Aquifer Sustainability

Task 2: Computational Models

Human activity directly impacts the surface of the earth and can alter its natural processes. When towns are being developed, hydrologists, engineers, and city planners must make careful decisions about how to use the region's natural resources to support the community. To maintain stability, a balance must be struck between society's needs and what the earth can provide. Pumping more water than what can naturally be replenished is a recipe for disaster.

Task: Your group will create a computational model of the simulation's aquifer to be used by hydrologists, city planners, and engineers as development of a community is planned. Your model must allow city planners to make recommendations on how big the community's population can grow while maintaining the aquifer responsibly.

In order to complete this task, your group first needs to decide what a healthy, sustainable aquifer looks like. Look back at your work from the *Aquifer Exploration* handout and revisit the simulation. What can you examine and/or measure that would indicate that the aquifer is stable? For instance, your group might decide to examine the area of the wetlands as an indicator of aquifer health (this has been done as an example for you).

Choose: 3 Indicators of Aquifer Sustainability using the Claim-Evidence-Reasoning to support your work.

	Indicator of Aquifer Sustainability	**Indicator of Aquifer Sustainability**	**Indicator of Aquifer Sustainability**	**Indicator of Aquifer Sustainability**
Claim A statement about the health of the aquifer	*Example: The* *area of the wetlands* indicates the overall health of the aquifer			
Evidence Data, graphs, etc. from the simulation that support your claim	*In the No Development scenario:* *In January of each year for five years, the wetland area is approximately 250 cells on the map* *After adding 5 city wells at maximum pumping rates, and 1 farm well, the wetland is only 59 cells in January of year 5.*			
Reasoning An explanation or justification for how the evidence supports your claim	*When "over pumping" in Part III on the first task, the area of the wetlands significantly decreased. This means that the water table is no longer at the surface, and to get to the water, one would have to drill a well.*			

Part II. Developing the Model

The model your group will develop with be mathematical and be done using a spreadsheet. Models are used to represent a system, understand problems, and to find or test solutions. Models should always be based on evidence, and are refined over time as more is learned.

The data that is collected for your computational model should be well thought out, and organized. Your answers to the questions below will describe your procedure for constructing your model.

1.) Choose 2 of your Indicators of Aquifer Sustainability to investigate. Why were these chosen?

2.) You will collect data for both of these indicators. What data will you collect? Be specific.

Indicator 1: Indicator 2:

3.) *How* will you collect data from the simulation (e.g. monthly, yearly, every six-months, etc)? Explain your reasoning.

4.) What are your independent and dependent variables for each data set?

Indicator 1: Indicator 2:

More Information:

- The city (residential) part of the community is 6.16 km^2. The farm is 3.99 km^2.
- The city can have up to five wells. Each well can pump between –5,000 and –15,000 m^3/day.
- The farm can have a maximum of three wells for crop irrigation during the growing season, May through October.
- The average 4-person American household uses 1.5 m^3 of water every day. 70% of this water comes from inside use such as flushing the toilet, taking a shower, and doing laundry.
- 1.0 m^3 = 264.17 gallons