

Groundwater Protection

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Before you begin using this module, you will need to know about using a Web-based GIS viewer. You can do this by watching the tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at <http://gis.lanecc.edu> → “Modules” tab → “Tutorial” link. The activity works best with a high speed Internet connection.

Objectives:

- Use GIS to investigate groundwater surface water interactions
- Improve map skills and problem solving

Remember, computer steps are indicated by a ► symbol and questions you need to answer are numbered.

Prior Skills: You will need to know how to turn layers on and off, use the ID tool and, zoom in and out of the map, toggle from layers to the legend, and perform a search (Boolean) query. You should also be able to convert units of measure using multiplication or division.

This lesson looks at the connection between groundwater, surface water and water quality. Below is a link to an excellent introduction to septic systems and groundwater with regards to septic tanks and agriculture protection. If you are unfamiliar with groundwater and septic systems, please refer to:

http://gis.lanecc.edu/modules/groundwater/GW_protection_septic_tank.pdf

Remember to work through the lab to answer the questions. If you try to just answer the questions they will not make sense. You will write your own answer sheet. Write or draw diagrams to answer the questions.

The map we will be using is web-based GIS so you can also do some of the work at home if you do not finish by the end of the lab.

- Open a web browser and go to:
<http://arccgis.lanecc.edu/website/gwater>

The general organization of the screen should look like:

<i>Tools</i>	<i>Map Area</i>	<i>Layers/ Legend</i>
	<i>Selection/Table Display (blank at start-up)</i>	

Look at the layers:

- ▶ Look at the layers available on our map.

You see a map of a watershed in the Pacific Northwest.

- ▶ Use the measure tool  to measure the extent (distance) of the watershed from north to south and east to west. With these measurements do a quick estimation of the area of the watershed.

1. *What value did you estimate the area of the watershed to be? (Please answer on separate sheet of paper)*

By comparison the Lane Community College campus is approximately 0.21 mi².

2. *In general terms which direction (N, S, E, W, SE, etc) does the stream system flow?*

- ▶ Turn on all of the layers and refresh the map. You will notice that some of the layers do not extend all the way to the watershed boundary.

3. *Why do you think that the data does not extend throughout entire watershed? Need a hint? See the footnote at the bottom of the page*.*

Besides simply being a digital map, a GIS allows different data layers to be analyzed and compared against each other both in terms of their spatial location (latitude, longitude) and their attributes. For instance a house would have latitude and longitude (spatial attribute) and also some characteristic of the house (3 bedroom, 1 bath) which would be the attributes.

4. *What data layers are available and what attributes do you think would be associated with each one?*

Now we will start to analyze the data.

- ▶ Make all layers visible except for the elevation layer and make septic tanks the active layer. Remember as you work with the map to be patient and to “Refresh Map” after you add layers.

- ▶ Use the identify tool  and select one of the septic tanks. Remember that each geographic location has attributes associated with it. For the septic tanks field the attribute fields are:

Attribute Name	What it represents
FID	Unique identifier
YEAR	Year of installation
ID	A building code
USECODE	Type of use (residential, commercial, or mixed)

Also remember that you can ask the data questions, which is called a query. We are going to select all septic tanks that are more than.

* In 1878, recognizing that the link between watersheds and public policy was critical, John Wesley Powell, the great explorer of the Colorado River, proposed that political jurisdictions conform to watersheds in the west. For this progressive watershed management idea, Powell lost his job as the head of the U.S. Geological Survey (Powell, 1878).

For this part of the exercise, you are coordinating a water quality survey. Before you begin the study you want to identify reaches that are potentially problematic. The *first set* of criteria for determining the streams to sample is:

Stream reaches within 50 meters of a septic tank whose

- Installation date is before 1989

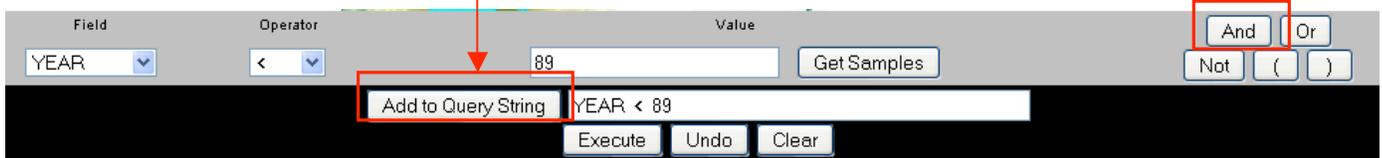
AND

- Is zoned residential.

