Name Date

ENGINEERING LAB

Design a Preserve for Your Community

Preserving natural landscapes for future generations can be hard work! Competing land use interests for agriculture, logging, urbanization, and other purposes must be balanced with the desire to preserve natural habitats. Preservation of land can involve many different stakeholders and be a lengthy process depending on the people, species, habitats, and regulations involved.

MATERIALS

- computer with Internet access
- map of your local area showing topography, bodies of water, and forest areas

How is land selected as a beneficial location for a park or preserve? How much land is needed to maintain high levels of biodiversity? How can you predict whether species will utilize the habitats you provide? In this activity, you will investigate these questions and use a computer simulation to help you design a nature preserve in your local area.

DESIGN CHALLENGE Define the criteria and constraints for a community nature preserve, design the preserve, and use a computer simulation to test and optimize the design.

CONDUCT RESEARCH

Refer to the Engineering Design Process flow chart on the next page as you design, test, and optimize your nature preserve.

Before you begin planning your design, do some research to learn how environmental scientists and other professionals design nature preserves. Record your findings in your Evidence Notebook. Use these questions to guide your research:

- What factors are considered when determining the location, size, and shape of a preserve?
- How are habitats engineered to increase and maintain high levels of biodiversity?
- How do scientists predict the ways that different species will interact and utilize the resources in a preserve?

