Investigating Hydroelectric Power Dams with My World GIS Teacher Guide

Hydropower is energy that comes from the force of moving water. Most hydroelectric power plants are developed at dams. In this activity, students will use My World GIS to study and analyze hydroelectric power dams. They will

1. Query and analyze features of US hydroelectric power dams.
2. Query and analyze features of the 10 most powerful US hydroelectric power dams.
3. Create a new layer containing Pennsylvania hydroelectric power dams.
4. Query and analyze features of Pennsylvania hydroelectric power dams.

Model the following procedural instructions with your students. It is recommended that you display your computer image at the front of the classroom.

Step 1: Download data.
a. Open your Web browser. Go to **www.ei.lehigh.edu/learners/energy/**
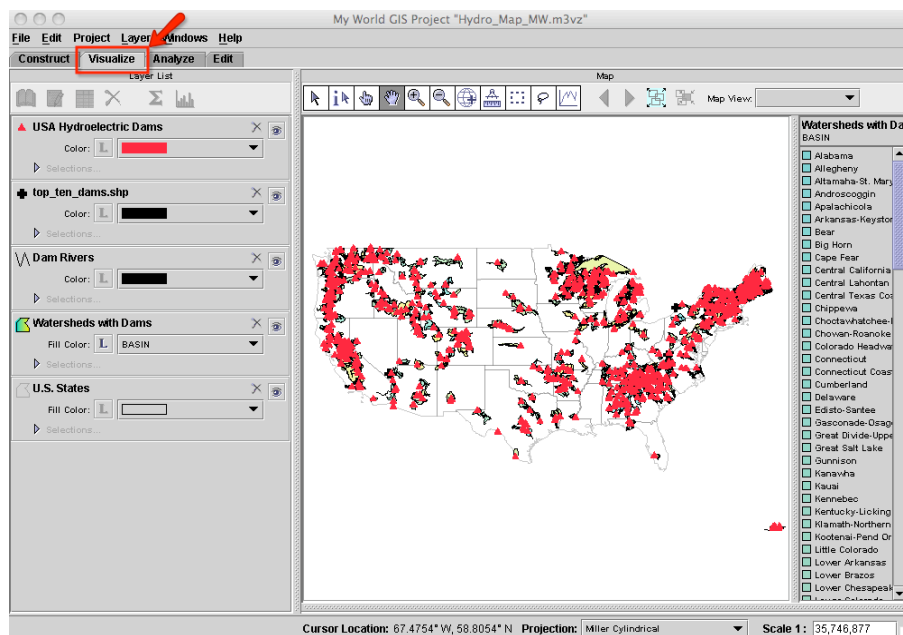b. Click on **Investigating Hydroelectric Power Dams with My World GIS.**

This downloads the **Hydro_Map_MW.m3vz** file on to your desktop (see icon below).

Step 2: Load data in My World GIS.
a. **Double click** on the **Hydro_Map_MW.m3vz** icon to open the file in My World GIS.

The window below should open on your computer. Check to make sure you are in the **visualize** mode (see arrow below).

Step 3: Query and analyze US hydroelectric dams. (Questions 1 - 5)

a. Click on the first layer **USA Hydroelectric Dams** in the **Layer List**.

b. Click on the **table** icon on the **Layer List tool bar** (see arrow below). A data table for the **USA Hydroelectric Dams** layer will open.


This data table contains 1,184 records (see arrow below).

The information on the data table includes the location of the dam, the height of the dam (in feet), and the area of the reservoir behind the dam. The area behind the dam is measured in units of acre feet. One acre is about the **area** size of a football field. The figure on the left shows the area of one acre overlaid on an American football field.

