Crystal Cove® CONSERVANCY

Session 1: Defining the Problem

Focus: Defining the Problem
Grade Level: 7-12
Session Length: 45-60 minutes

Driving Questions

- How is the beach at Crystal Cove State Park changing over time?
- How can we define the problem that we need to solve?

NGSS Links

- Asking Questions and Defining Problems

Systems Thinking Characteristics

- Identifying System Components & Processes

In the first session of the Coastal Dynamics Program, students are introduced to the environmental engineering process as they define the problem that they need to solve.

Students divide into their project teams and set up their field notebooks for the unit. Next, project teams are tasked with defining the problem we want to solve at Crystal Cove State Park. As they explore the Crystal Cove Historic District virtual, project teams gather information on the problem created by the changing beach and develop a short problem statement that will drive the rest of the unit.

Learning Outcomes & Assessments

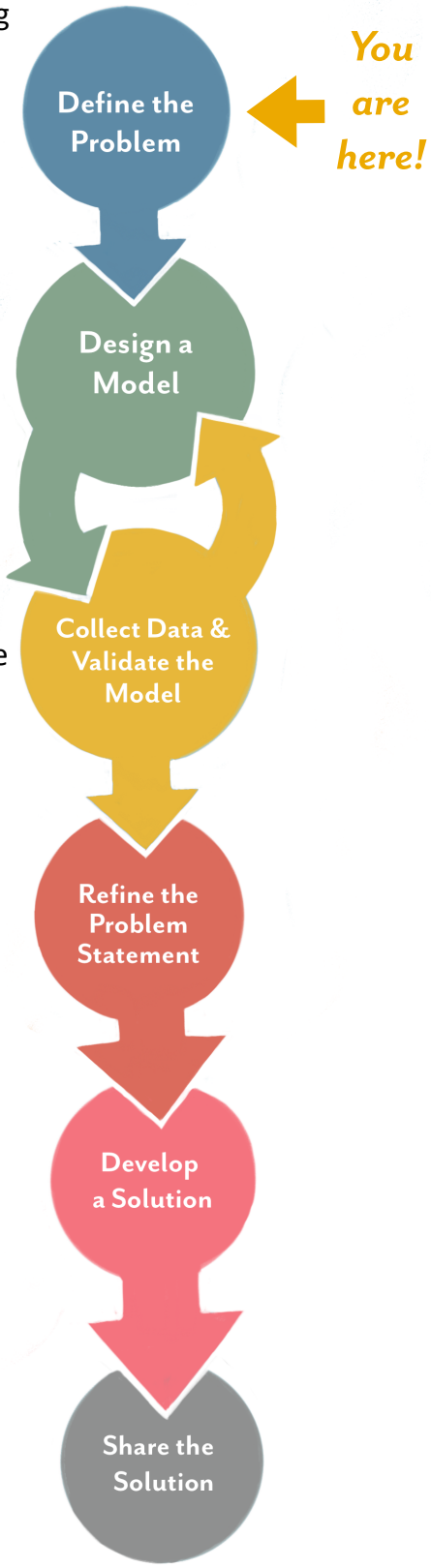
By the end of this module, students will be able to...	*You can assess this using...*
1. *Create* a problem statement that succinctly describes (1) the problem related to beach change at Crystal Cove State Park and (2) why we care about solving it.	Project team problem statements
2. *Reflect* on why defining the problem is a critical step in the environmental engineering process.	Field notebook reflection

Session Overview

Section	Description	Length	Format
Launch	Students meet Erick, who introduces them to the Coastal Dynamics Program and the environmental engineering process. After, they divide into their project teams and set up their field notebooks, which they'll use throughout the project to take notes and track their thinking.	10 minutes	Whole class
Explore	Students explore the Crystal Cove Historic District virtually to learn more about how its changing beaches are creating a potential problem for beach access and the historic cottages.	20-25 minutes	Individual
	Afterwards, they work in their project teams to create the first draft of a short problem statement.	10-15 minutes	Project teams
Share	Optionally, students share their reflections on the virtual exploration and their problem statements with the whole class.	10 minutes	Project teams
Reflect	In their field notebook, students reflect on their experiences and their next steps to begin exploring beach change near the Crystal Cove Historic District.	5-10 minutes	Individual

The Environmental Engineering Process: Defining the Problem

In Session 1, students are introduced to the environmental engineering process, which they'll be following throughout the Coastal Dynamics program. Today, they take part in the first step: Defining the problem.



