Developed by the Virginia Geospatial Extension Program and VirginiaView

Watershed Wanderings

Virginia Geocoin Adventure
Activity Guide and Project Reflections

In this activity, your group will explore:

- The geography of watersheds
- Nonpoint source water pollution
- Geography terms and tools

Laura Johnson
Educational Consultant

John McGee
Professor & Geospatial Extension Specialist,
Virginia Tech

James Campbell
Professor,
Department of Geography,
Virginia Tech

A digital version of this document is available at: https://virginiaview.cnre.vt.edu/geocoin/

Watershed Activity Overview

In this activity, you'll be using the travels of your trackable geocoin to explore the effects of nonpoint source water pollution. The location of your geocoin will become the site of a future poultry farm. You'll explore the possible effects of this farm and what it means to live downstream.

Watershed Background Information

Go to the following link on the EPA water website:

http://water.epa.gov/type/watersheds/whatis.cfm

In your own words, what is a watershed?

What does the following common phrase mean: "We all live downstream"?

There are two main categories of water pollution that can affect the quality of water in a watershed: point source and nonpoint source. In the table below, classify each of the following types of water pollution as point or nonpoint source, using the definition given in the following EPA webpage:

http://water.epa.gov/polwaste/nps/whatis.cfm

Pollution source	Point or Nonpoint
Discharge pipe from a manufacturing plant	
Runoff from one confined animal feeding operation	
Discharge into a stream from an underground mine	
Excess lawn fertilizer application next door	
Motor oil spilled near a storm sewer	

Go to: https://www.epa.gov/nps/types-nonpoint-source-pollution

What are the main sources of nonpoint source water pollution in our region (Mid-Atlantic, or search for your region if you are not in a Mid-atlantic state)?

Name three impacts that a large-scale chicken house may have on water quality and quantity (go to https://www.epa.gov/nps/nonpoint-source-agriculture#Q2 and watch an informative video here

https://thinktv.pbslearningmedia.org/resource/envh10.sci.life.eco.chickenwaste/chicken-waste-and-water-pollution/ with additional info. here https://sciencing.com/effects-sewage-aquatic-ecosystems-21773.html

for more information):

They may be small, but these birds can have a big impact on water quality when raised in large numbers.

1. _____
2. _____
3. _____

Watershed Data Collection

You or someone else in your group should have dropped off a Geocoin in a Geocache a while ago (See the Virginia Geocoin Adventure: Getting Started Manual if these terms sound unfamiliar). Now, we can use your Geocoin's log information to explore different watersheds. We will be imagining that your Virginia Geocoin is a chicken tycoon looking for a new site to build a large poultry farm. Each "stop" the geocoin makes will give us a chance to weigh the effects of poultry farming at that location by looking at the characteristics of that location's watershed.

1. Log in to www.geocaching.com with the login you used when you dropped off the geocoin (and you need logon to view the movements of your geocoin in GoogleEarth).

Note to Leaders: You'll want to make sure that your Geocoin has traveled to at least 3 different places before starting this activity . **If it has not, then you can always select a different geocoin to complete this exercise (you can identify and 'adopt' someone else's geocoin that is already in circulation)**. You can conduct a search for Trackable Geocoins on www.geocaching.com., and under the 'Play' menu, select 'Find Trackables'. You can search for a "Trackable by name", and enter VirginiaView (for a listing of all VirginiaView Geocoins), Map@syst (for a listing of all Map@syst Geocoins), 4H (for a listing of all 4H geocoins), or any other geocoin name that you might be familiar with. You can sort these lists by distance traveled (number of miles).

2. Go to the tracking log page for your geocoin.

- Go to the Play -> Find Trackables menu item to go to the Trackables page. Enter the Tracking Code (from the coin itself) or the Trackable name (from the coin package, for example, VirginiaView Geocoin-79). Click on the geocoin name to view the log page.