One acre foot is about the **volume** size of a football field that is one foot deep. The figure on the right shows the volume of one acre foot. It is a volume that would hold 325,851 gallons of water.
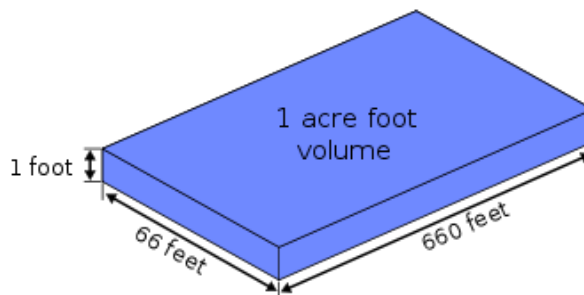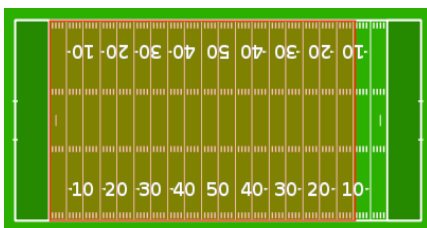
c. Click on the **YEAR COMPLETED** column **once.** What happens to the column?
You should notice that the column title box is highlighed in white and the years are sorted in **ascending** order. The dam completed at the earliest date is at the top of the list.

Scroll down the table to row 1147. Note that this dam and the 37 records belows it do not have a year listed. The completion date of these dams are not in the data table.

d. Click on the **YEAR COMPLETED** column **a second** time. What happens to the coulmn?
You should notice that the years are sorted in **descending** order. The dam most recently completed is at the top of the list.

e. Click on the **YEAR COMPLETED** column **a third** time. What happens to the column?
You should notice that the column title box is grey like the others in the table and the years are neither in ascending nor descending order. The years go back to their original order.

Instruct students to use the USA Hydroelectric Dams data table to answer **questions 1 - 5** on their investigation sheet.

f. Close the data table for the **USA Hydroelectric Dams** (see arrow below).

Step 4: Use the analysis tools to create a new layer. (Questions 6 - 10)

How many hydroelectric power dams are between 300 and 500 feet tall?
We are going to create a new GIS layer that will display all the hydroelectric power dams that are between 300 and 500 feet tall.

