.
FOSS Investigation 3 Part 3: Sand Sculptures	Look at Session 2-3 notes for modified version that connects with storyline
FOSS Investigation 3 Part 4: Clay Beads	**SKIP**, does not align with storyline.
FOSS investigation 3 Part 5: Making Bricks	Use materials and procedure for modified version described in Session 3
FOSS Investigation 4 Part 1: homemade soil	Implement as shown in FOSS guide with connections to storyline (session 4)
FOSS investigation 4 Part 2: Soil Search	Look at session 5 for a modified version that connects with the storyline.
FOSS Investigation 4 Part 3: Studying Local Soil	**SKIP**, does not align with storyline.

SESSION 1:
Structures that prevent erosion

Warm-up

Start by showing this slides presentation and reconnecting students to the driving question of the unit: How can we design a solution to protect Washington's Coast from erosion? Ask students to think about the problem at Washaway beach and why it is so serious.

Materials Needed

- Slides presentation
- KLEWS chart

Main activity

Show students different structures that people have built in order to prevent erosion of the coast. After each image, ask students these questions: What do you think the structure is made of? How might this structure help the beach from washing away? Have students turn-and-talk and then share their ideas after each image. Tell students that each team will be designing their own structure to help the people who live near Washaway Beach. In this lesson, we will be exploring some different materials and will be seeing if they can help us to design a solution for the inhabitants of North cove.

Wrap-up

Ask students to think about the different images they saw of structures that people have built to prevent erosion. Is there anything from the pictures that can be used to answer the driving question? Is there any evidence they saw? (ex. people use things like rocks and soil to build structures to help prevent erosion).

SESSIONS 2-3: FOSS Investigation 3

(Part 3: Sand Sculptures)

Please follow FOSS guide for directions on how to prepare the sand matrix. This session might work better as 2 short sessions versus one long session. Note: the teacher will need to make the "sand matrix" by mixing cornstarch with water in a saucepan before the session (the mixture will stay usable for a week in the refrigerator). Students will not be making sand sculptures, but will be using the sand mixture to create a structure that could potentially block water (a prototype for residents of Washaway Beach).

Warm-up

Tell students that today we will be exploring how a sand mixture can be used to make a structure that could prevent erosion.

Main activity

Have students work in groups of 2-4.

Day 1:

1. Follow the FOSS protocol to have students mix the sand and the sand matrix in their Plastic plates.
2. Ask students if they can use this material to make some kind of a structure in the center of the plate that could prevent water from moving completely from one side of the plate to another. Tell students that we will wait for the structure to dry before testing it.
3. Have students draw a simple sketch of their dikes in their observation template.

Wait at least two days for students' structures to dry.

Day 2 (at least two days later):

1. After structures have dried, have students take half a cup of water and ask them to pour water on one side of the structure. Ask them to talk with their group about what happened. Have each student draw a diagram of what happened in their templates. Ask students to use arrows to show how the water moved and what happened to the dike after.
2. Clean out the trays for later use.

Wrap-up

Have each group share what happened to their dike after water was poured using their drawings. Check-in with the KLEWS chart. Did we find any evidence about how the sand mixture was, or was not helpful in preventing the water from flowing? Write students findings in the "E" or "Evidence" column of the KLEWS chart.

Materials Needed

FOSS Investigation 3: Sand Sculptures, Part 3:

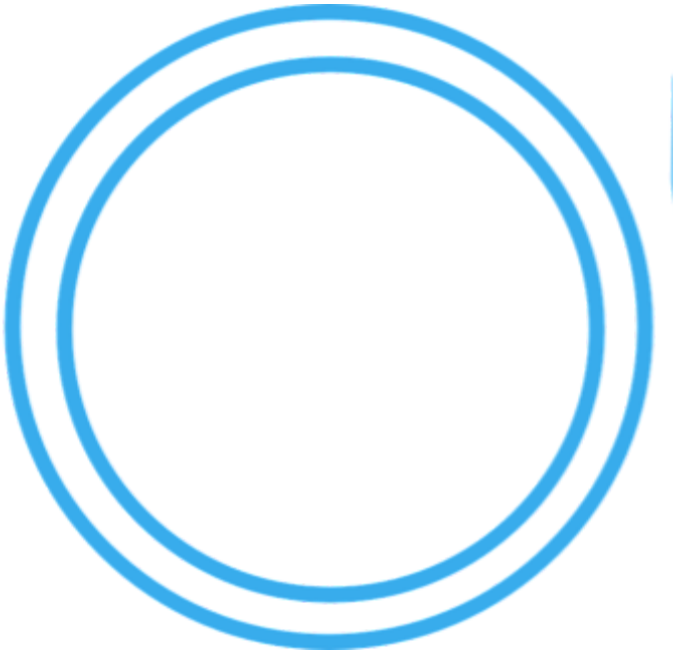
- Plastic plates
- Pencils
- Basins
- Vials
- Metal spoon
- Whisk broom and dustpan
- Clean sand (3 lbs)
- Sand Matrix (follow directions to mix cornstarch with water in a saucepan)
- Zip bags
- White glue

- KLEWS chart
- Observation template

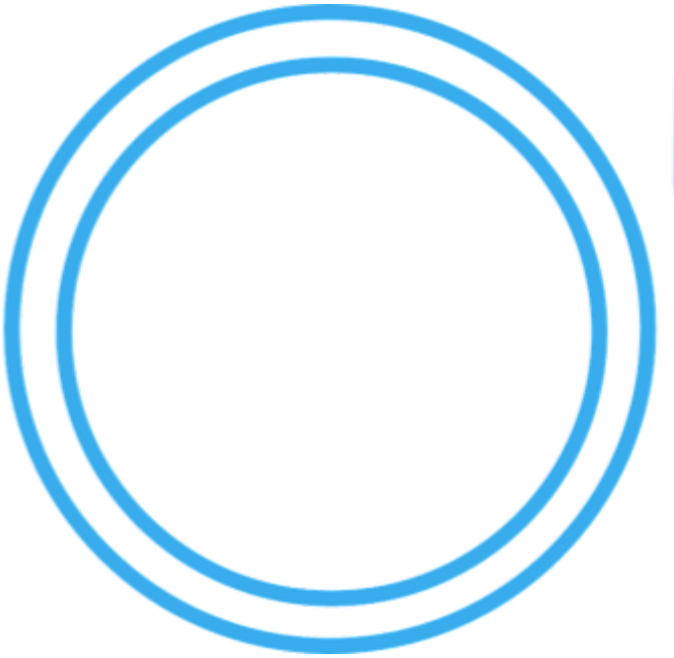
Observations of Sand Structures

Name_____

Our structure before:



Our structure after:



SESSION 4: FOSS Investigation 3

(Part 5: Making Bricks) OPTIONAL

Note: This investigation will require additional materials not included in the kit (look to the right). Also, in order for students "bricks" to properly bake, you will need to identify a warm-dry location (easiest found in late spring, summer, or early Fall). Look at pages 24-26 in the FOSS guide for directions on how to set up for the investigation.