Name	Last Log	Owner	Location	Traveled
VirginiaView Geocoin	12/26/2020	Clamstock	PlagueRide...	846117 mi
VirginiaView Geocoin-813	01/04/2021	Clamstock	Drstevo	380317 mi
VirginiaView Geocoin-4[illegible]	03/12/2016	Clamstock	Unknown	55097 mi
VirginiaView Geocoin-88	08/22/2015	Clamstock	Unknown	34139 mi
VirginiaView Geocoin-622	07/20/2017	Clamstock	Unknown	21818 mi
VirginiaView Geocoin-77	03/14/2019	Clamstock	Brunnen im...	16512 mi
VirginiaView Geocoin-594	06/07/2018	Clamstock	Dang Cache	16262 mi
VirginiaView Geocoin-170	11/03/2016	Clamstock	Unknown	14042 mi
VirginiaView Geocoin-438	06/03/2020	Clamstock	grannycher...	13606 mi
VirginiaView Geocoin-204	09/18/2013	Clamstock	Unknown	13082 mi

Figure 1. Tracking History for a Geocoin. Each line represents a log entry. We'll be using the log entries where the coin actually moved. You can sort the list by distance traveled.

3. Scroll down to the bottom of the log page to see the Tracking History. Each entry in the log (Figure 1) represents one potential chicken farm site.

Note to Leaders: Be sure that Google Earth is already installed on your computer(s) – visit http://www.google.com/earth/index.html for the download and basic information. For a primer on how to navigate in Google Earth, access the tutorial from here https://virginiaview.cnre.vt.edu/tutorials/

4. Now we'll narrow this list down to 2 potential farm sites by using Google Earth. We want to eliminate any geocoin stops that are obviously not suited for the chicken farm (such as residential neighborhoods). From your geocoin's log page (from Step 2), click on "View in Google Earth" under the Trackable Options menu. (You may need to scroll up to the top of the log page to see this). This will launch Google Earth if it is not already open, and the tracks for your geocoin will now be listed on the left-hand menu, and should show up as a yellow track on the map.

