Optimal and Sustainable: Renewable Energy Revamp

Student Activity Guide

Name: _____ Date: _____

Introduction: In the United States, we currently use coal, oil (petroleum), and natural gas for most of our energy; however, these fossil fuels are nonrenewable and can have negative impacts on Earth's climate and the environment. Citizens of the (fictitious) town of Solutionville want to replace coal as their main source of electricity with cleaner and more renewable sources, but the use of many of these renewable energy technologies are limited by things like geography, climate, and cost. How would you deal with these limitations?

Your Challenge: With a partner, design a renewable energy plan for the town of Solutionville.

1. Using the information on the following pages and the Spreadsheet Tool:

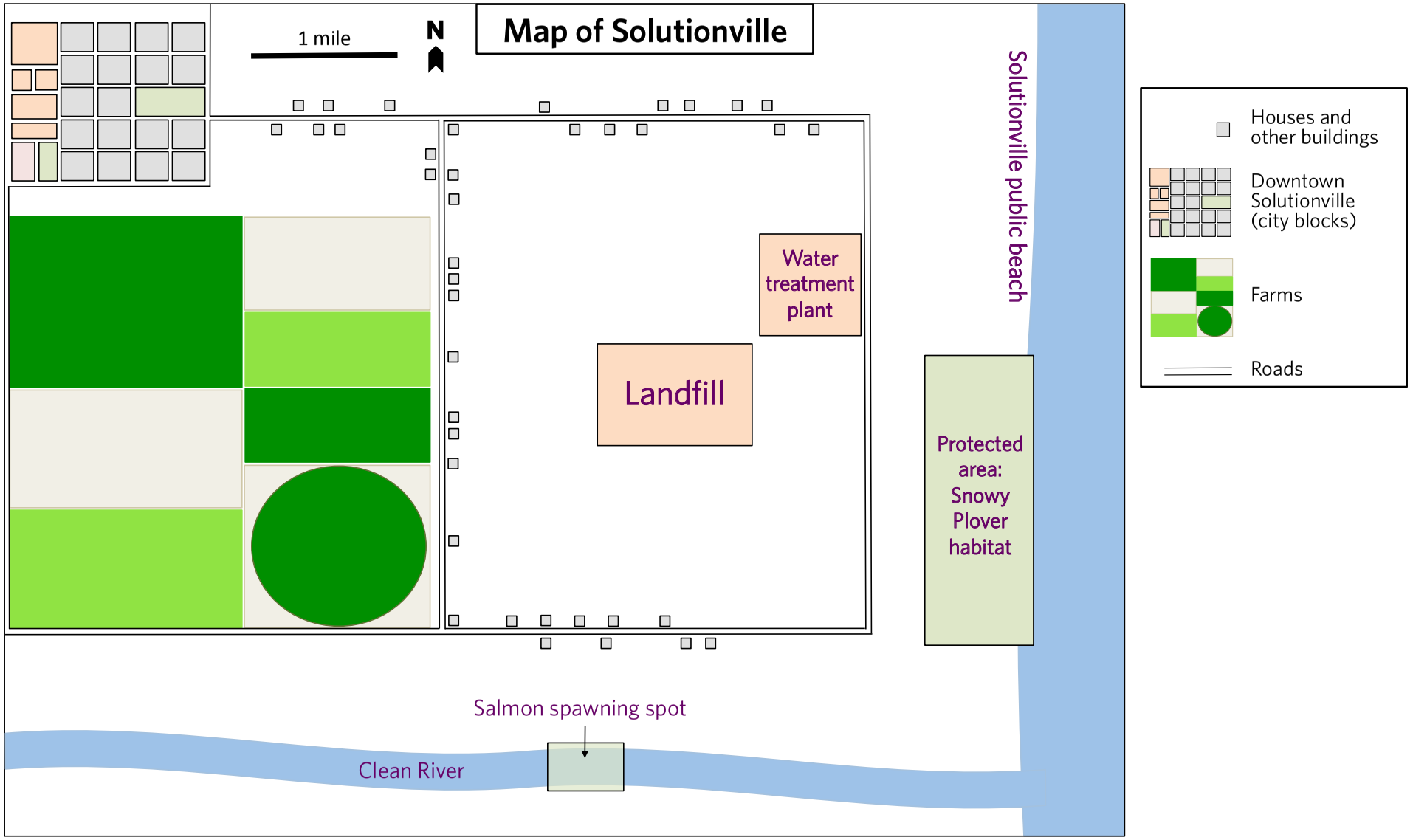
   - **Figure out** what combination of renewable energy technologies can provide a constant and reliable 100,500,000 kilowatt-hours (kWh) of electricity per year for all of the residents and businesses of Solutionville *without going over budget*.
   - **Draw** (to scale!) the locations of where you will build your renewable energy technologies on the Map of Solutionville on page 2. Your Spreadsheet Tool will help you calculate how much land space you will need for each. Use a ruler and the scale bar on your map to carefully choose your locations. Be ready to justify why you built things where you did!
   - Using the maps on pages 4-6, **show** that your plan meets all of the geographic energy potential constraints (that the renewable energy technologies will work where you put them).