Engineering is focused on solving real-world problems. To solve a problem, an engineer first needs to understand what that problem is. The first step in this process is to identify the needs of the people involved. This process can sometimes be expansive: enormous teams of engineers might work together over months or years to investigate complex real-world systems. Today, to do this in a simplified fashion, students will work in their project teams to draft a short problem statement that concisely describes what the problem is, what it is affecting, and why we care about it.

The problem statement does not need to be detailed. In fact, it is better to keep it short and concise (no more than two sentences) so that students can quickly and easily describe the problem that they are trying to solve. Student project teams will revisit and refine their problem statement later in Session 8, when they prepare to start developing a solution.

Example problem statements for the Coastal Dynamics program:

- Crystal Cove State Park's Historic District is home to one-of-a-kind historic cottages and a popular sandy beach. Human impacts on natural beach systems, which will continue to grow over the next few decades, threaten both of these treasured resources.

- On the beaches near Crystal Cove State Park's Historic District, natural beach systems are being disrupted by human-created factors such as reduced sediment input, increased storm events, sea level rise, and limited coastal armoring. Over the next thirty years, this may cause sediment to erode faster than it can be replenished, putting the beach at risk of being lost and the historic cottages at risk of being damaged.

Virtual Materials

- Session 1 Google Slides Presentation: **http://bit.ly/2Oy1NiR**
- Session 1 Thinglink: ***http://bit.ly/3urSqSl***
- Session 1 Field Notebook Template (optional): **http://bit.ly/376Wehy**

Each student will need…

- A device with internet access (a computer, smartphone, or tablet will all work!)
- Field notebook and pencil

Before You Start Teaching

- Copy over the ***Session 1 Slideshow*** to your own Google Drive account. Test to make sure that the videos work. (If not, you may have to check the permissions on the Crystal Cove Conservancy Youtube Account.)
- Decide how you want to divide your class into project teams. In your copy of the Session 1 Slideshow, update ***Slide 8*** with your chosen directions.
- Decide how you want your class to set up their field notebooks. In your copy of the Session 1 Slideshow, update ***Slide 9*** with your chosen directions.
- Decide whether you want students to share their draft problem statement with you. If you do, set up the Defining the Problem template for each team (or another method to allow them to copy/paste their problem statements). Edit ***Slide 13*** to include any specific instructions.

Learning Sequence

Launch

Getting Started (10 minutes)

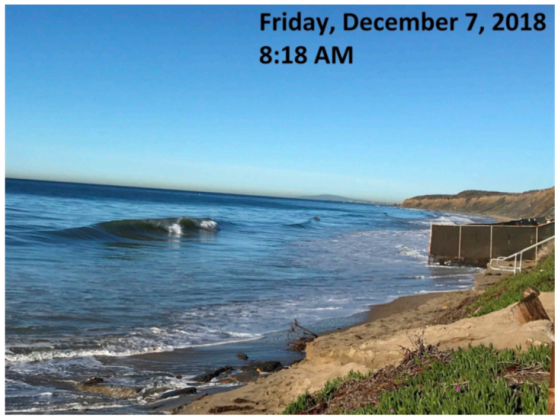
1. Open the Session ***1 Slideshow*** and play the video on ***Slide 2*** for your class. In this video, students will meet Erick, who welcomes them to the Coastal Dynamics project and give a brief overview of what they'll do throughout the unit.

2. After you've finished the video, reiterate to students that your class has been asked to learn about how our beach systems are changing and how we can protect beaches like the one at Crystal Cove State Park well into the future.

3. Continue to ***Slide 3***, where students will be given an image of a king tide event, an event where an especially high tide occurs. It happens roughly three - four times a year. The image is located in Crystal Cove, more specifically, at Cottage #13, the "Beaches" cottage. As the students observe the image, have them think about the questions provided and jot down any observations or questions they have.

- What do you think is happening in this image?
- Is what you observe natural? Does it happen often?
- Why might an engineer or scientist investigate this scenario?