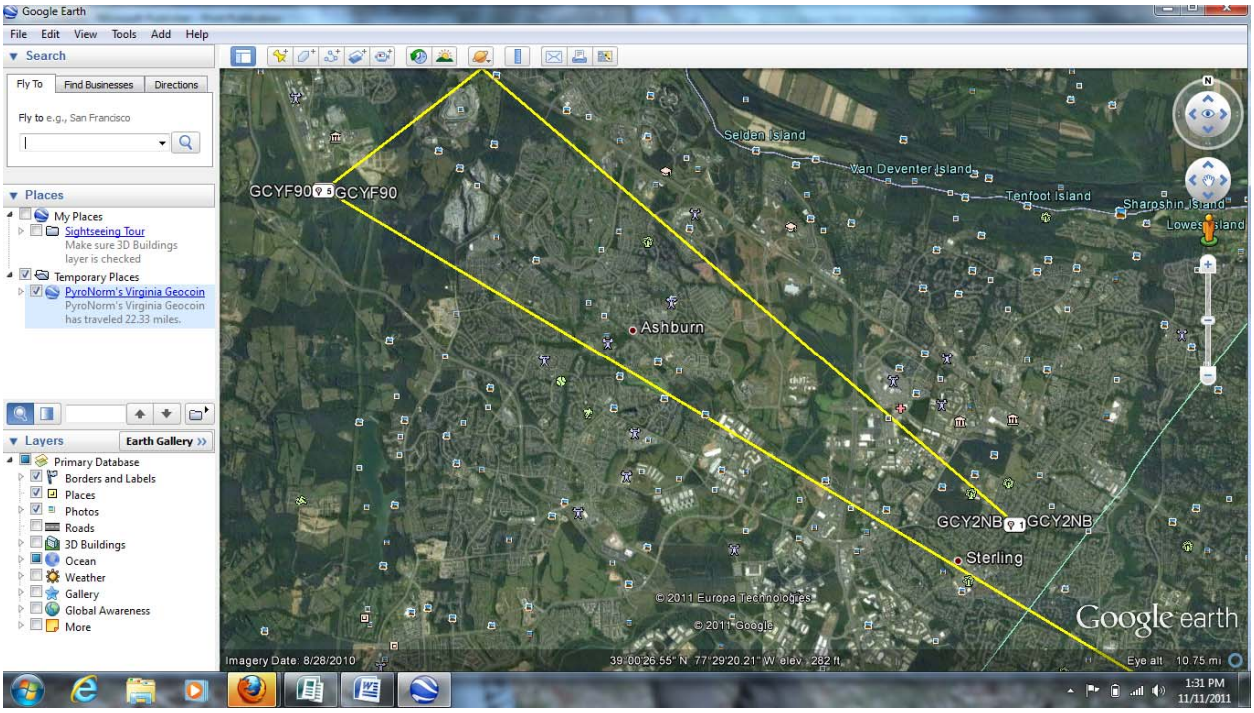
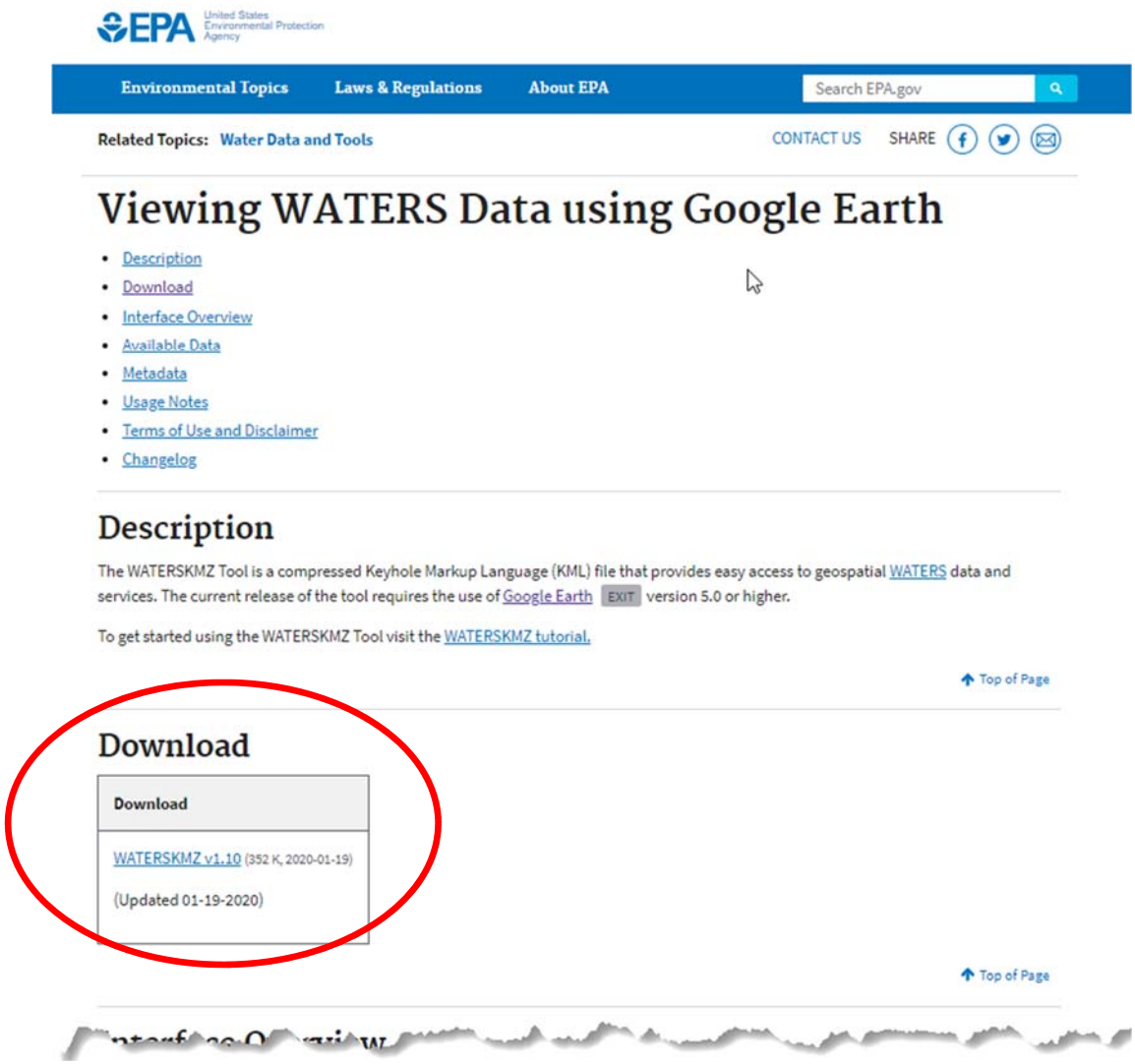


Figure 2. Points and yellow tracks between the geocoin stops in Google Earth.

- Be sure that the "Borders and Labels" base data is turned on in Google Earth. For each stop on the geocoin's journey, zoom in and explore the immediate area .
- By viewing the satellite imagery, you should be able to determine if the geocoin landed in a spot that is obviously not a suitable site for a chicken farm (such as a suburban neighborhood). Choose 2 potential sites and list their names (the site name will be the name of the Geocache the coin was placed in) in the form in Appendix A.