a. Click on the **Analyze** tab above the **Layer List** (see arrow below).
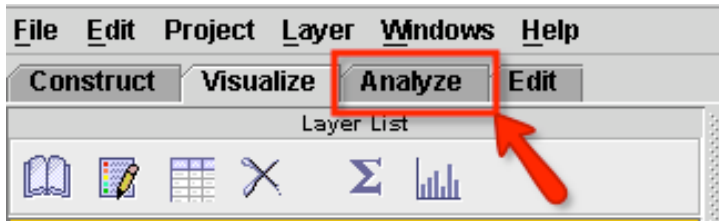
My World GIS will display the window below.
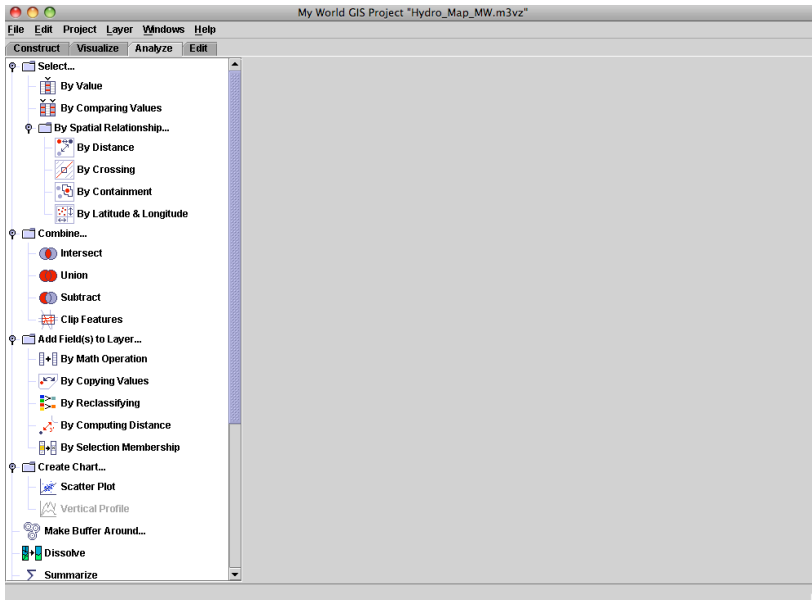
b. Click **By Value** (see arrow #1 below).
    Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list if
    it is not already selected (see arrow #2 below).
    Click the box to the right of **Whose** and select **HEIGHT ft** from the list (see arrow #3 below).
    Check the box to the left of **Is Less Than,** and type **500** in the text box (see arrow #4 below).
    Check the box to the left of **Is Greater Than or Equal to,** and type **300** in the text box (see arrow #5
    below).
    Type **300-500 ft high** in the **Result Name** text box (see arrow #6 below).
    Click **OK** (see arrow # 7 below).
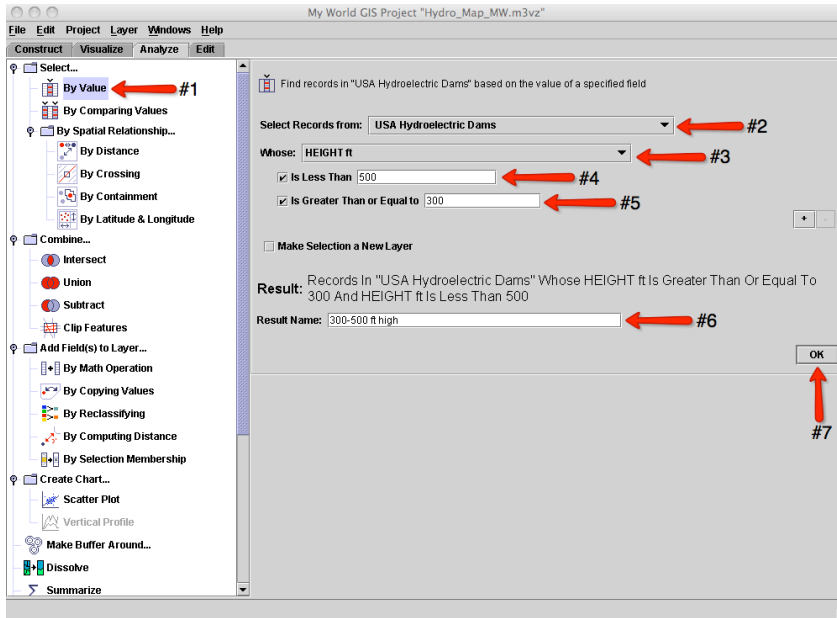
My World GIS will add a sublayer called **300-500 ft high** to the **USA Hydroelectric Dams** layer (see arrow below).
Look at map display. These dams are highlighted in yellow.
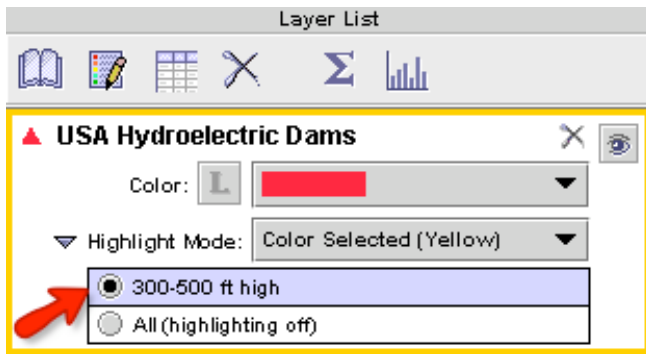
c. Click on the **table** icon [table icon] on the **Layer List tool bar**.

[notepad icon] Instruct students to use the data table to answer **question 6** on their investigation sheet.

d. Close the 300-500 ft high window.

How many dams on the Columbia River generate electricity?

e. Click on the **Analyze** tab above the **Layer List**.
Click **By Value** (see arrow #1 below).
Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list if it is not already selected (see arrow #2 below).
Click the box to the right of **Whose** and select **RIVER** from the list (see arrow #3 below).