Warm-up

Tell students that today we will continue to investigate materials that we could use to build our solution for the people of Washaway Beach. Ask students to recap how the sand barriers worked in the previous investigation: Did they work or not?

Main activity

1. Guide students through the directions on how to make the brick mixture (mixing the clay soil with grass/straw).
2. Instead of using a large brick mold as shown in the FOSS guide, use a small mold like an ice-cube tray for students to create little bricks that they will then use to build a mini structure. Ask students not to fill all the way up to the top (flatter mini-bricks) will be easier to build with.
3. After bricks have dried for a few days, dump them out of their molds.

Wrap-up

Recap with students, what materials were the bricks made of. Do they predict that the bricks will be effective in stopping water or not? Allow students to share their predictions.

Materials Needed

FOSS Investigation 3: Making Bricks, Part 5:

1 ice cube tray per group (as block-like as possible).*

Dry grass or weeds (teacher collects)*

Clay soil (teacher collects from outdoors)*

Basins

Plastic cups

Plastic grocery bag or bucket*

Shovel*

Pitcher*

Water*

Paper towel*

Bucket*

**not included in kit*

SESSIONS 5-6:
Making brick barriers (OPTIONAL)

Before starting this session, make more of the sand-matrix material in case students want to make a sand paste to join their bricks together.

Materials Needed

- Students bricks
- Metal pans
- Water in cup

Warm-up

Tell students that today we will continue to investigate materials that we could use to build our solution for the people of Washaway Beach. Ask students to recap how the sand barriers worked in the previous investigation: Did they work or not?

Main activity

Day 1:

1. Make sure students have their materials and are clear on directions.
2. Allow students to work with their teams to build their structures. Students will probably not have enough bricks to stack on top of one another, but they should have enough to build a barrier separating one part of the plate from another. Give students the option of using the sand matrix mixture to fill in the gaps between their bricks.
3. Have students draw a simple sketch of their dikes using this template.
4. Since many students may have used the sand mixture, allow 2 days for the mixture to dry completely before testing the barriers.

Day 2:

1. After structures have dried, have students take half a cup of water and ask them to pour water on one side of the structure. Ask them to talk with their group about what happened. Have each student draw a diagram of what happened in their templates. Ask students to use arrows to show how the water moved and what happened to the dike after.
2. Clean out the trays for later use.
3. Ask students, how did this structure stop the water (or not) differently from the sand structure? Have students discuss in groups and then bring the group together to discuss.

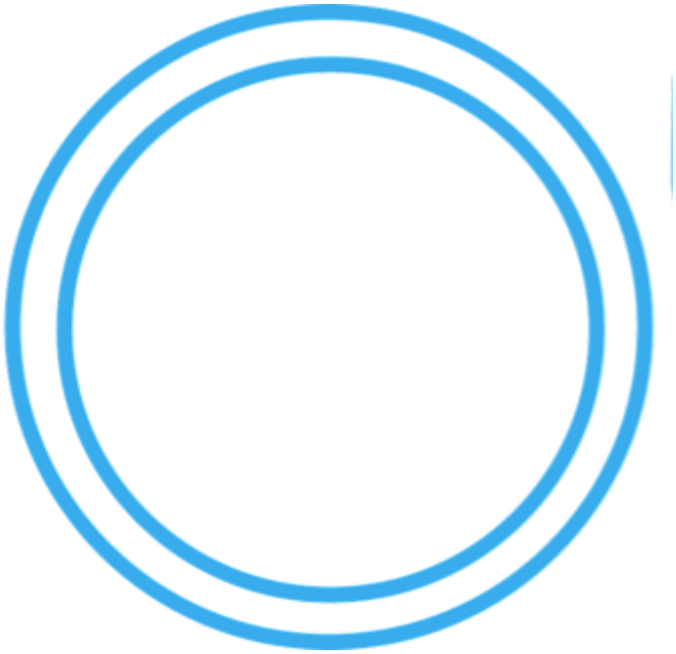
Wrap-up

Ask students to think about which structure was more effective in preventing the water from getting to one side? Which material would be better for to stop beach erosion? Why do they think this material would be better? Check-in with the KLEWS chart, what additional evidence did students find in their investigations? What did they learn? Add to the "L" and "E" columns.

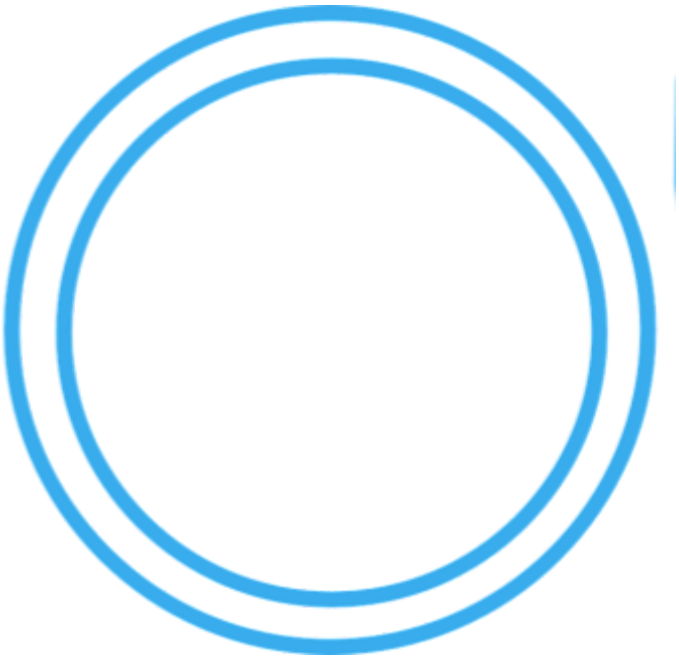
Observations of BrickStructures

Name_____

Our structure before:



Our structure after:



SESSION 7: FOSS Investigation 4: Homemade Soil

Warm-up

Connect back to the storyline and the theme for this lesson. Tell students that for the next few sessions, we will be exploring soil and if it is a good material for our barricades.