5. Next, we'll add data from the EPA (named WATERS) that will give us more information about individual watersheds. Open a web browser and go to https://www.epa.gov/waterdata/viewing-waters-data-using-google-earth#Download and download the WatersKMZv1.10 file.

6. 

From this page, click on the Vector WATERS data download (WATERS

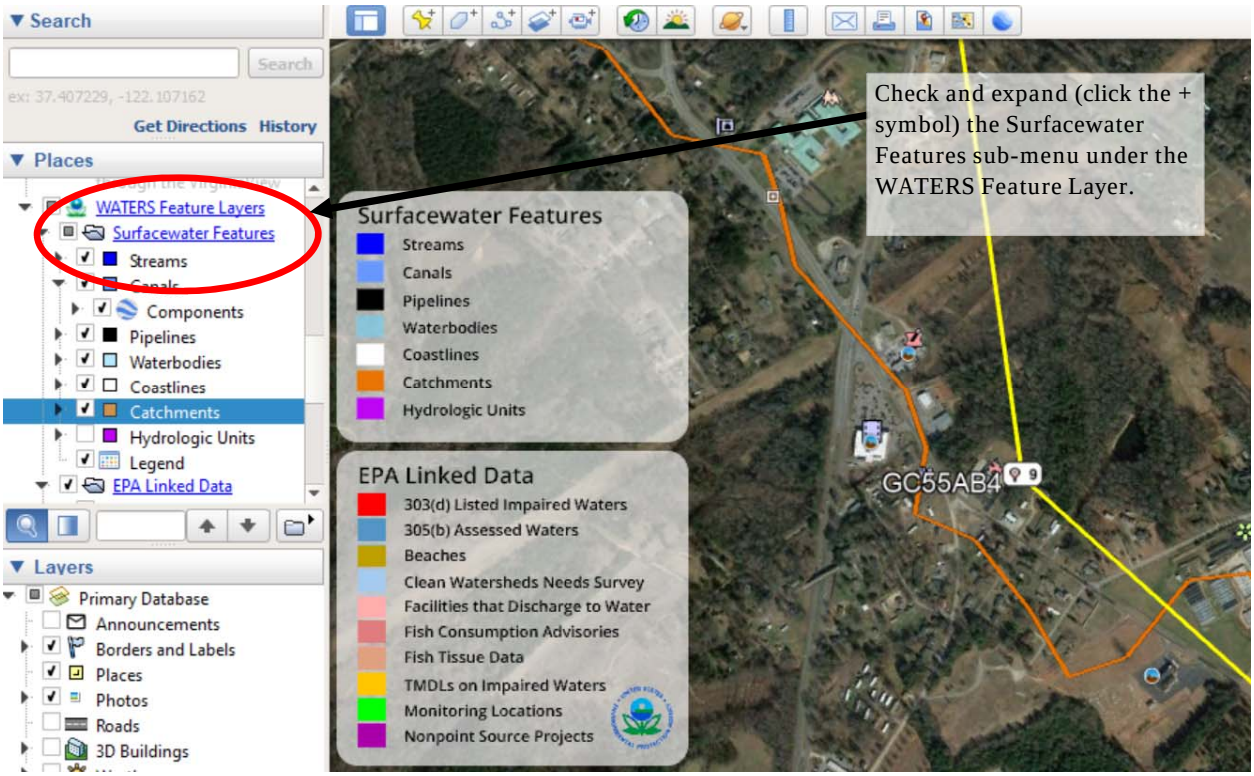


Figure 4. Using the WATERS Feature Layer menu. (Screenshot © 2020 Google Earth).

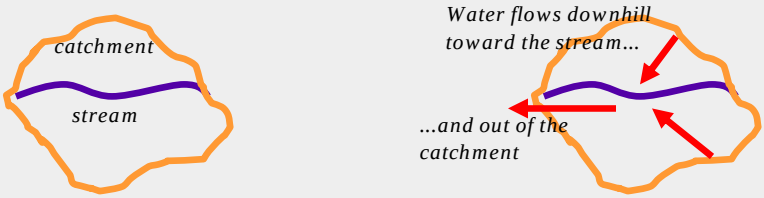
Data 1.4 (Vector).kmz). Since this is a kmz file, we can open it directly with Google Earth, so do this when prompted.