What You Will Need

* Partner
* Ruler
* Calculator
* Pencil/eraser
* Scratch paper
* Computer with Spreadsheet Tool

Tips and Hints

- *Remember that some renewable energy sources like the wind and sun are intermittent, meaning that they aren't necessarily available all the time. You might not want to rely solely on intermittent energy sources!*
- *You can use any combination of renewable energy sources as long as they meet the outlined conditions and you can justify your choices with logical explanations.*


Map of Solutionville
1 mile
N
Solutionville public beach
Water treatment plant
Landfill
Protected area: Snowy Plover habitat
Salmon spawning spot
Clean River
Houses and other buildings
Downtown Solutionville (city blocks)
Farms
Roads

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Solutionville Facts and Figures

Population
30,000 people, 3 people per household on average

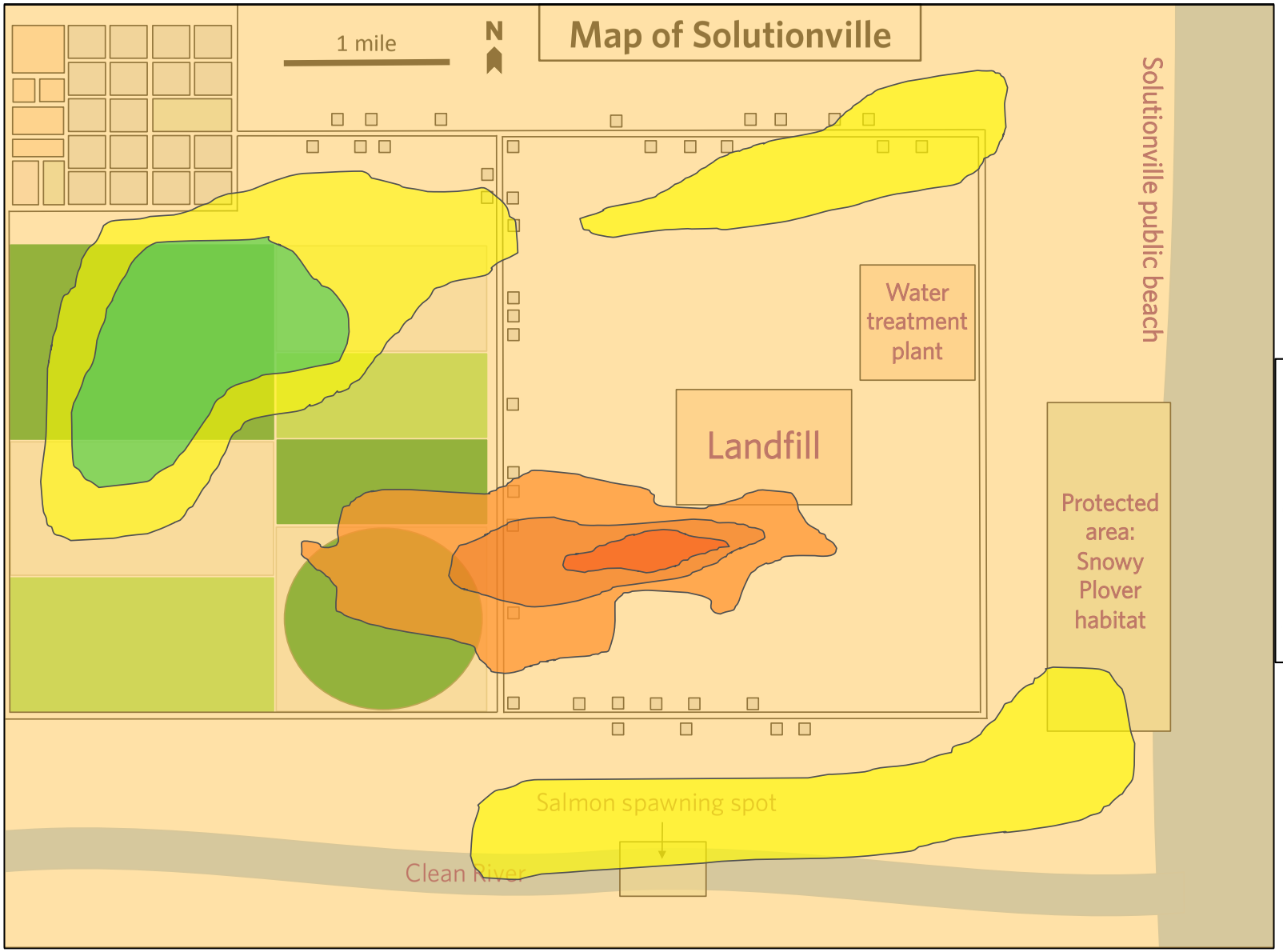
Energy needs
10,000 kWh of energy per home per year, plus an additional 500,000 kWh of energy (total) for agriculture and other community facilities