Main activity

1. Have students work in groups of 2-4. Follow FOSS guide for this investigation and stop at STEP 6: Introduce Soil.
2. Instead of finishing the investigation, redirect student's attention to the storyline. Have students build some kind of a line or barrier separating one part of the tin plate from another. Soil is not very moldable so the barrier may be loosely structured.
3. Have students pour some water on one side of the barrier. What happened? Did the soil stop the water from getting to the other side? Was the soil washed away?

Wrap-up

Have students think about the medium of soil. Would soil by itself be a good material for people in Washaway Beach to use to prevent erosion? Have students share with a partner and then share as a whole group. Check-in with the KLEWS chart to add details to the "K," "L," or "E" columns.

Materials Needed

FOSS Investigation 4: Homemade Soil:

- Basin
- Spoon
- Potting soil
- Plastic cups
- Paper towels
- Sand
- Gravel
- Small pebbles

SESSION 8: FieldSTEM walk: What type of soil is present in our schoolyard and what is growing in it?

Warm-up

"We've seen that some types of material wash away in water easily, and some materials don't wash away so easily. What's an example of a type that washes away easily? (clay) Not so easily? (rocks). We saw some evidence of erosion in our schoolyard; does our schoolyard wash away in a hard rain? (no). I wonder what kind of soil we have in our school yard."

Main activity

Take students out to an area of the school yard where you can dig up a couple shovels full of soil (ask your facilities crew for a good spot, explaining that you will replace the disturbed soil when you finish). Dig up some soil, and ask students to each get a handful of it, and squeeze it in their one hand to make a ball. When they open their hands, share observations – does it stick together, does it fall apart, does it stick together briefly or until poked and then fall apart? This is a test called "the squeeze test", and it can tell us what kind of soil we have. If it holds its shape, it's called loam. If it holds its shape but then falls apart when you poke it, it's clay. If it falls apart as soon as you open your hand, you have sandy soil. Optional: Fill the hole you dug with water, and observe how long it takes the water to drain/percolate into the ground. Ask students to predict if water would drain faster or slower in a hole dug on a sandy beach. Ask students to put their handful of soil back in the hole, to restore the landscape for the plants and animals that use it as a habitat.

Wrap-up

"Do you think some plants like one kind of soil over another?" Share that some plants grow better in soil that drains quickly, like desert plants. Other plants, like most trees and grasses, grow better in soil that 'holds onto water', like loam or clay. Add new understandings about soil to KLEWS chart.

Materials Needed

- Schoolyard (where you are ok digging)
- A shovel
- A bucket of water
- KLEWS chart

SESSION 9:
How can plants help prevent erosion?

Warm-up

Connect to the Field STEM Experience students just had when they went outside for a walk. Ask them to recap: Why doesn't all the soil in our yard or in the forest just wash away when it rains? How do plants help the dirt/sand in an area from washing away? Allow students to share ideas.

Materials Needed

Slides presentation

Main activity

Show students the video in the slides presentation. Pause after each container and let students talk about why the water runoff was different for each container. Why was the water coming out of the container with the plants the most clear? How did the roots help the soil from washing away? Show students images of vegetation being used as a solution to prevent erosion.

Wrap-up

Bring students together to check-in with the KLEWS chart. Ask students, what did we learn about how plants might prevent erosion? Do you think this is helpful information when we are trying to help the people of Washaway beach in solving their problem of beach erosion? Allow students to share their responses and write ideas in the "Learned" or "Evidence" columns. Remember that evidence is what students directly saw (in an investigation, video, or picture), and what students "learned" is students' interpretation of this evidence and how it relates with the question they are trying to answer.

How Lesson 4 Supports Next Generation Science Standards

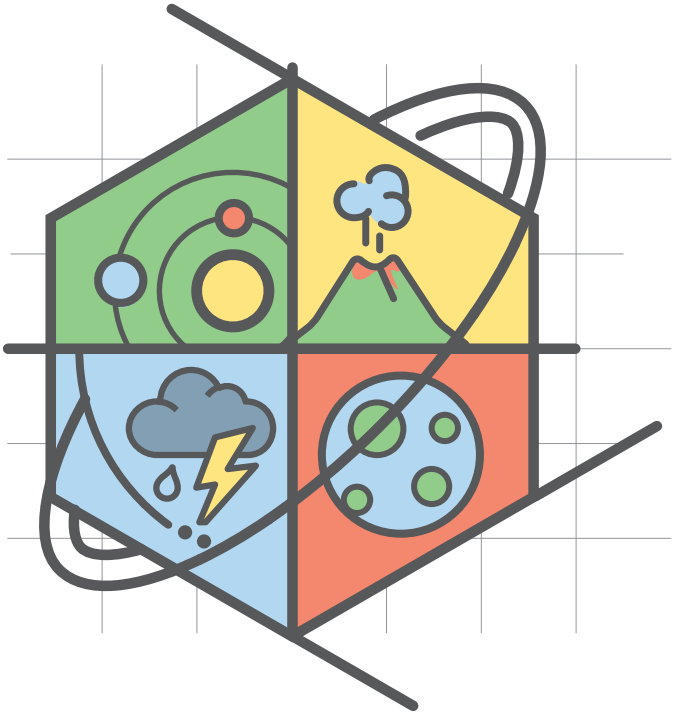
Earth's Systems: Processes that Shape the Earth