Type **Columbia** in the text box to the right of **Contains** (see arrow #4 below).
Type **Dams on Columbia River** in the **Result Name** text box (see arrow #5 below).
Click **OK** (see arrow #6 below).
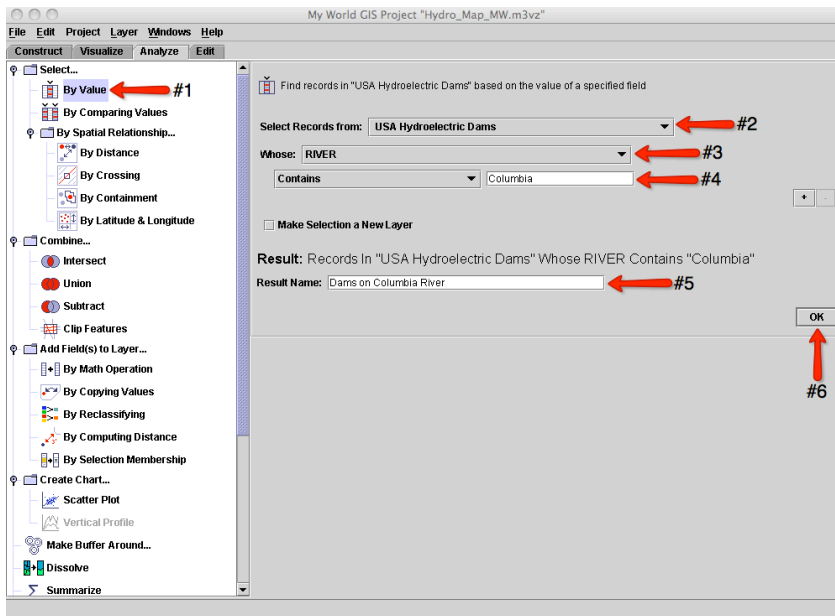
My World GIS will add a sublayer called **Dams on Columbia River** to the **USA Hydroelectric Dams** layer (see arrow #1 below).
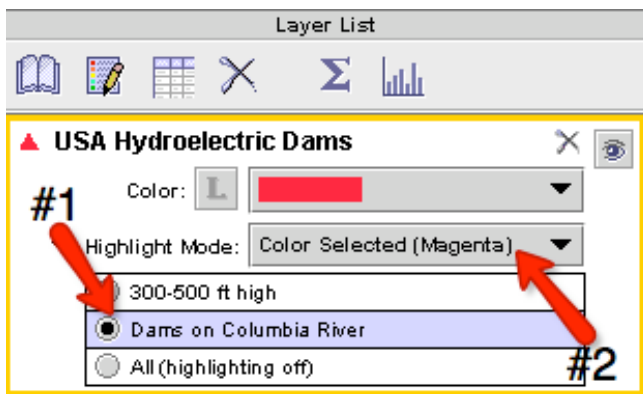
f.   Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)** (see arrow #2 above). This will change the color of the dams on the Columbia River to Magenta.

Instruct students to use the GIS map and the Dams on Columbia River data table to answer **questions 7 - 10** on their investigation sheet.

Step 5: Query and analyze the 10 most powerful US hydroelectric dams. (Questions 11 - 15)

a. Click on the second layer **top_ten_dams.shp** in the **Layer List**.

b. Click on the **histogram/bar chart** icon on the **Layer List tool bar** (see arrow below). A histogram/bar chart for the **top ten dams** layer will open.
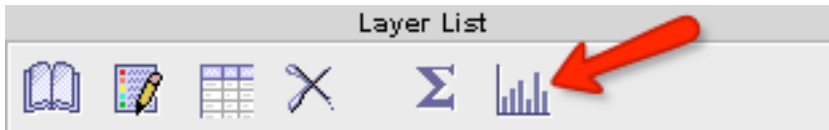
c. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **RIVER** (see arrow #1 below)**.** The histogram/bar chart will display rivers that host the top 10 most powerful US hydroelectric power dams and the number of dams on each river. Scroll down to see the whole histogram/bar chart (see arrow #2 below).
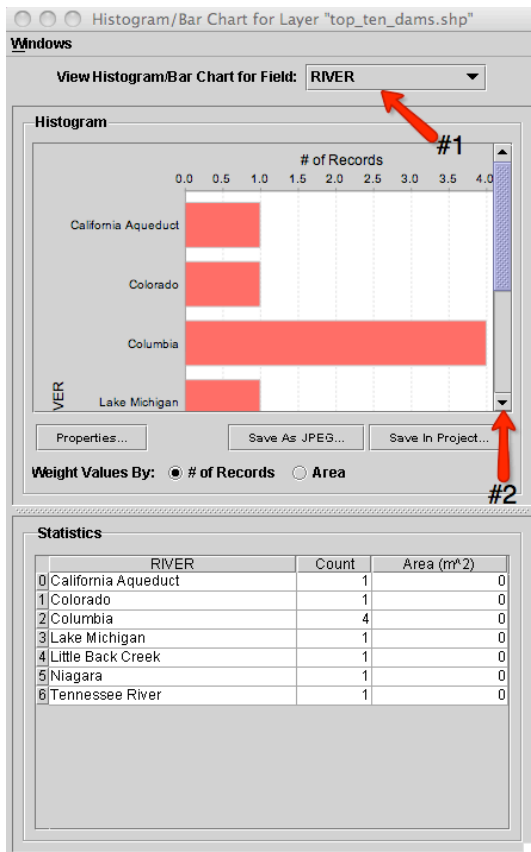
Instruct students to use the histogram/bar chart to answer **questions 11** and **12** on their investigation sheet.

d. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **STATE.** The histogram/bar chart will display the states in which the top 10 most powerful US hydroelectric power dams are located and the number of dams in each state.

   📝 Instruct students to use the histogram/bar chart to answer **question 13** on their investigation sheet.

e. Close the **Histogram/Bar Chart** window**.**

f. Click on the **table** icon ▦ on the **Layer List tool bar**. A data table for the **top ten dams** layer will open. This table includes a new field for these dams: CAPACITY MW. This is the amount of energy production that the dam generates. The units are megawatts. 1 megawatt is equal to 1,000,000 watts. Recall that when your television is on, it uses about **137 *Watts*** of electricity each second it is on.

   📝 Instruct students to use the table data to answer **questions 14** and **15** on their investigation sheet.

💻 **Step 6: Create a new GIS layer for Pennsylvania dams.**

a. Click on the **Analyze** tab above the **Layer List.**
   Click **By Value**.
   Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list.
   Click the box to the right of **Whose** and select **STATE** from the list.
   Type **PA** in the text box to the right of **Contains**.
   Check the box to the left of **Make Selection a New Layer** (see below).

   ☑ Make Selection a New Layer

   Type **PA Dams** in the **Result Name** text box.
   Click **OK**.

   My World GIS will add a new layer called **PA Dams** to the Layer List (see arrow #1 below) and the names of the PA Dams in the panel on the right (see arrow #2 below).
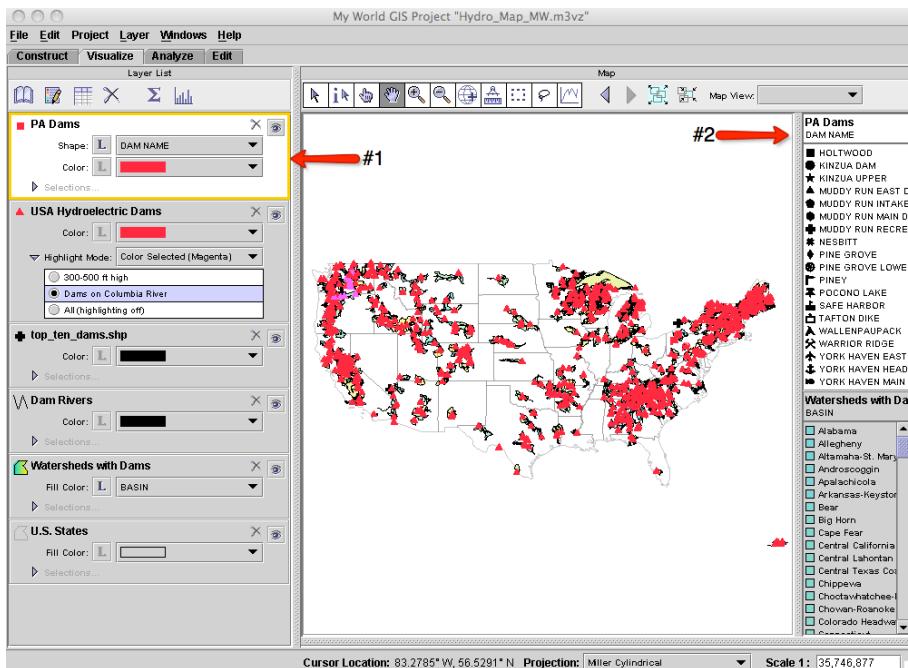
Step 7: Query and analyze hydroelectric power dams in Pennsylvania. (Questions 16 - 23)

a. Click on the **table** icon on the **Layer List tool bar**. A data table for the **PA Dams** layer will open.