5. Google Earth should still be open and showing both the MyWATERS data and your Geocoin's stops in the Places panel (the upper left-hand menu). In the Places panel, under MyWATERS, turn on (check) the Surfacewater Features sub-menu, and turn off (uncheck) the EPA Water Program Features sub-menu.

6. You can see on the Surfacewater Feautres sub-menu that streams, **catchments**, and **hydrologic units** are outlined, as well as other water features. For each potential farm location, we want to determine the the approximate size of the catchment for that stream, the name of the hydrologic unit., and the closest stream's name.

Catchment: The area of land that drains into a specific part of a stream (contained within the catchment boundary).

Hydrologic Unit: A collection of interconnected catchments. Hydrologic Units are similar in total land area to one another.



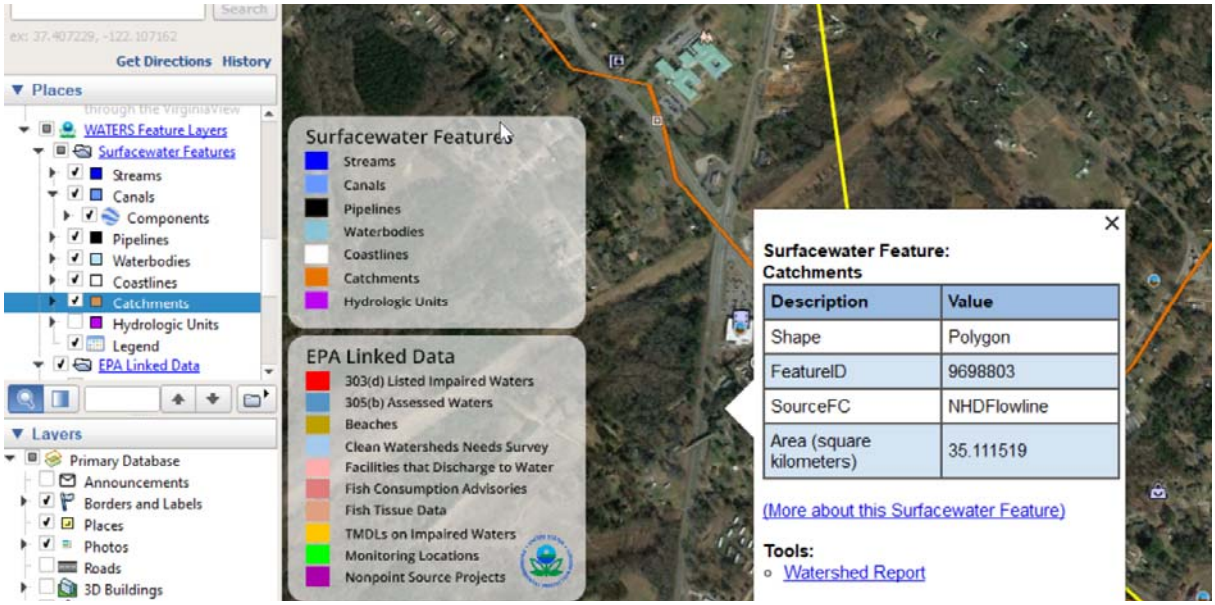


Figure 5. To learn more about the catchment that contains your farm site, uncheck the Hydrologic Units menu item. Click anywhere inside the orange catchment boundary that surrounds your farm site (Geocache site) to bring up the pop-up information box. The feature ID is the number of the catchment, and the box also contains the catchment area. (Screenshot © 2012 Google Earth).

Land Use: The human use of land. Some examples of different human land uses would be industrial, commercial, agricultural, and residential.

Land Cover: The physical features that cover land. Some examples would be forested, grassland, agricultural, urban, water, and others.

- First, learn more about the catchment (orange outline) that the farm location falls inside. To do this, uncheck the Hydrologic Units menu item. Click anywhere inside the catchment of your farm location to get more information about it. Some of the catchments have names, others have numbers. This is the area that drains to a particular stream. Record its name and area in Appendix A. See figure 5 for more information.

- Make sure you can see the entire outline of the catchment that surrounds your farm site. Estimate the *main (majority)* **land use or land cover** inside the catchment by looking at the Google Earth imagery and record it in Appendix A.