Performance Expectation	Connections to Classroom Activity, *Students:*
2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	• Study various design structures that have been built to prevent erosion of beaches and river banks. • Conduct an investigation with a sand mixture and bricks to see which is more effective in stopping the flow of water. • Connect design solutions to the problem of Washaway Beach.
SCIENCE & ENGINEERING PRACTICES	
Constructing Explanations and Designing Solutions Asking Questions and Defining Problems Constructing Explanations Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	• Obtain information through images to analyze how people have prevented erosion on the coast and what materials they have used to achieve this. • Construct an explanation for how their barrier (sand or brick) is affected by water. • Construct an argument for whether their structure is effective in barricading water and preventing erosion. • Ask questions about the effectiveness of one material vs another in preventing erosion.
DISCIPLINARY CORE IDEAS	
ESS2.A: Earth Materials and Systems. ETS1.C: Optimizing the Design Solution	• Expand their understanding of how water causes change through the process of erosion. • Compare how different materials can be used to resist erosion. • Create models to show how their different structures were affected by water.
CROSSCUTTING CONCEPTS	
Stability and Change Influence of Engineering, Technology, and Science on Society and the Natural World Science Addresses Questions About the Natural and Material World	• Explain how one material was more stable (and therefore, better) at preventing change in the structures. • Study several design solutions (jetties, breakwaters, and planting vegetation) and how they prevent the changing coastline.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/2Earth%E2%80%99s-systems-processes-shape-Earth

LESSON 5: Saving Washaway Beach



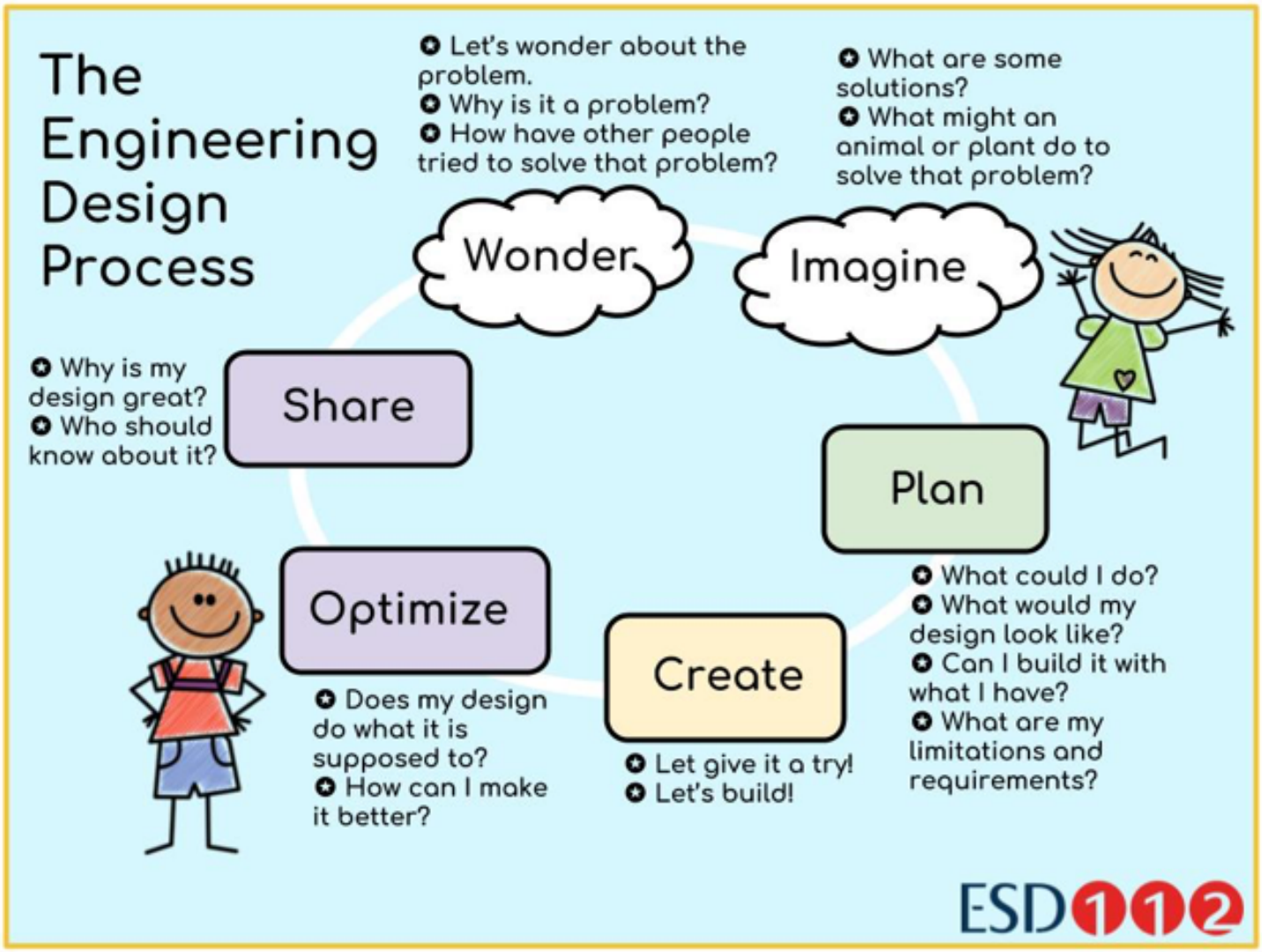
STRATEGY: EVALUATE

Students will engage in the engineering design process to create a plan for their dike to help the Washaway Beach Community. Students' designs will be backed up with an argument explaining why they materials they used will help prevent against rapid and slow erosion. This version of the engineering design process is created for students in primary grades and it will guide them through the thinking and planning that is necessary to effectively solve a problem!

