

Focus: Defining the Problem

Grade Level: 7-12

Session Length: One or two sessions of 45-60 minutes

Driving Questions

- What do we now understand about the problem that we need to solve?
- What are our design criteria and design constraints?

NGSS Links

- Defining the Problem
- MS-ETS1-1
- HS-ETS1-1

In the eighth session of the Coastal Dynamics Program, student project teams use what they have learned about Crystal Cove’s North Beach to refine the problem statement that they first created in Session 1.

At the the start of the session, student project teams revisit their problem statement and update it based on what they’ve learned about how Crystal Cove’s North Beach is changing. Afterwards, they brainstorm design criteria and design constraints, preparing them to begin working on a solution proposal in Session 9.

Learning Outcomes & Assessments

<i>By the end of this module, students will be able to...</i>	<i>You can assess this using...</i>
1. Apply what they’ve learned about how the North Beach is changing to refine their problem statement.	Refined problem statements; Class discussion
2. Identify design criteria and design constraints for their project.	Class discussion; Field notebooks

Session Overview

Section	Description	Length	Format
Launch	Erick welcomes the students to Session 8 and explains that they will revisit the problem statement that they created in Session 1 to revise it based on the new knowledge they have learned about the North Beach. Erick also mentions that they will determine the design criteria and constraints for their project.	5 minutes	Whole class
Explore	Students use their knowledge of Crystal Cove's North Beach to write a problem statement. They compare this to the problem statement they wrote in Session 1 and work with their team to use both drafts to create a new draft of the problem statement. They also work with their team to define design criteria and constraints for their project.	40-45 minutes	Project teams
Share	Students share their revised problem statement and explain how it is different from their original statement. They also share their design criteria and constraints.	5-10 minutes	Whole class
Reflect	Students reflect on their experience during Session 8.	5 minutes	Individual

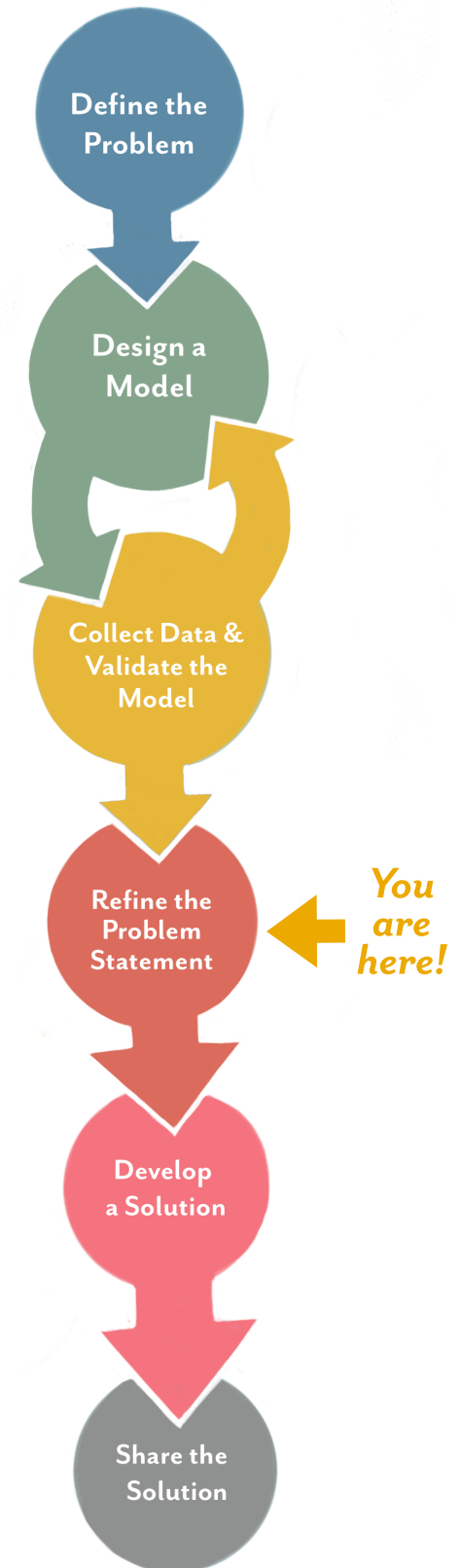
The Environmental Engineering Process: Refine the Problem Statement

In Session 8, students use what they've learned about how the North Beach's sand volume is changing over time to refine their original problem statement.