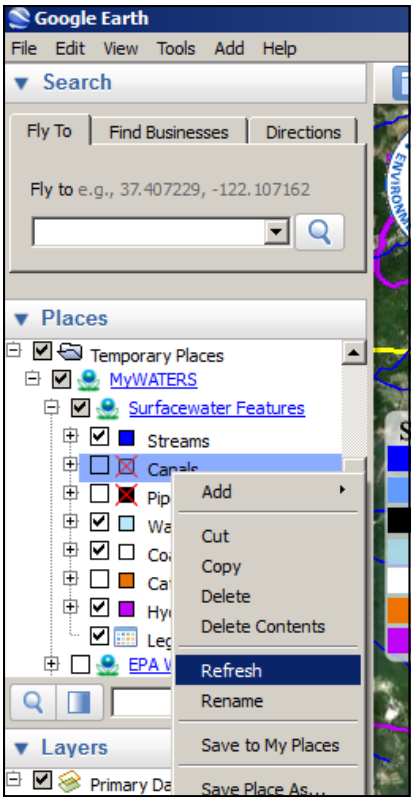


Figure 7. Right-click on a layer or sub-layer name to refresh it if you should get a red "X" through the layer's symbol. Wait for the square to stop turning for the refreshed data to be visible.

- Stream Name: click on the closest stream to your farm site that is *within its catchment* boundary. Record the stream name (if available) in Appendix A.

- Impaired Waters: turn on the EPA Water Program Features sub-menu. Check to see if any impaired waters (red lines or areas) fall within the site's catchment. Record this information in Appendix A. If there are other interesting EPA programs in the catchment, record those as well.

- Hydrologic Unit: turn off the catchments (uncheck) and turn on the Hydrologic Units. Click near your farm site again, and determine what Hydrologic Unit your farm site falls within. Record this in Appendix A.

- Note: if you can't see the data you need from the WATERS layers OR you have a colored symbol box with a red "X" through it, try right-clicking on the layer's name in the Places menu and clicking "Refresh." Once the colored square stops spinning, you should have a refreshed view on your map. (Figure 7)

8. **Challenge (Optional/Advanced):** Try to determine the closest downstream town to your farm site. Use the Hydrologic Units and the Streams layers to give you clues.

- Turn on (check) Streams and Hydrologic Units, and turn off (uncheck) all the other MyWATERS layers and sub-layers. Zoom so you can see the entire Hydrologic Unit that contains your farm site. *Note: Be sure*

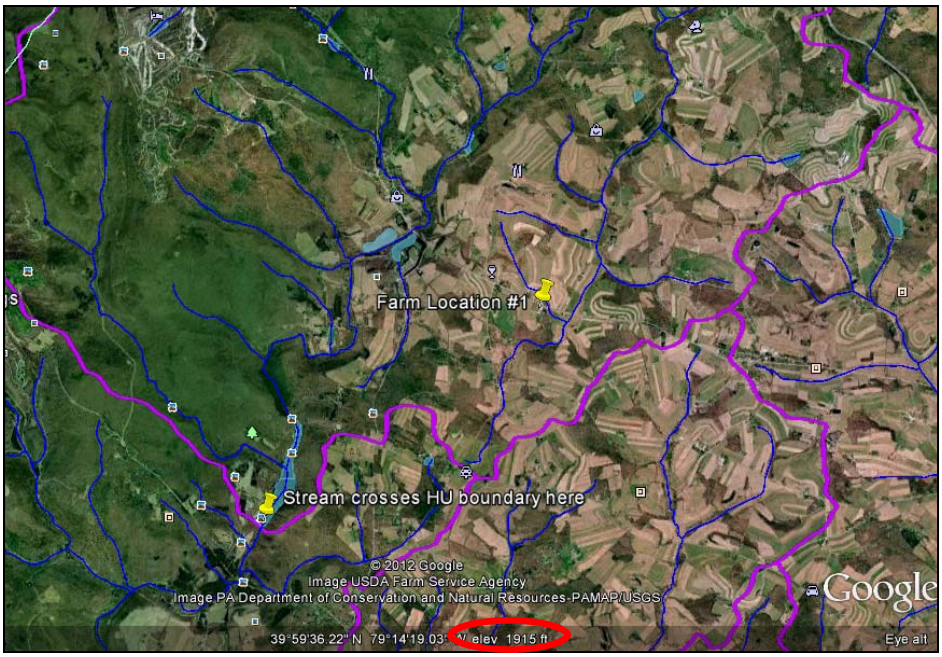


Figure 8. Placemarks added to the farm site and outlet point of the Hyodrologic Unit containing the farm site. To read elevation at a point, hover your mouse over the

to refresh your streams and Hydrologic Units layers as you zoom out. (see above note and Figure 7)