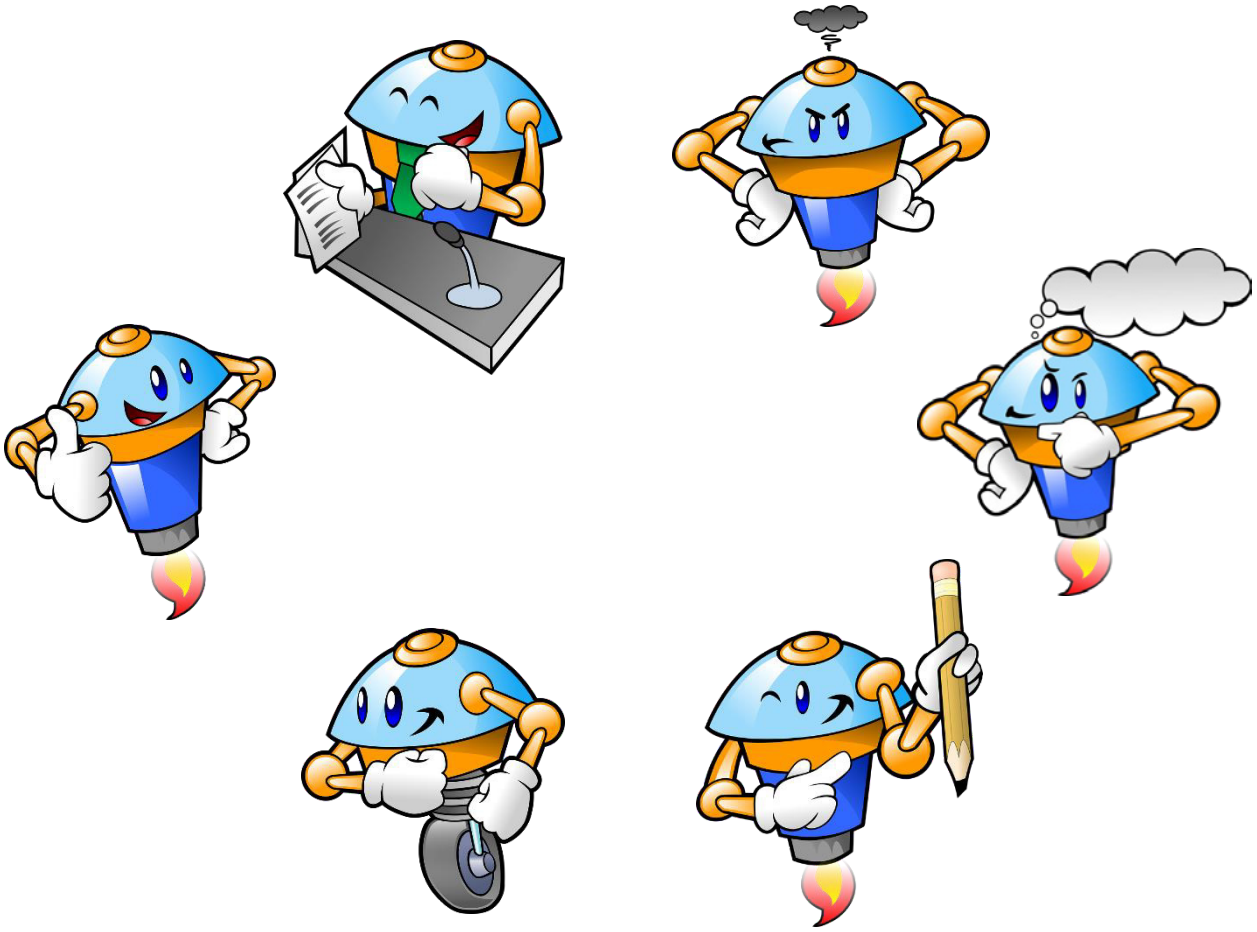
STEM

THE ENGINEERING DESIGN PROCESS:
Engineering design mini-project

The next several sessions will engage students in an age-appropriate engineering design project. This engineering design process has been articulated to help primary students understand different parts of the process. This Engineering Design Project Template can be used as a place for students to plan and log their ideas. An editable version can be found here.



Engineering Design Project



Name:_____

STEP 1: WONDER

What is the problem?

Use words or pictures to draw the problem you are trying to solve.

STEP 2: IMAGINE

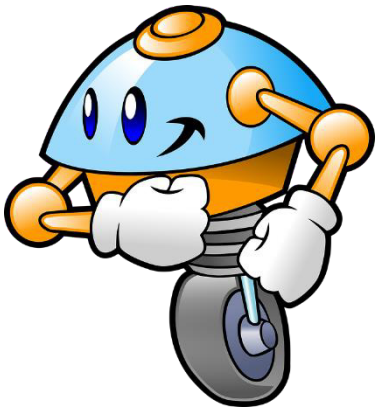
What are some solution ideas?

STEP 3: PLAN a prototype

Draw what your solution looks like. What materials will you use?

STEP 4: CREATE a prototype

Build!



STEP 5: OPTIMIZE your solution

Does your design work? How can you make it better?

STEP 6: Share

Share why your design is great! Who should know about it?

SESSION 1:
Wondering about the problem

Warm-up

Use this slides presentation to re-introduce the problem of coastal erosion at Washaway Beach. Ask students to describe to their partners what is happening to the coastline and then share ideas as a group. Have a students to take a look at the KLEWS chart where they have been tracking their learning throughout the unit.

Main activity

Ask students to draw a picture about why the coastal erosion is a problem in their community. You can show students the slides of the devastated community if they are having trouble remembering how the problem is affecting the community in very tangible ways.

Wrap-up

After students have drawn their sketches of the problem, have them share with a group of 3-4 students.

Materials Needed

- Slides presentation
- Engineering design template

SESSION 2:
Imagining the solution

Warm-up

Look at the KLEWS chart again and ask students to remember: what materials have we investigated in this unit? What materials were not so affected by the water? What materials flowed away really easily? What materials were harder for the water to move?

Main activity

Ask students, what could a solution to the beach erosion look like? How could you possibly create the most awesome dike that will save the beach for the people of North Cove? What are some things people have already done to try and prevent the damage? Ask students to draw a sketch of different solution ideas and how they might look. No idea is too crazy at this point in the process. Have students work individually on this step, they will be collaborating on design plans in the next session.

Wrap-up

After students have drawn their sketches of the imagined solution, have them share with a group of 3-4 students.

Materials Needed

Slides presentation

Engineering design template

SESSION 3:
Planning the solution

Warm-up

Tell students that today they will be taking their imagined solutions and put them together into a plan for a solution for people of North Cove.

