

Hurricane Irene and the Gilboa Dam (160 Minutes)

Introduction: On August 28th, 2011

Hurricane Irene made landfall in New York State. Low lying areas around New York City received warnings of the hurricane's potentially destructive forces. For the majority of home and business owners in New York City's metropolitan region, the threat of Hurricane Irene amounted to a lot of hype and very little adverse effects.

Unfortunately for residents in the Mohawk River Basin, and more specifically those who resided in the drainage basin of the Schoharie Creek and points downstream where the Schoharie dumps into the Mohawk River received no warnings of the potential hazards the Irene presented. Forecasters did not expect the immense rains that fell on the region and the resulting flooding in the valleys, villages and towns that were situated in low lying areas.



From the headwaters of the Schoharie Creek at the Gilboa Dam, to the end of the Mohawk River at Cohoes Falls there were varying degrees of severity of the resulting flooding. There were fears that the flooding could have been much worse because of the potential for the Gilboa Dam, which holds back about 17.6 billion gallons of water, could have had a catastrophic rupture. Because the potential for catastrophe exists at every Dam built in the United States, no matter how remote the chances of failure are, each state is required to produce reports that predict worst case scenarios for Dam failure and the resulting devastation to downstream communities.

Through this lab you will uncover facts and figures as they relate to Hurricane Irene and the flood waters at several points downstream of the Gilboa Dam. You will then create an emergency worst case scenario flood inundation report that includes the high water marks from the flooding of hurricane Irene, and then add on top of that high water mark the change in water elevation resulting from the catastrophic failure of the Gilboa Dam.

Objective: At the end of this lab you should be able to use a topographic map to solve and project real world problems, and describe their usefulness to government officials, private citizens, and in the business world.

Hypothesis: If the Gilboa Dam failed during a record flooding event (like Hurricane Irene), then low-lying municipalities on the Schoharie Creek and Mohawk River would experience high level inundation with damaging and potentially life threatening consequences.

Procedure:

- 1. Collect relevant information about the Gilboa Dam, the Schoharie Village, Amsterdam, and Cohoes Falls; then plot their locations on a map.**
 - a. Navigate your Chromebook to <http://www.census.gov/2010census/popmap/>.
 - b. On the top right corner of the "Interactive Population Map", click "Total Population" button

- c. On the left side of the map under the “Geographical Levels” list, select “Place”.
- d. Find the population for Amsterdam, NY by typing the city’s name into the search box, and selecting the shaded area on the resulting map; record this in Data Table 1.
- e. Find the population the Schoharie Village by typing the village’s name into the search box, and selecting the shaded area on the resulting map
- f. On Map A plot the locations listed in Data Table # 1, using their latitude and longitude
- g. With a blue color pencil darken the Schoharie Creek, Mohawk River, and Hudson River on Map A, clearly label all three bodies of Water.
- h. Use Map A to determine the body of water (Mohawk River or Schoharie Creek) that is associated with each location; record this in Data Table 1.
- i. Determine the distance each location is from the Gilboa Dam on Map A, along the path of the Schoharie Creek and/or the Mohawk River (Hint: Do not measure straight line distance).
- j. Using Map B or C of Amsterdam, New York; estimate the surface elevation of the Mohawk River and record your answer in the first column of Data Table 2.
- k. Using Map D of the Village of Schoharie, estimate the surface elevation of the Schoharie Creek and record your answer in the first column of Data Table 2.
- l. Using Map A and your surface elevation data, add arrows to all three bodies of water to show their direction of movement.
- m. Using your arrows, determine the compass direction the Schoharie Creek and Mohawk River flow, record this information in Data Table 1.

2. Determine the flood levels during Hurricane Irene for the Schoharie Village and Amsterdam, NY

- a. Navigate to the United States Geological Survey website at the following link:
http://nwis.waterdata.usgs.gov/ny/nwis/uv/?site_no=01354083 (This is also on the next page)
- b. From the historical records of the high water marks at Lock 11 of the Erie Canal, determine the maximum height, or stage, (in feet) of the water from flooding on August 29th, 2011. Record this in Data Table 2.
- c. For both Schoharie and Amsterdam, determine the high water elevation during Hurricane Irene by using the following formula:

$$\text{Hurricane Irene Max Water Elevation} = \text{Surface Elevation} + \text{Max Water Height}$$
- d. The estimated increase in surface water elevation of the Mohawk River is estimated to be roughly 6 to 10 feet in the event of a Gilboa Dam failure. Using a number from that range and enter it in Data Table 2.
- e. For both Schoharie and Amsterdam, determine the high water elevation during Hurricane Irene if the Gilboa Dam had failed by using the following formula:

$$\text{Max Water Elevation during Irene with Dam Failure} = \text{Additional Water Height} + \text{Irene Max Elevation}$$

Max Water Elevation during Irene with Dam Failure = Additional Water Height + Irene Max Elevation

3. Complete an Inundation Map for both Amsterdam and the Schoharie Village based on Hurricane Irene Flood Data, and Gilboa Dam catastrophic failure.

- a. Complete both Inundation maps of Amsterdam by shading in areas affected by the increase in the Mohawk’s surface water elevation during Hurricane Irene with a color of your choosing (Don’t forget to fill in the key for each map)
- b. With a second color pencil shade in additional areas that would have been affected by a failure of the Gilboa Dam during Hurricane Irene.
- c. repeat steps a & b for the Schoharie Village on the Schoharie Village inundation map



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LOCATION.--Lat 42°56'02.4", long 74°11'30.7" referenced to North American Datum of 1983, Montgomery County, NY, Hydrologic Unit 02020004, on left bank in waterfront park at Amsterdam, and 480 ft downstream from bridge on State Highway 30.

DRAINAGE AREA.--3,152 mi².

PERIOD OF RECORD.--Miscellaneous discharge measurements, water years 1966-67. January 2015 to current year.

GAGE.--Water-stage recorder, acoustic velocity meter, and crest-stage gage. Datum of gage is 235.02 ft above NGVD of 1929.

REMARKS.--Considerable regulation of stage by Lock 11 on the Erie (Barge) Canal about 1.3 mi upstream and Lock 10 on the Erie (Barge) Canal about 3.0 mi downstream. Water Years 2015-16: Records poor.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge 37,300 ft³/s, Feb. 25, 2016, gage height, 19.25 ft; maximum gage height, 22.90 ft, May 30, 2016; minimum discharge not determined; minimum gage height, 7.75 ft, Apr. 19, 20, 2016.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Aug. 29, 2011, reached a stage of 41.94 ft, from floodmarks in downstream cabin of Lock 11 about 1.3 mi upstream, and a stage of 35.70 ft, from floodmarks in upstream cabin of Lock 10 about 3.0 mi downstream, from information provided by New York State Canal Corporation. Flood of June 29, 2006, reached stages of 38.18 ft and 28.92 ft, from floodmarks at same locations respectively.