Instruct students to use the PA Dams data table to answer the **questions 16 - 20** on their investigation sheet.

b. Click on the **histogram/bar chart** icon on the **Layer List tool bar**. A histogram/bar chart for the **PA Dams** layer will open.

c. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **WATERSHED.** The histogram/bar chart will display watersheds that host Pennsylvania hydroelectric power dams and the number of dams in each watershed.

Instruct students to answer question **21** on their investigation sheet.

d. Click on the **Analyze** tab above the **Layer List**.
    Click **By Value** (see arrow #1 below).
    Click the box to the right of **Select Records from** and select **PA Dams** from the list (see arrow #2 below).
    Click the box to the right of **Whose** and select **RIVER** from the list (see arrow #3 below).

Check the box to the right of **SUSQUEHANNA RIVER** (see arrow #4 below).
Uncheck the box to the left of **Make Selection a New Layer** (see arrow #5 below).
Type **Dams on Susquehanna River** in the **Result Name** text box (see arrow #6 below).
Click **OK** (see arrow #7 below).
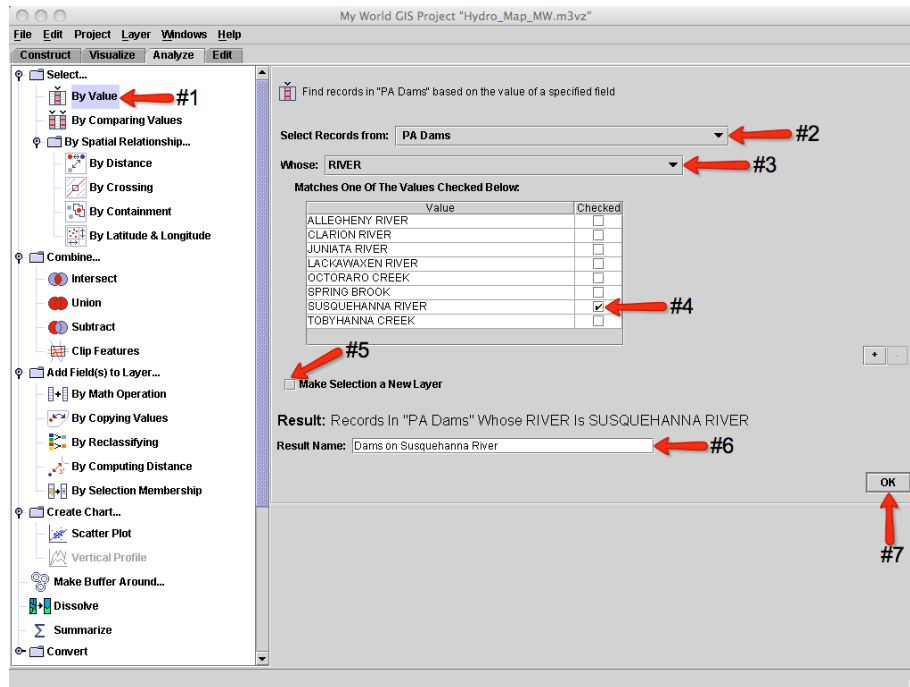
My World GIS will add a sublayer called **Dams on Susquehanna River** to the **PA Dams** layer.

Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)**. This will change the color of PA dams on the Susquehanna River to Magenta.

Instruct students to use the GIS map to answer **question 22** on their investigation sheet.

e. Click on the **table** icon on the **Layer List tool bar**. A data table for **Dams on Susquehanna River** sublayer will open.

Instruct students to use the data table to answer **question 23** on their investigation sheet.