The first part of the query is:



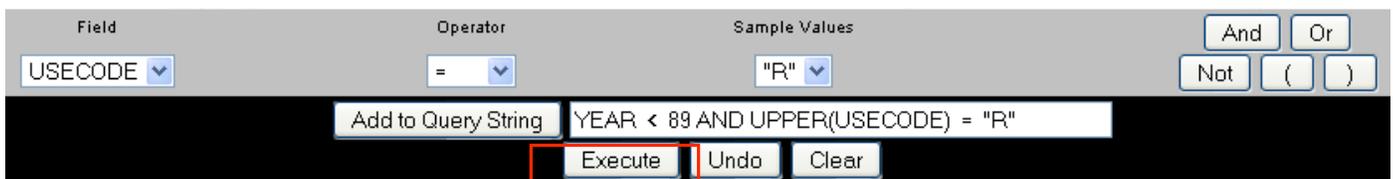
- ▶ Activate the query tool by clicking on the  icon.
- ▶ At the bottom of the screen you will now create the query.
 - ▶ For *Field* select YEAR. This will designate which data field to use.
 - ▶ For *Operator* use <. This will select all areas that are less than the designated field.
 - ▶ For Value enter 89
 - ▶ Then push the *Add to Query String* button. Your screen should look similar to this:



You have completed the first part of the query, which asked the data behind the map “Select all of the septic tanks that were installed before 1989.”

We will now the next part of the query, which refines the query. What is the second part of the query?

- ▶ Make sure that the query described above is correct.
- ▶ Select the *And* button from the query tools. It is highlighted by a red box in the above screenshot.
- ▶ With query builder, create query with the tools that has USECODE equal to “R” (residential). Use the Get Samples tool to get the “R” value.
- ▶ Add to query string. Your query should look like:



- ▶ **Press Execute** (Look at the bottom of the screen).

5. Explain in words what you just asked the computer.

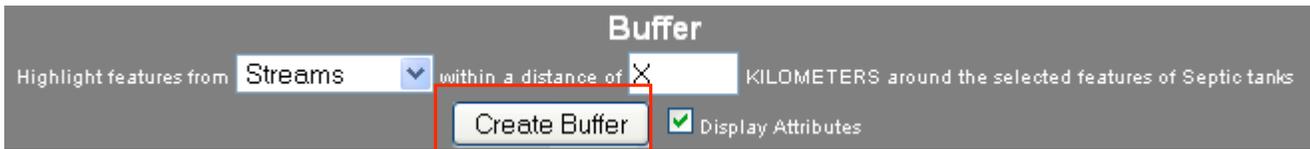
6. How many records did you get (make sure to use the more records if necessary)?

We will now use the Buffer tool  to highlight and display the attributes of the stream reaches within 50 meters of a stream.

The first thing that needs to be done is to convert 50 meters to kilometers. There are 1000 meters in a kilometer or 1 meter is equal to 0.001 kilometers. Write down your conversion. It will be referred to as X in the next section.

7. *What value did you get for the conversion? Please show your work.*

- ▶ Select the Buffer tool .
- ▶ Now at the bottom of the page select “Highlight features from Streams”
- ▶ Within a distance of X KILOMETERS around the select features of Septic tanks.
- ▶ Choose display attributes, and **Create Buffer**.



8. *How many stream reaches did you find?*

9. *Now using this information how would you go about prioritizing streams to monitor water quality? Would it make any difference where you did water quality sampling in regards to elevation in the basin? Please write a paragraph or two.*