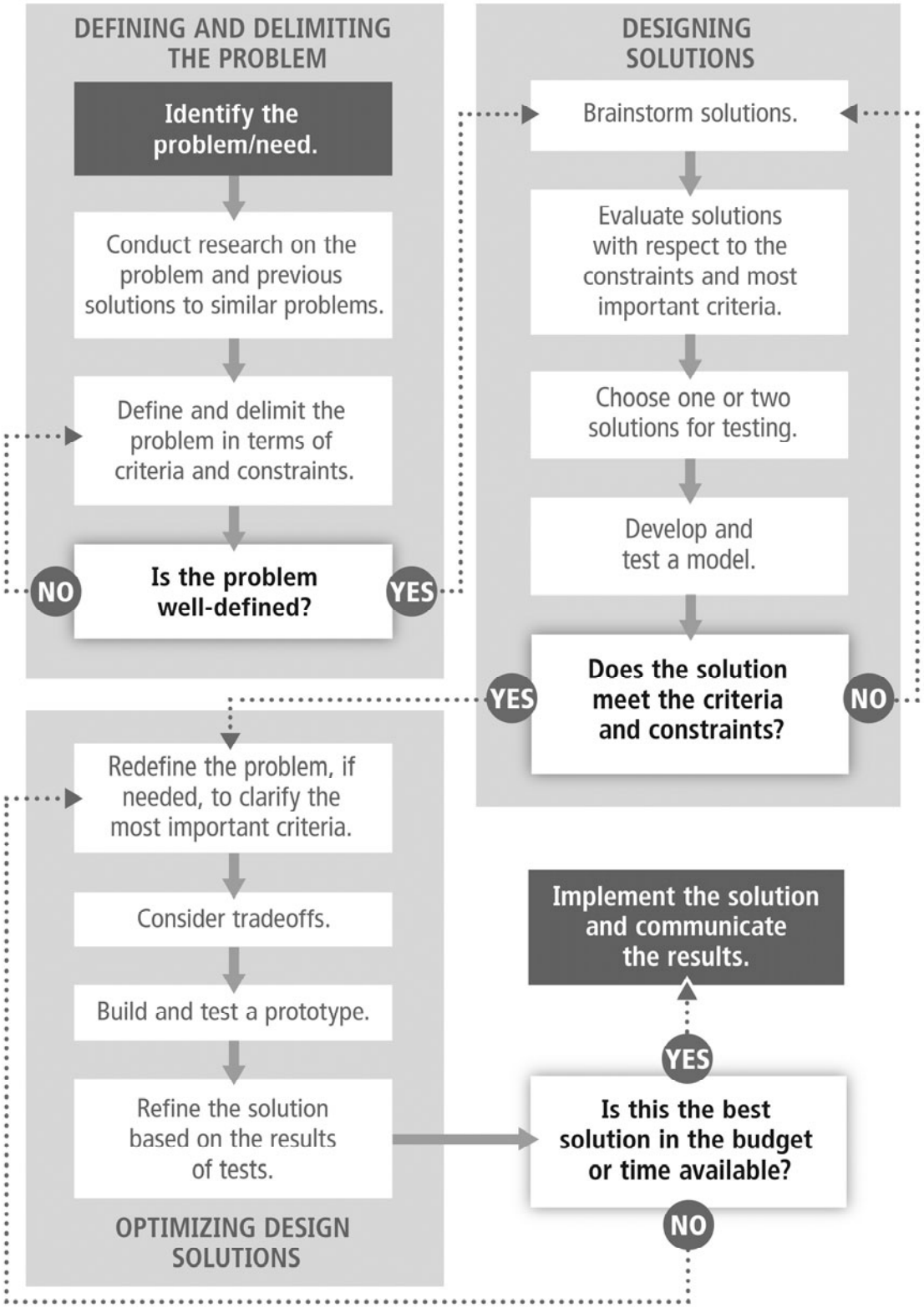
DEFINE THE PROBLEM

Now think about how you might build a nature preserve near your community. Define the problem that building the preserve will solve. Start by gathering information about species in your area that could benefit from a preserve and locations that could be modified to increase the number of habitats for those species.

Then use the information you found to brainstorm a list of criteria and constraints for your preserve. For example, you might hope to maintain biodiversity by supporting a certain number of species in the preserve. Another criteria might be to provide access points and infrastructure for visitors. Constraints might include limited space or the budget available to purchase land.

Define the problem your nature preserve will solve and list the criteria and constraints for the preserve in your Evidence Notebook.

Engineering Design Process



DESIGN SOLUTIONS

Use the information you have gathered to brainstorm an approximate size, shape, and species composition for your preserve. Plot the borders of your preserve on a map of your area, if possible. Record the dimensions and shape of the park, as well as the number and types of species you hope to maintain there. Include any necessary information related to species richness, species interactions, and space requirements for various species. Record your calculations in your Evidence Notebook and show the mathematical models you used.

As you design your preserve, consider the following questions:

- Does the land include invasive species?
- Will the invasive species need to be removed?
- Will features such as ponds, wildlife crossings, or artificial nesting or burrow sites need to be added to provide the habitat that the desired species need?

As you further refine your design, you may need to adjust your criteria and constraints. This is a normal and expected part of the engineering design process. Record these changes in your Evidence Notebook.

TEST

Use a computer simulation to test whether the design you are proposing will meet the criteria and constraints you outlined. Open-source simulation programs can be found on some university websites. Use one of these programs to design your own simulation, or find a ready-made simulation to test your prototype. Run a minimum of three trials, and summarize the results in your Evidence Notebook, including identifying information for the software you used.

OPTIMIZE

Adjust the design for your preserve as needed after each trial. You may need to prioritize your list of criteria and constraints and consider tradeoffs between them. As with adjusting the criteria and constraints, considering tradeoffs is a typical part of the engineering design process. Record adjustments made, reasons for them, and subsequent test results in your Evidence Notebook.

COMMUNICATE

Prepare a presentation to explain the proposed design to your city, state, or federal government. Include a visual representation of the preserve, evidence to support its design, and an explanation of how the evidence supports the claims in your proposal. Include information about how the preserve's design will allow for greater biodiversity, as well other ways it would benefit the community. Finally, name the agencies and organizations that would most likely need to be involved, including landowners, and explain how you hope to obtain funding for your project.

EXTEND

Obtain and Evaluate Information Research the history of an actual nature preserve. You may choose a local, regional, or state preserve, or a national park or wildlife refuge. Who proposed creating a nature preserve in that area? What were the goals—was the intent to save particular species of plants and animals, or was there another driving force? Who was involved in creating the preserve? Who opposed it? How successful has the preserve been in meeting its original goals? How has the preserve changed since its founding, and how has it stayed the same? Which of these changes are natural, and which have been caused by humans? Report your findings to the class in an oral report, or contribute to a class wiki or blog on this topic.