Two versions of a high tide image:



4. Afterwards, advance to ***Slide 4***, where Erick introduces the environmental engineering process that we will follow throughout the program.

5. After watching the video, advance to ***Slide 5***, which shows a graphic of the environmental engineering process that you will follow throughout the program. As students encounter the engineering process in other sessions throughout the program, there will be a marker indicating what step they are currently on.

Reiterate to students that this environmental engineering process is different from the traditional design-test-build process that many engineers follow. When dealing with coastal change, solutions to problems can be big and expensive, therefore, you may not have a second chance to retest it.

6. Inform students that today, they will be diving into the first step of the environmental engineering process. "*Define the Problem"* to explore the problem that Crystal Cove wants to solve.

7. Next, it is time to divide your class into their project teams, which they'll work in throughout the project. In ***Slide 6***, Erick will introduce the concept of why engineers often collaborate together in project teams and how they use field notebooks to keep track of their ideas. Play the video for students, and then move onto ***Slide 7*** to give students an overview for the day and ***Slide 8 and 9*** to divide them into their teams and set up their field notebooks.

Explore

Part 1: Exploring the Crystal Cove Historic District (20-25 minutes)

1. Now that students have divided into their project teams and set up their field notebooks, tell them it's time to start exploring Crystal Cove's Historic District. Advance to ***Slide 10*** and play the video of Erick, who will describe how they will use the Thinglink to begin the first step of the environmental engineering process, defining the problem and coming up with a problem statement.

2. Move on to ***Slide 11***, which will give students directions on using the Thinglink and questions to guide them on how to define the problem.

Reiterate the directions for students: They are to explore the Thinglink individually and take notes in their field notebook as they go. As they click on the points of interest, they'll learn about the history of Crystal Cove and the different components that can affect or cause change within a beach system.

Students should make sure to record anything that might be important to our work protecting the Crystal Cove beach, paying close attention to the following questions:

- What is the problem that we want to solve?
- Who or what does the problem affect? and
- Why is the problem important? Basically, why do we care about it?

If you feel that it would be helpful, open the Thinglink and demonstrate how to move around it using your mouse. Click on the icons to pull up short videos or images.

3. Give students 10-15 minutes to explore the Thinglink individually.

Part 2: Creating a Problem Statement (10-15 minutes)

1. After students have had a chance to explore the Thinglink individually, have them rejoin their project teams. Advance to ***Slide 12*** where Erick will describe their next step: they should use their notes from the virtual exploration to create the first draft of a problem statement, which describes the problem that they are going to try and solve during the Coastal Dynamics program.

2. Move on to ***Slide 13***, which gives specific written directions about the problem statement.

Problem Statement Requirements:

- A clear, concise description of the problem that needs to be addressed by the project team.
- Not more than two sentences.
- Describes a problem that can be solved.
- Leaves the solution open (i.e., it does not mention what you'll do to solve the problem).

The problem statement should also answer the following questions:

1. What is the problem?
2. When and where does this problem occur?
3. Who or what does this problem affect?
4. How is this problem affecting them?
5. Why is it important to solve?

Remind the students that this problem statement will be what guides them through the rest of the environmental engineering process. They will have a chance to revisit their problem statement later in the program to revise it, so it does not need to be perfect at this point. It just needs to be concise and clear.

3. Give students about ten minutes to work on their problem statements. As they do so, circulate between the groups as you are able and listen in on the discussions. Encourage students to keep the problem statements short and concise, and to make sure to leave it open-ended.

Share

Sharing their Problem Statement with Others (Optional) (5 minutes)

1. If there is time, after the students have had a chance to draft their problem statements, have the class come back together. Open up ***Slide 14*** and give the class a chance to share the problem that they identified and the problem statements that they created.

Reflect

Reflecting on Session 1 (5-10 minutes)

1. Tell students that they have one last task. In the slideshow, advance to ***Slide 15*** and play the video, where Erick will introduce why it's important for engineers to take time to reflect on how our thinking is changing.

2. Move on to ***Slide 16***, which will share reflection questions. Ask students to spend five minutes reflecting on their experiences today in their field notebook.

3. Finally, thank the class for their time today. Tell them that when you gather again, they will use the problem statement that they created to define the system that we want to study and create a virtual model to help them think about how the beach at Crystal Cove is changing over time.