As students refine their problem statement, they'll need to explain how they think the North Beach is changing over time. This will require them to use their model and their data as evidence to make a claim. Encourage students to refer back to their model and the trends that they noticed in the data as they work on revising the problem statement individually and as a group.

In addition, student project teams will need to identify their design criteria for success, or what a successful solution will need to do, and design constraints, or restrictions and limitations on the solution. These are a common part of the engineering design process that your class may be familiar with from other engineering projects. If this is the first time that students are encountering design criteria or design constraints, you may want to spend more time defining them and giving examples.

Student collaborations during Session 8 will prepare them to develop a solution in Session 9.



Virtual Materials

- *Session 8 Google Slides Presentation*
- *Session 8 Field Notebook Template* (optional)

Each student will need...

- A device with internet access (a computer, smartphone, or tablet will all work!)
- The problem statement that they created in Session 1
- Field notebook and pencil

Before You Start Teaching

- Copy over the *Session 8 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 long to give students for this session. You may want to plan to break Session 8 into two class meetings so students can focus on the problem statement in one and the design criteria and constraints in a second class meeting.
- Locate the problem statements that students created during Session 1 so that they can revisit them.

Learning Sequence

Launch

Introduction to Session 8 (5 minutes)

1. Open the [Session 8 Slideshow](#) and play the video on [Slide 2](#) for your class. In this video, Erick will explain that they will revisit the problem statement that they created in Session 1 to revise it based on the new knowledge they have learned about North Beach. Erick also mentions that they will determine the design criteria and constraints for their project.
2. After watching the video, advance to [Slide 3](#), where you will find a graphic of the environmental engineering process with a marker pointing at “Refine the Problem Statement.” Tell students that today, they will move on to the next step in the Environmental Engineering process by revisiting their Problem Statement from Session 1 and updating it based on what they’ve learned about how Crystal Cove’s North Beach is changing over time.
3. Once you’ve gone over this step in the engineering design process, advance to [Slide 4](#) to give students an overview of what they will do and learn during Session 8.

Explore

Refining the Problem Statement (40-45 minutes)

1. Advance to [Slide 5](#) and play the video of Erick giving an overview of how to write a problem statement.
2. After watching the video, move to [Slide 6](#), which provides written directions for students to follow to write their initial ideas for the problem statement. At this time, they will work individually. They will be able to work with their teammates to revise their statement, so it does not need to be perfect at this point. This step gives students the opportunity to gather their initial thoughts before working with their team. Walk around the room to check on progress and provide assistance when necessary.
3. After everyone has written their initial thoughts, advance to [Slide 7](#). Play the video of Erick explaining how they will revisit the problem statement they wrote during Session 1 and work with their team to make revisions based on what they have learned about the North Beach situation.

4. After watching the video, advance to *Slide 8*. This slide provides written information about what is included in a problem statement and the questions the students should answer as they revise their problem statement. Make sure all teams have access to the problem statement that they wrote in Session 1 so they can make revisions. Walk around the room to check on progress and provide assistance when necessary.

5. Once all the teams have a new draft of their problem statement, advance to *Slide 9* if you want them to provide feedback to each other. This step is optional, so you may advance directly to *Slide 10* if you do not have time for a feedback session. If you are doing a feedback session, provide the students with the details of how you want each group to share their problem statements with another group, give them time to review the statements and generate feedback, and then provide them with time to share their feedback with each other. Walk around the room to check on progress and provide assistance when necessary.

Defining Design Criteria and Constraints

6. Once the feedback session is complete (if you chose to do that step), advance to *Slide 10*. Play the video of Erick explaining design criteria and constraints.

7. After watching the video, move on to *Slide 11*. This slide provides written instructions on how to define design criteria and constraints. Give teams time to make decisions. Walk around the room to check on progress and provide assistance when necessary.

Share

Sharing Our Model Updates (5-10 minutes)

1. Once students have finished writing their design criteria and constraints, advance to **Slide 12**. Ask students to use the questions on the slide to share the work they have done during this session with their classmates. Facilitate the discussion so that all teams have the opportunity to share and encourage students to ask questions of other teams.

- What is your new problem statement?
- How is your current problem statement different from the original problem statement that you developed in Session 1? How does this reflect how your understanding about beach change has evolved?
- What are your design criteria and design constraints?

Reflect

Reflecting on Session 8 (5 minutes)

1. At the end of the discussion, advance to **Slide 13** in the slideshow and play the video, where Erick will recap the experience today and ask students to spend a few minutes reflecting.

2. Move on to **Slide 14**, 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 they will design a solution to address the problem statement that they wrote in this session.