- Use the Add Placemark (Push Pin) tool to mark the location for the farm site. Then turn off your Geocaching layer in the Places Panel.
- Use the Add Placemark tool to mark the location of the outlet point for each Hydrologic Unit (where a stream actually *crosses* the Unit boundary and goes into another one). Each Hydrologic Unit has *only one outlet point*, but there are usually two places where water will cross the Unit boundary: where it connects to any Units with higher elevations, as well as the outlet. To determine if you are looking at the inlet or outlet point, look at the elevation for each listed at the bottom of the map window when you hover over the point. The lower of the two elevations is the outlet point. All the surface water inside the Unit boundary drains to this point.

Note to Leaders: More information on drawing paths is available at http://support.google.com/earth/bin/answer.py?hl=en&answer=148072&ctx=cb&src=cb&cbid=a5g87owk9ha1 or the GoogleEarth Tutorial at https://virginiaview.cnre.vt.edu/tutorials/ . Encourage your participants to trace the stream flow as best they can, but not to get too caught up in creating a perfectly downhill path. This is not possible with the tools available in Google Earth! If the line they trace has an overall elevation loss (Even a small one) they have done well. Be sure to check their work.

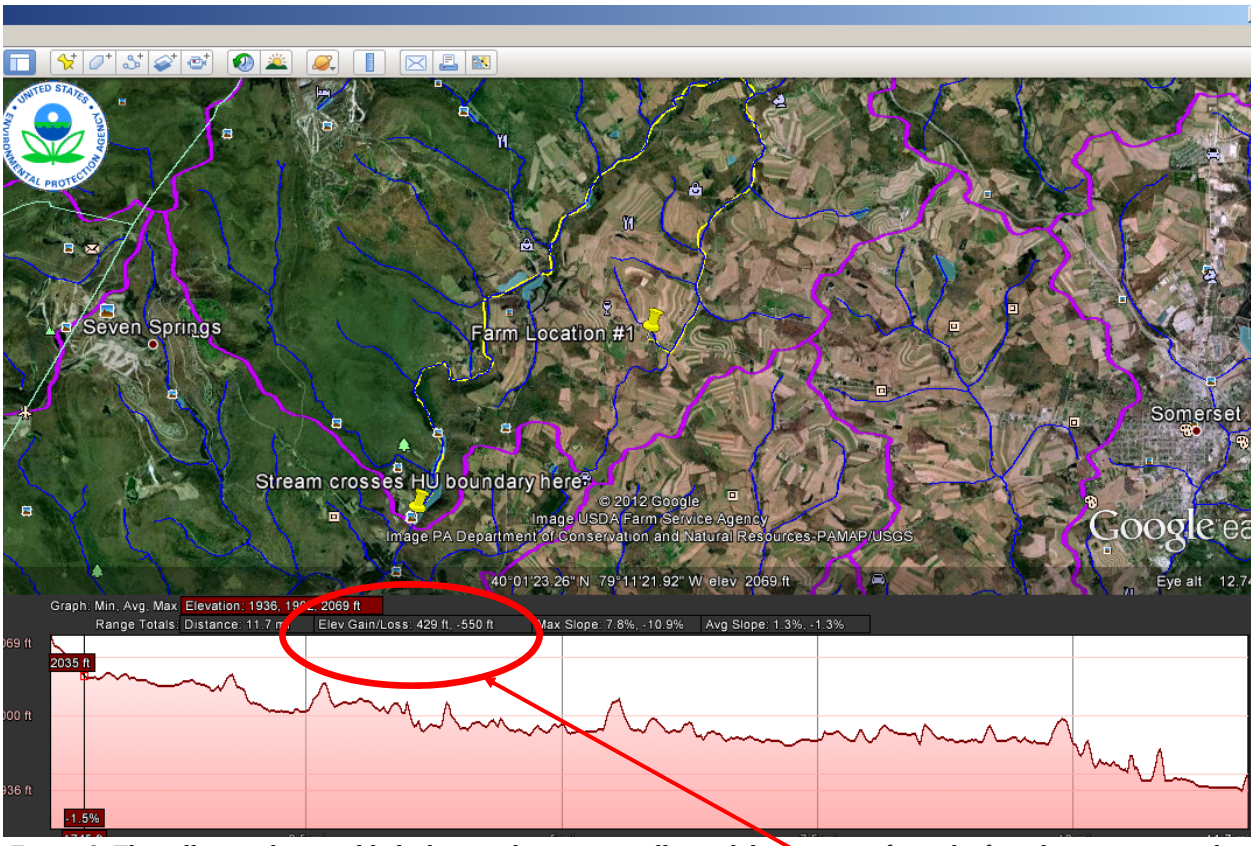


Figure 9. The yellow path was added, showing how water will travel downstream from the farm location site to the outlet point of the Hydrologic Unit. By right-clicking on the path name and Show Elevation Profile, we can see that there is an overall elevation loss (more negative feet than positive feet) which means the path was correctly located along the stream network.

- Now we can determine a downhill path from the farm location to the outlet point, and see if any towns or cities are within the path. Use the Add Path tool to trace the water leaving your farm to the outlet point *along the streams and waterbodies* as they flow downhill. You will likely need to stop as you go to reposition the map—to do this, click OK, reposition the map as you need to, then right-click on your path name in the My Places panel and go to Properties. This allows you to keep editing. Check your work by right-clicking on the new Path name in the Places panel, and select Show Elevation Profile (Figure 9). Remember—water always flows downhill, so if your path has an *overall* elevation loss, you are on the right track! Be sure to ask your leader/teacher for guidance with this one!

- After you've created your downhill path to the outlet point, explore the closest town within your path (if there is one). Record the town or city name in Appendix A, and do an internet search to find the town's population. Use the elevation profile of the path to find the distance (in miles) along the stream network from the farm site to the town.