Main activity

Have students work in groups of 2-3 to create a plan that uses at least one part of each person's imagined ideas. Ex. if there are 3 people in the group, the plan should have one idea from each team member. Talk to students about the terms **criteria** and **constraints**. Criteria are specifications and requirements for what the device should be able to do. How do we know it was successful? Constraints are limitations or rules—in this activity, constraints could be the materials that students have to use and how small their models will be compared to the real beach. Have students work together to draw their solution on a large piece of chart paper. Students can also sketch their drawings in their template packets and then transfer their ideas to the chart paper. Ask students to use at least a few words to describe what materials are being used in each part of the design. Students will come back to their charts during the "Optimize and Explain" session to add details and refine.

Wrap-up

Have each team share their design with another group to get feedback. What is something they were unsure about and could use help with? Ask teams to take turns sharing their ideas and getting feedback. After about 5 minutes, ask teams to switch roles. The Charrette Protocol is one possible way for you to facilitate a session where students ask for and provide feedback to their peers.

Materials Needed

Engineering design template

Chart paper

Markers, crayons, colored pencils

Charrette Protocol

What is it? The Charrette Protocol is used by engineers and other STEM professionals to get meaningful feedback from their colleagues regarding work that is in progress. The point of the Charrette is to use collaboration to optimize a specific piece of work. Each team decides where they need feedback, which gives them control over the feedback process.

Directions to charrette:

1. Ask students to work with their team to identify one area of need in their design that they need help with. Where were you struggling and what could you still use help with?
2. Pair up student teams. Try to be intentional about the pairings (ex. pair teams that have complementary strengths).
3. Actual ProtocoL
    a. 1-2 minutes: One team shares their design plan and presents their problem area where they would like feedback. Then, this team must stop talking (can be very hard for kids, or adults).
    b. (5-10 min) The other team discusses the first team's problem and talks through some potential solutions. The first team is not allowed to talk, they have to listen to the other team discussing their problem.
    c. When the first team feels they have gotten enough out of the conversation to answer their question or to address their problem, they thank the second team for the feedback and end the session.
    d. Teams switch roles and go through protocol again.

Tips and tricks:

- ★ Give students 5 minutes to discuss their project with their own team and come up with a problem that they need help with. This may be hard for students to identify, but every project has something that can be improved.
- ★ Emphasize that the team that is presenting the problem should not be talking while the other team discusses.

SESSIONS 4-5:
Create a model (OPTIONAL)

If you have the time/resources, you can have students use the materials from the kit to create small models of their designs using the metal plates from the kit.

Warm-up

Tell students that they will be spending time actually building a mini-model of their design solution. They can use the materials that they have used previously (from the kit) or may scavenge for materials outdoors (in the schoolyard, garden, or playground)

Main activity

1. Give students a few sessions to build their models. Provide support if students are having trouble working together or building their project. Students can build this paper house and place it on some soil on one side of their barrier to see how it will be affected if water is poured on the other side.
2. Supervise students who want to go outside to scavenge for materials.
3. Allow students to test and refine their models by taking some water and pouring on the side opposite to the house. Supervise students when they test (pour water slowly) so that they are not discouraged by their model being destroyed by too much water being poured.

Wrap-up

Have students "huddle" with their teams and decide if they are satisfied with their design or if there is something they would like to change. In the next session, students will have a change to optimize and to explain how/why their model is effective.