Energy budget
$30 million per year

Climate
Warm, dry, and sunny summers and cool, wet, cloudy winters

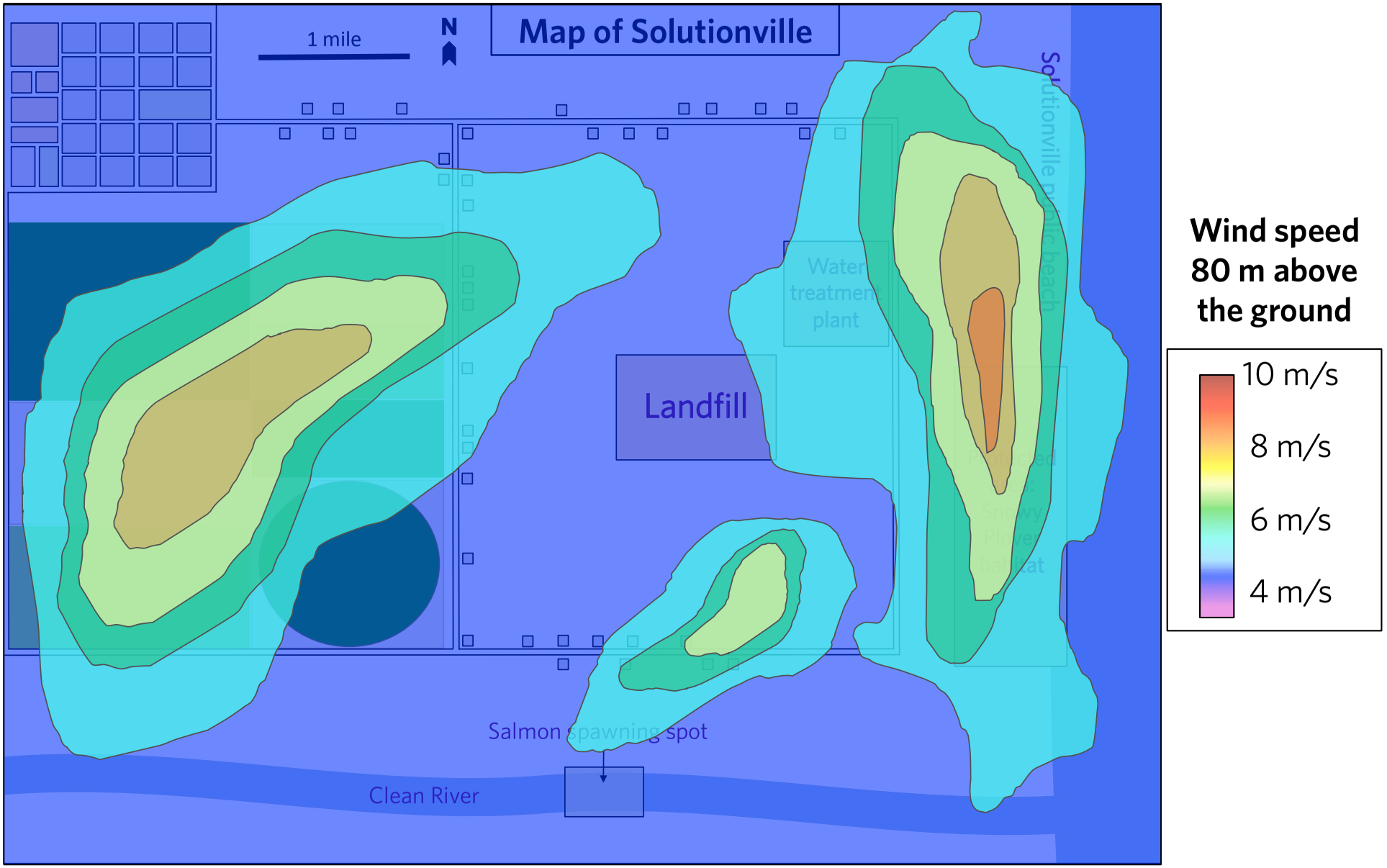
Economy
Mostly agricultural; Solutionville farms grow a variety of fruits and vegetables and raise animals.