- If there is no town within the downhill path you just created, first record the distance of the downhill path you created from the farm site to the outlet point. Then, look at the other Hydrologic Units that are connected to the one containing your farm site. Mark the outlet points (using Add Placemark) of each Hydrologic Unit until you find one that contains a town. Write down the name of this town and how many hydrologic unts are linked from your farm site to the town.

Assessing and Reflecting

Take a look at all the information you've recorded on the worksheet in Appendix A. Which of these two sites do you believe would be best for a chicken farm location from a watershed health point of view? Why? Do you think this decision would be in conflict with a business' point of view?

Use Google Earth to create a presentation map or video that shows your site of choice. Add layers from the MyWATERS layers and create placemarks or other objects to help make your point. Print your map.

What types of additional things might the chicken farmer do to lessen their impacts on the health of the watershed?

Appendix A. Watershed Information for potential chicken farm sites

Potential Site #1

Name: _____

Coordinates of the site: Lat._____ / Long. _____

Catchment name or number: _____

Catchment area: _____(remember units!)

Major land use inside of catchment: _____

Stream name (if available): _____

Impaired waters within catchment? _____

Hydrologic Unit name? _____

Optional/advanced (step 8)

Closest *downstream* town: _____

Town population size: _____

Distance along stream network from farm site to closest town or Hydrologic Unit output point (whichever comes first): _____

If closest town is outside of first Hydrologic Unit, how many connected units until a town was reached? _____

Potential Site #2

Name: _____

Coordinates of the site: Lat._____ / Long. _____

Catchment name or number: _____

Catchment area: _____(remember units!)

Major land use inside of catchment: _____

Stream name (if available): _____

Impaired waters within catchment? _____

Hydrologic Unit name? _____

Optional/advanced (step 8)

Closest *downstream* town: _____

Town population size: _____

Distance along stream network from farm site to closest town or Hydrologic Unit output point (whichever comes first): _____

If closest town is outside of first Hydrologic Unit, how many connected units until a town was reached? _____

Resources

Land Use and Land Cover with Satellite Imagery:

United States. Department of the Interior. Geological Survey. *A Land Use And Land Cover Classification System For Use With Remote Sensor Data*. By James R. Anderson, Ernest E. Hardy, John T. Roach, and Richard E. Wimter. Waschington: United States Government Printing Office, 1976. USGS. Web. https://pubs.er.usgs.gov/publication/pp964 .

Tutorials for using Google Earth:

https://virginiaview.cnre.vt.edu/tutorials/

EPA WATERS tutorial:

https://www.epa.gov/waterdata/waters-geoviewer-tutorial