Materials Needed

Pebbles

Rocks

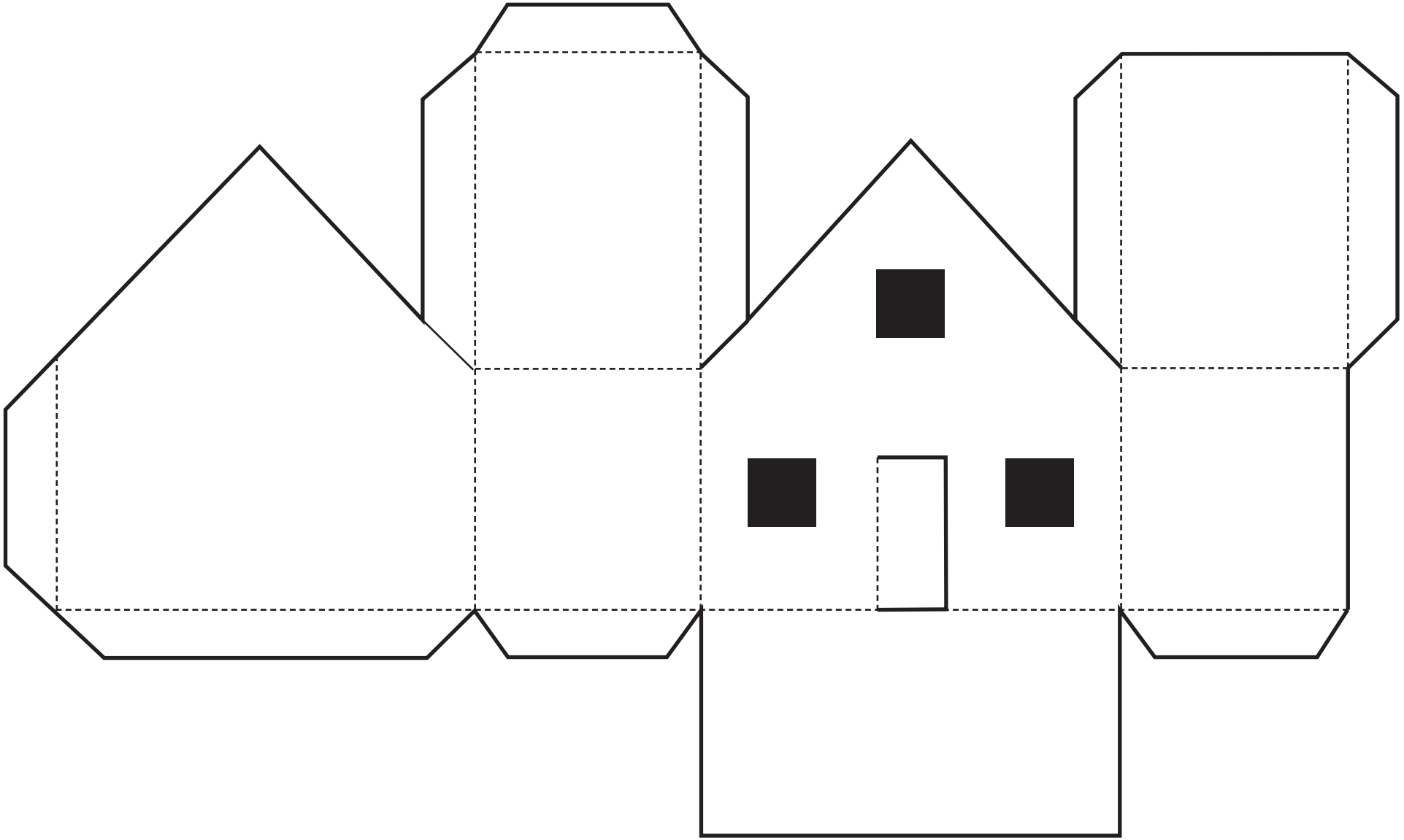
Soil

Sand and sand matrix

Items to be scavenged for outdoors (small plants, grass, rocks, dry leaves, moss, lichen, sticks and twigs, etc.)

Paper house template

1-Story House

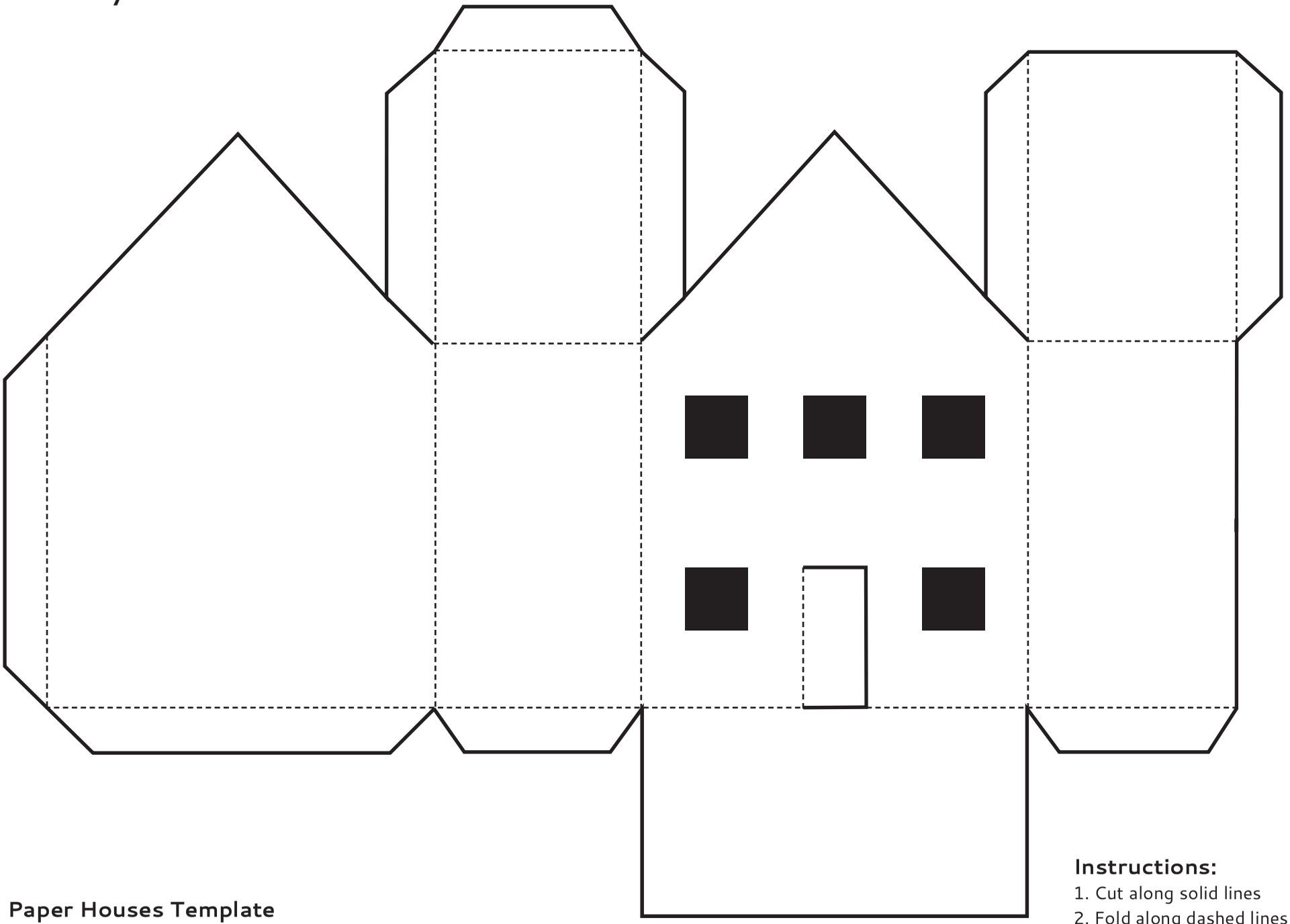


Instructions:

1. Cut along solid lines
2. Fold along dashed lines
3. Cut out black sections

Paper Houses Template

2-Story House

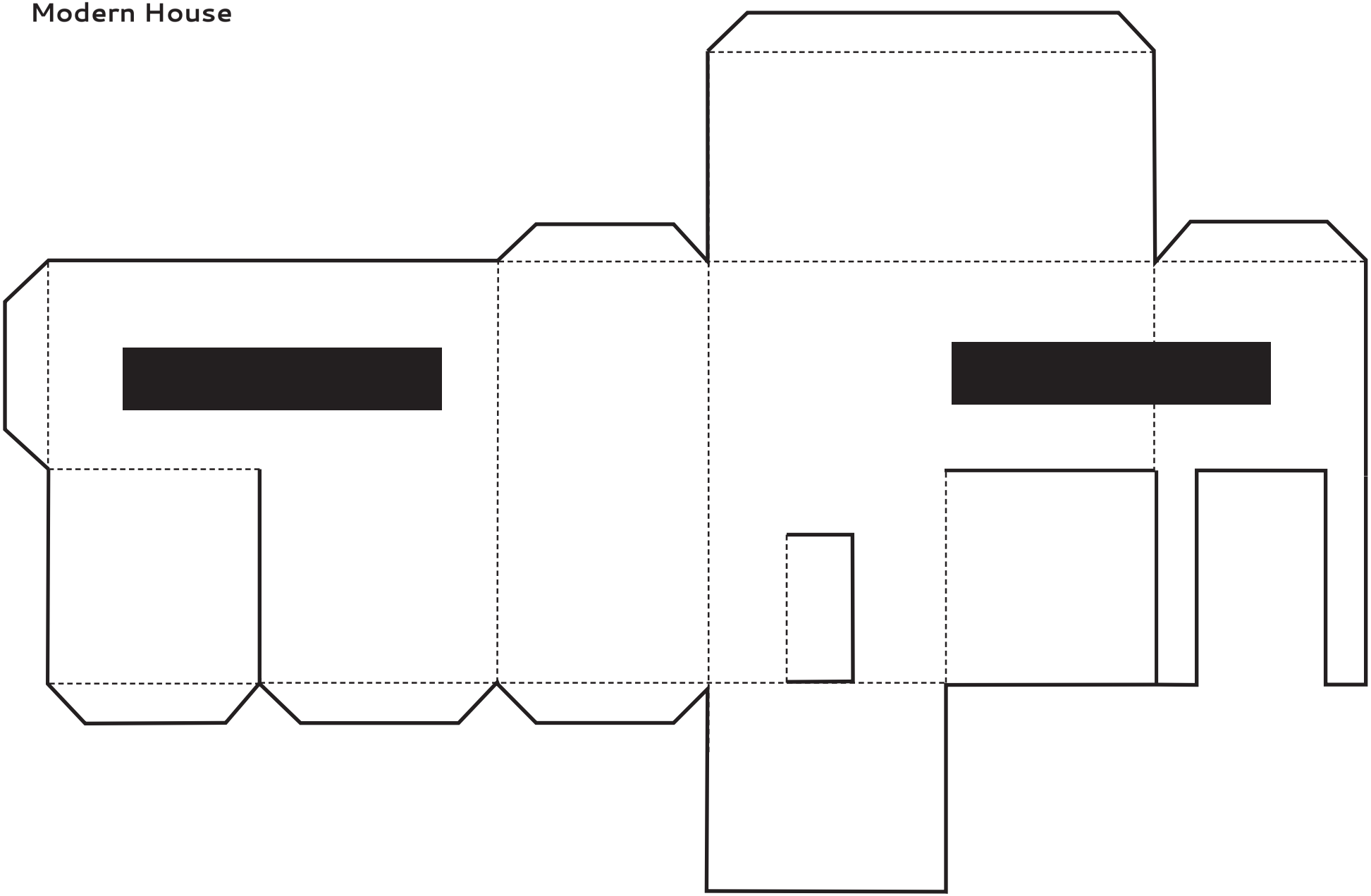


Instructions:

1. Cut along solid lines
2. Fold along dashed lines
3. Cut out black sections

Paper Houses Template

Modern House



Instructions:

1. Cut along solid lines
2. Fold along dashed lines
3. Cut out black sections

Paper Houses Template

SESSION 6:
Optimize & explain

Warm-up

Ask students, why is your design solution effective? What materials did you use and how might they help prevent erosion in real-life for the Washington coast? Ask students to talk to their team about the strengths of their design.

Main activity

Have students go back to their plan poster that they created in session 3. What is the purpose of each material they used? Ask students to look back at the diagrams they created in a previous session (on chart paper). How can they add words to describe how each material they used helps in their design? Provide these sentence frames to help them write the captions on their models:

- The _____ helps stop erosion because _____.
- The _____ is important because_____.
- Our dike is great because _____.

Wrap-up

Have students practice sharing their model and diagram with other groups. In the final session, students will be presenting their design solutions to the community and they will be more successful with this if they have practice presenting first.

Materials Needed

Students' design plan diagrams

Students' models

SESSION 7:
Share!

This is a culminating session where you can invite guests to celebrate students' hard work by providing a place where they can share their design solutions. Invite parents, administrators, other teachers, or other classes for a design solution showcase.

Warm-up

Start the session by showing the audience the problem that students were trying to solve (the images of the eroding coastline of Washaway Beach). Share the driving question with the audience. Share the KLEWS chart with guests, showing a visual representation of all the learning that students have done over the span of the unit.

Main activity

Organize a gallery walk style layout where student teams are able to converse with guests about their projects. Make sure students had ample time to practice talking about their design solutions, how they created their designs, and how each part of the design is important in making it effective.

Wrap-up

Thank guests for attending and commend students for their excellent work! Student presentations can be videotaped and shared on YouTube to further the impact that students have had while solving this real-world problem throughout the unit.

Materials Needed

Student projects

Slides to show Washaway Beach

How Lesson 5 Supports Next Generation Science Standards

Earth's Systems: Processes that Shape the Earth

Performance Expectation	**Connections to Classroom Activity,** *Students:*
2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	• Design a solution to the problem of beach erosion in Washaway Beach.
SCIENCE & ENGINEERING PRACTICES	
Asking Questions and defining problems Developing and using models Designing solutions	• Ask why beach erosion is a problem for the washaway beach community and what can be done about this problem? • Create a model of a possible design solution to the problem that uses one idea from each team member's initial model. • Design a solution that can be used to help the people of Washaway beach with their erosion problem.
DISCIPLINARY CORE IDEAS	
ESS2.A: Earth Materials and Systems. ETS1.C: Optimizing the Design Solution	• Create a design plan for a way to prevent beach erosion. • Create a physical model of the design and test its effectiveness. • Modify the design to be more effective.
CROSSCUTTING CONCEPTS	
Stability and Change Cause and Effect	• Create a prototype solution that promotes stability of the shoreline. • Analyze the effects of water on their prototype design and optimize model to be more resilient to changes caused by water erosion.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/2Earth%E2%80%99s-systems-processes-shape-Earth