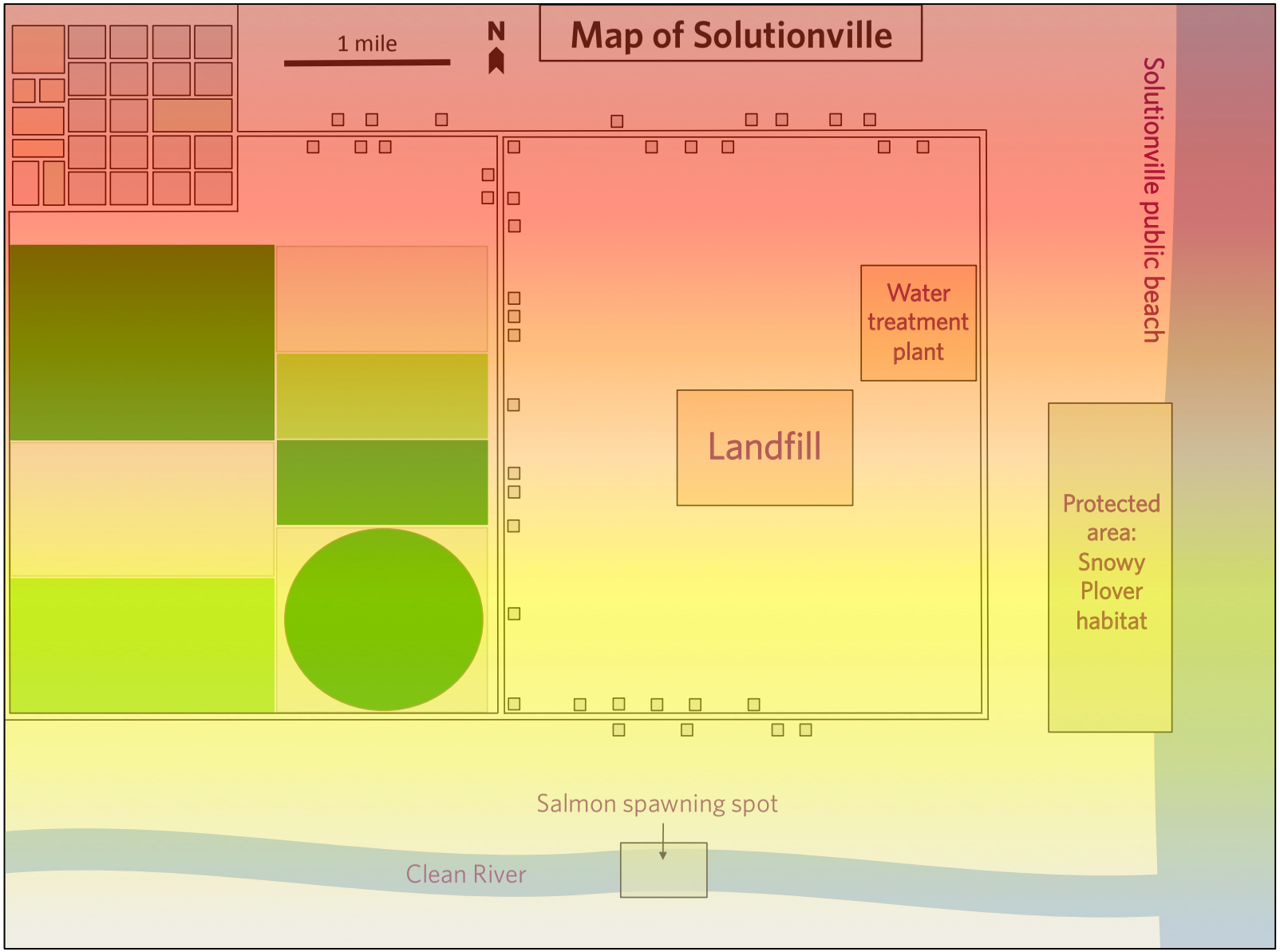
Biodiversity
Solutionville's coastal waters are home to many plants and animals, several of which are endangered. Part of the shoreline has been designated as protected habitat for the threatened snowy plover shorebird. There are other species of seabirds, including gulls and pelicans. Salmon migrate seasonally up the Clean River to spawn.



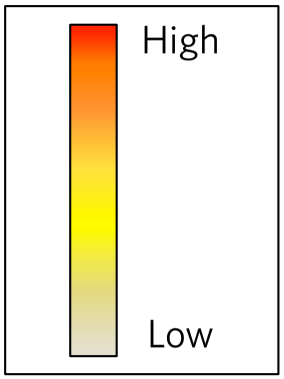
Geothermal energy potential

- Outstanding
- Excellent
- Good
- Fair
- Ok
- Poor


Map of Solutionville
1 mile
N
Landfill
Water treatment plant
Salmon spawning spot
Clean River
Wind speed 80 m above the ground
10 m/s
8 m/s
6 m/s
4 m/s



Average amount of sunlight



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Notes and calculations